

TIME[®]7231 Vibration Tester

Instruction Manual

(V20140428)



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1 General Descriptions

1.1. Basic working principle

TIME®7231 uses piezoelectric acceleration transducer to convert vibration signal into electric signal. Then by analyzing input signal, results including RMS of velocity values, peak-peak value of displacement, peak values of acceleration or real-time spectral charts are displayed or printed out.

1.2. Application range

The vibration meter is designed to test conventional vibration, especially the vibration test in rotating and reciprocating machines. It can be used not only to test the acceleration, velocity, and displacement of vibration as well as rev (or inherent frequency), but also perform simple failure diagnosis.

The technical specifications of TIME®7231 comply with the requirements of GB 13823.3. TIME®7231 is widely used in machinery, power, metallurgy, automobile and other industrial fields.

1.3. Technical Specifications

Table 1.1 Basic technical specification

Measuring range	Acceleration: 1.0m/s ² ~392.0 m/s ² (Peak) Velocity: 0.10cm/s~80.00cm/s(RMS) Displacement: 0.01mm~18.10mm(Peak-Peak)
Frequency range	Acceleration: 10Hz~10kHz Velocity: 10Hz~1kHz Displacement 10Hz~500Hz
Accuracy	± 5%
Temperature	0°C~40°C
Relative humidity	≤ 80%RH

1.4. Other parameters

- Display screen: 320×240 dot matrix
- Battery's parameters: Li battery, work 20 hours continuously.
- Dimensions: 171mm×78.5mm×28 mm.
- Weight: 230g

1.5. Features

- Two display modes: numeric value mode and spectrum mode
- The acceleration, velocity, displacement of vibration and rev (or inherent frequency) can be tested.
- The testing meter can display measurement values in status bar according to alarm limit and warning limit.
- Simple failure diagnosis: Automatically raise the alarm and require the spectrum testing mode when the measurement value is beyond the limit.

- If equipped with printer, measurement value and spectral charts can be printed out.
- Memory function: It can store 100×100 measurement values and 100 spectral charts.
- Li battery is used: The battery can charge at any time safely and it can work continuously for a long time after charging is finish.
- Auto-shutdown, alarm, data output function.

1.6. Basic configuration and Optional accessories

- Basic configuration

Title	Quantity
TIME®7231 main body	1
6V/500mA ~220V / 50Hz power adapters	1(select one of them)
6V/500mA ~110V / 50Hz power adapters	
Vibration transducer TSV-01(low sensitivity)	1
Leather wrap	1
Magnetic base	1
Manual	1
Package case	1

- Optional accessories

Title	Quantity
RS232 communication cable	1
TA230 printer	1
Probe groupware	1

2 Technical terms

1. Vibration: A rapid linear motion of object about an equilibrium position, like piston, tuning fork or motor.
2. Vibration displacement: The magnitude of a vector from the initial position to a subsequent position assumed by a body.
3. Vibration velocity: The rate of speed of vibration.
4. Vibration acceleration: The rate of change of vibration velocity with respect to time.
5. Vibration frequency: The number of complete cycles of vibration per unit time.
6. Point number: One point number correspond to one testing point
7. Patrol test: Test more than one point in a fixed routine. Each point correspond one testing point.
8. Warning limit: Remind users that the vibration is beyond the limit of the safe state.
9. Alarming limit: Remind users that the vibration is beyond the limit of the destruct status.
10. RMS, peak values and peak-peak values (see Figure 2-1)

