PEN
VIBRATION TESTER
AV-160P

This Vibration Tester is small in size, light in weight, easy to carry,it is convenient to use and operate. Its ruggedness will allow many years of use if proper operating techniques are followed. Please read the following instructions carefully and always keep this manual within easy reach.

1. FEATURES

* Can display the parameters of Displacement, Velocity and Acceleration simultaneously.
* In accordance with ISO 2954, used for periodic measurements, to detect out-of-balance, misalignment and other mechanical faults in rotating machines.
* specially designed for easy on site vibration measurement of all rotating machinery for quality control, commissioning, and predictive maintenance purposes.
* Individual high quality accelerometer for accurate and repeatable measurements
* Bearing condition monitoring function
* LCD digital display
* Lightweight and easy to use.
* Wide frequency range (10Hz.To 10kHz.) in acceleration mode.
* Can communicate with PC computer for statistics and printing by the optional cable and the software for RS232C interface.

2. SPECIFICATIONS

Display: 4 digit LCD backlit
Accuracy: ±10% of reading + 2 digits
Transducer: Piezoelectric Accelerometer
Parameters Measured:
Velocity, Acceleration, and Displacement

Measurement Range:

Displacement	0.001-3.000mm Equivalent Peak-Peak;	0.04-120.0 mil
Velocity	0.1-300.0mm/s True RMS;	0.000-13.00 inch/s
Acceleration	0.1-300.0m/s² Equivalent Peak;	985 ft/s²

Frequency Range:

Displacement: 10Hz. ~ 1kHz.
Acceleration: 10Hz. ~ 10kHz
Velocity:10Hz. ~1kHz.

Metric/ Imperial conversion
With Max. value hold and low battery indication.
PC interface: USB/RS232C or Bluetooth
Power off : Manual off at any time or auto power off is enabled by user

Operating conditions:

Temperature: 0~50°C (32~122°F)
Humidity: <90%RH

Power supply: Lithium Battery
Size:202x43x23mm 8.0x1.7x0.9inch
Weight: 130g (Including Batteries) 4.59oz

Standard Accessories:

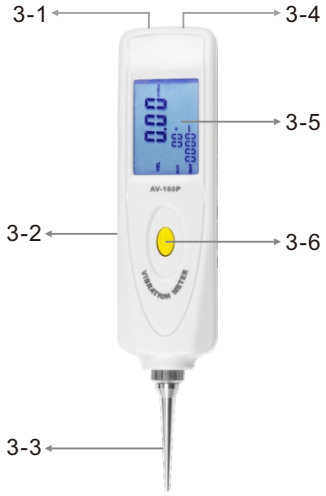
* Power Adapter

* Carrying case
* Operational instruction manual

Optional Accessories:

* Cable and software for RS232C or USB
* Bluetooth

3. FRONT PANEL DESCRIPTIONS



3-1	Charger Interface
3-2	Debugging Aperture
3-3	Accelerometer Probe
3-4	RS232C Interface
3-5	Display
3-6	Power Key

4. MEASURING PROCEDURE

4.1 Depress the Power Key and release to power on the meter.
4.2 Press the probe onto the tested surface vertically.
4.3 Parameters including Displacement, Velocity and Acceleration are displayed.

5. MAX HOLD FUNCTION

5.1 Depress the Power Key and release to power on the meter.
5.2 Press the Power Key again, the 'MAX' symbol is displayed, representing entering the Max Hold Mode. The reading on the display is the max value during measuring.
5.3 To quit the Max Hold Mode, just press the Power Key once more.

6. METRIC / IMPERIAL CONVERSION

6.1 Depress the Power Key and release to power on the meter.
6.2 Depress the Power Key and not release it until the 'UNIT' symbol is displayed. The unit will be converted between Metric and Imperial.

7. CONSIDERATIONS

7.1 Which Parameters Should be Measured?
* Acceleration, velocity, and displacement are the three tried and tested parameters, which give accurate and repeatable results.
* Acceleration is normally measured in m/s² peak (meters per second squared) or ft/s², has excellent high frequency measurement capabilities, and is therefore very effective for determining faults in bearings or gearboxes.
* Velocity is the most commonly used vibration parameter. It is used for vibration severity measurements in accordance with ISO 2372, BS 4675 or VDI 2056, which are guidelines for acceptable vibration levels of machinery in different power categories. These are presented as a table in section 4 of this manual. Velocity is typically measured in cm/s or inch/s RMS (centimeters or

millimeters per second).
Note: This instrument measures in cm/s. If you are more familiar with measurements in mm/s, or wish to compare your measured values directly with the vibration severity chart in section 4, multiply the displayed value by 10.
* Displacement is typically used on low-speed machines because of its good low frequency response, and is relatively ineffective when monitoring bearings. Units are typically microns or mm equivalent peak-peak.