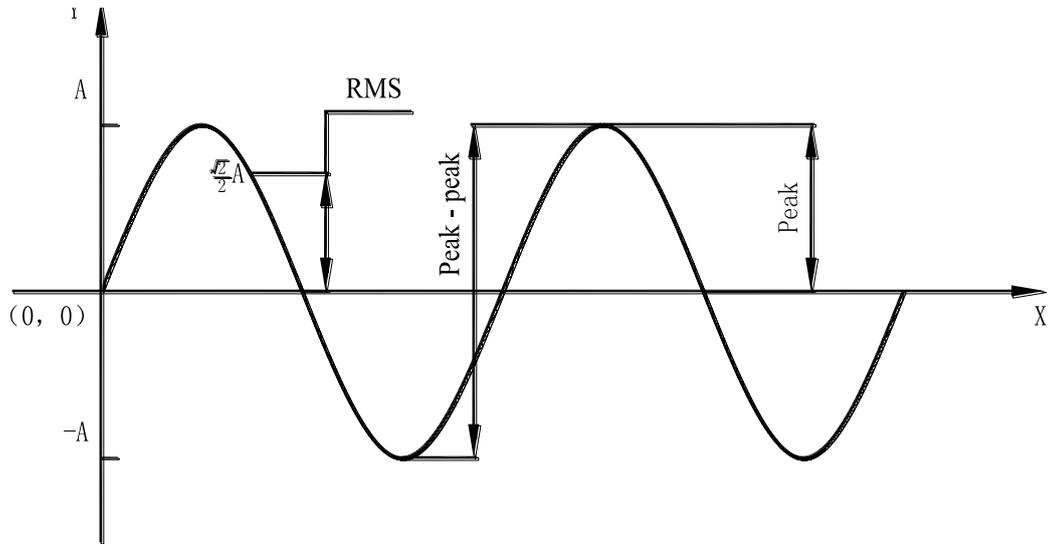


Figure 2-1

3 Configuration

3.1. Description of components

According to different situations, the transducers maybe fixed in the probe groupware or connected to the magnetic base (see chapter 4 in detail.).

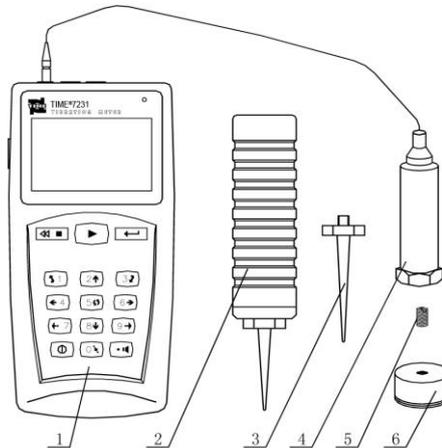


Figure 3-1

- 1. Main body
- 2. Probe groupware
- 3. Long needle
- 4. Vibration transducer
- 5. Bolt
- 6. Magnetic base

3.2. Appearance

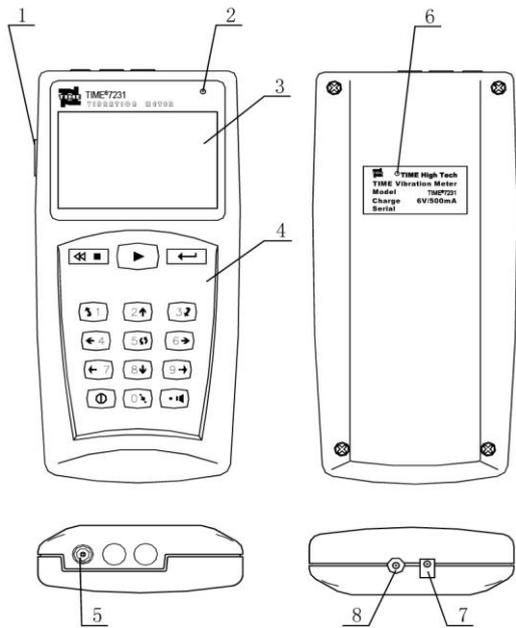


Figure 3-2

1. Obligate 2.Charger indicator 3.Display screen 4.Keyboard 5.Transducer socket
6.A sensitivity knob in the hole 7.Charging socket 8.Communication socket

4 Installation of Transducer

4.1. Installation principle

- The testing position should show the vibration characters of the object to be tested.
- The main axis of the transducers should be consistent with the direction of the object to be tested.
- The transducers should be in close contact with the object to be tested.

4.2. Install method

Table 4.1

Install method \ Contrast	Install with bolts	Install with magnetic base	Install with probe
Cost	None	low	Rather high
Affection on the result	None	When roughness is worse than Ra1.6, the result maybe not stable.	When caring about acceleration and the vibration frequency is higher than 1KHz, the result will be smaller.
Convenience	Not good	good	Best

4.2.1. Installed with bolt

Application range: Screw eye has no influence on the running of the object being tested.

Usage: Drill a screw eye 5mm deep in the object being tested. Connect the transducer to the object by bolts (see Figure 4-1). And this is the method that the frequency response is best.

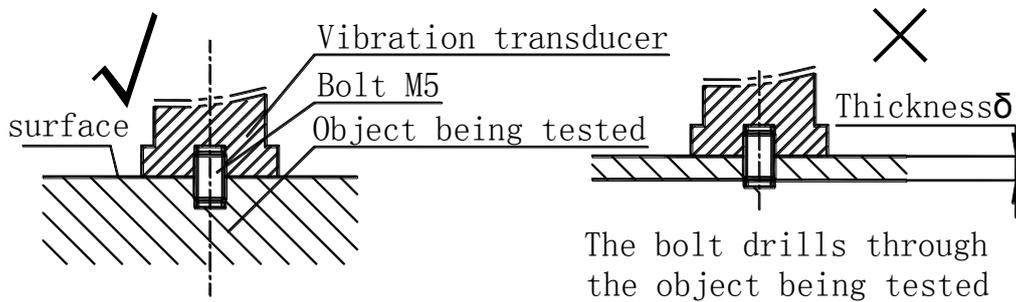


Figure 4-1

4.2.2. Installed with magnetic base

Application range: Magnetic, flat surface, roughness less than Ra1.6, acceleration less than 20 m/s^2 .

Usage: Take off the iron wafer and rubber wafer which is under magnetic base, attach the magnetic base to the object being tested and then screw the transducer of tester on the magnetic base (see Figure 4-2).

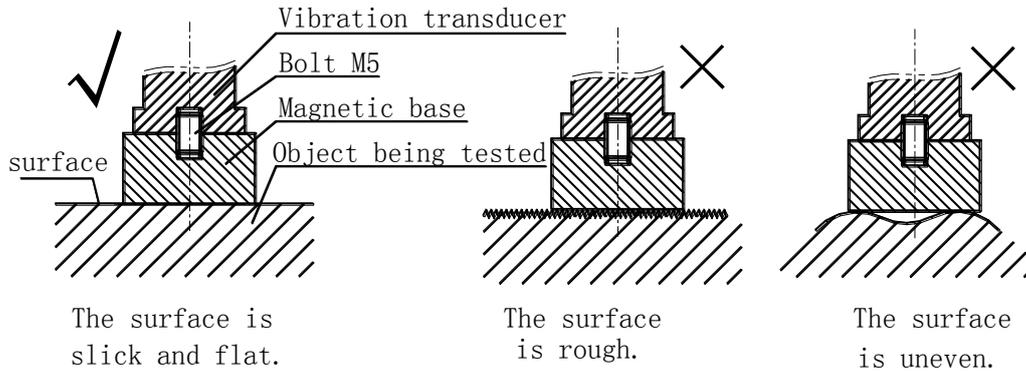


Figure 4-2

Operation tips:

Before measurement ,pay attention to :

- (1) The surface being tested should be flat and the roughness should be less than 1.6
- (2) The iron wafer under magnetic base should be taken off. The magnetic force should be enough.

4.2.3. Installed with probe

Applications range: Frequency is less than 1kHz; vibration energy is not too small.

Usage: Connect the needle to the transducer directly by using probe groupware (see figure 4-3)

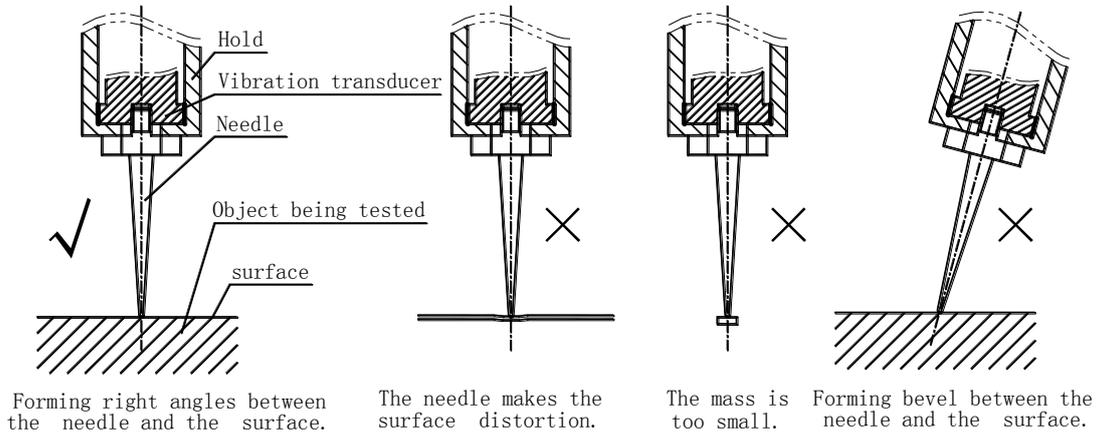


Figure 4-3

4.3. System operation

Note:

- Press  to switch on/off the meter.
- Press  to enter into measurement
- Press  to confirm operation or enter into submenu.