7.2 Introduction To Vibration Measurement.
Vibration is a reliable indicator of the mechanical health or condition of a particular machine or product. An ideal machine will have very little or no vibration indicating that the motor, as well as peripheral devices such as gear boxes, fans, compressors, etc., are suitably balanced, aligned, and well installed. In practice, a very high percentage of installations are far from ideal, the results of misalignment and imbalance exerting added strain on supporting components such as bearings. Eventually this lead to added stress and wear on critical components,

resulting in inefficiency, heat generation and breakdowns. This often occurs at the most inconvenient or uneconomical times, causing costly production down time. As parts of mechanical equipment wear and deteriorate, the equipment vibration increases. Vibration measurement is therefore a powerful aid in the predictive maintenance of such equipment, reducing downtime and assisting in the smoother running of the plant or factory. Unscheduled breakdowns result in production losses and the faulty equipment is usually repaired hastily to get production going as quickly as possible. Under these stressful conditions staff are not always able to do repairs correctly regardless of how conscientious the yare, resulting in a high probability of further early equipment failure. By implementing a predictive maintenance program with regular measurements of critical factors like vibration, downtime can not only be reduced, but planned maintenance is more effective, resulting in improved product quality and greater productivity.
Continuous monitoring and trending of vibration levels over a time period is therefore a valuable addition to a machine's historical

record.
7.3 What is a Trend?
A trend is an indication of the way in which a monitored vibration parameter behaves over time. If regular vibration measurements are taken and plotted over a period of time, the resulting graph shows the progress or deterioration of a particular machine.
* Typically this will have the general shape shown in the diagram below, regardless of the type of machine being considered. For a short time after installation, whether it is a new or a repaired machine, vibration levels may fall slightly as the machine is run in, followed by a long period of unchanging levels during the machine's normal operating lifetime. Then comes a period of rising levels as machine parts wear out prior to failure. Such a trend enables the maintenance engineer to predict the time of failure and maximize use of the machine, while ordering spares and planning it`s maintenance for a time convenient to the production schedule.

8. Appendix: Vibration standards

A. Rank of machine vibration (ISO 2372)

Vibration Amplitude	Machine sort			
Vibration Velocity V rms (mm/s)	I	II	III	IIII
0~0.28	A	A	A	A
0.28~0.45				
0.45~0.71				
0.71~1.12	B			
1.12~1.8		B		
1.8~2.8	C		B	B
2.8~4.5		C		
4.5~7.1	D		C	C
7.1~11.2		D		
11.2~18			D	D
18~28				
28~45				
>45				

Note:
(1) Class I is small motor (power less than 15 kw). Class II is medium motor (power between 15 ~75kw). Class III is high power motor (hard base). Class is high power motor (stretch base)
(2) A, B, C, D are vibration Rank. “A” means good, “B”means satisfying, “C” means not satisfying, “D” means forbidden. Vibration velocity should be taken from the three perpendicular axes on the motor shell.

B. ISO/IS2373 Motor quality standard according as vibration velocity

Quality rank	Rev (rpm)	H: high of shaft (mm) Maximum vibration velocity (rms) (mm/s)		
		80 < H < 132	132 < H < 225	225 < H < 400
Normal	600~3600	1.8	2.8	4.5
Good (R)	600~1800	0.71	1.12	1.8
	1800~3600	1.12	1.8	2.8
Excellent (S)	600~1800	0.45	0.71	1.12
	1800~3600	0.71	1.12	1.8

Limit of rank “N” is suitable for common motor. When the request is higher than that in the table, limit can be gotten by dividing the limit of rank 'S' with 1.6 or multiples of 1.6.

C. Maximum vibration of motor that power larger than 1 horsepower. (NEMA MG1-12.05)

Rev (rpm)	Displacement (P-P) (um)
3000~4000	25.4
1500~2999	38.1
1000~1499	50.8
≤999	63.6

For AC motor, rev is maximum synchronous rev. For DC motor, it is maximum power rev. For motor in series, it is work rev.

D. Maximum vibration of high power induction drive motor. (NEMA MG1-20.52)

Rev (rpm)	Displacement (P-P) (um)
≥3000	25.4
1500~2999	50.8
1000~1499	63.6
≤999	76.2

National Electric Manufacturers Association (NEMA) Establishes two standards above.