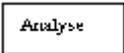
● Press  to cancel or return last menu, press  to end measurement when in measuring status.

● Press  for obligate

● Press  to switch on/off buzzer.

● Press  to switch on/off the point increment function.

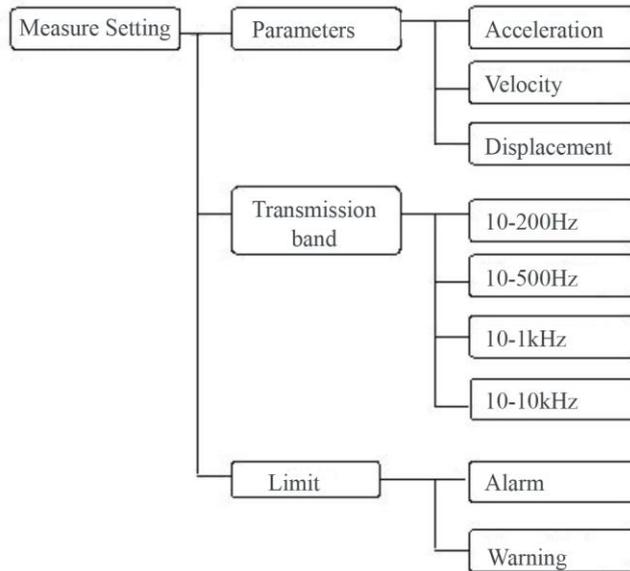
● Menu in reverse video indicates the item is selected. For example  is in being selected status, while

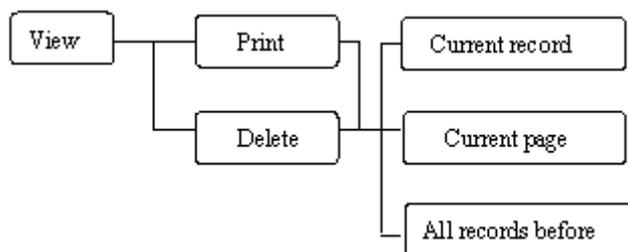
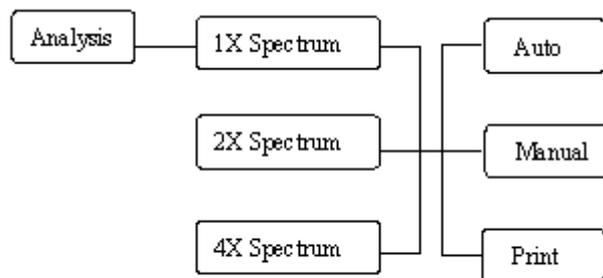
 is not.

● When menu item is in horizontal direction, press  and  to select the item you required.

● When the menu is in vertical direction, press  and  to select the item you required.

● When  appears, press  and  to perform corresponding operation.





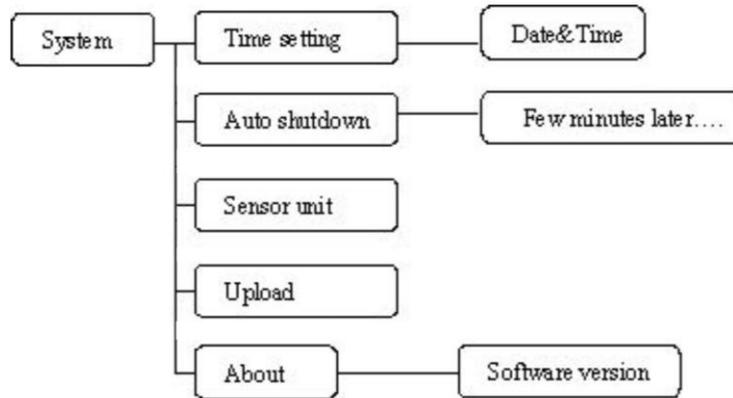


Figure 4-4

From the figure 4.4, the main menu comprises four basic function blocks:

- Measurement setting: the selection of measurement parameters
- Analysis: description in spectral chart and easy diagnosis of the vibration.
- View: view the stored measurement result.
- System: setting of the system parameters

- Press  key to power on → Press  key to start the testing operation (displays one moving column) → Press  key again to finish the test → Read the measurement values
- When testing continuously, the measurement point number can increase automatically. Users can also choose the measurement point number by Up/Down keys

The main menu contains several following items:

(1) Battery: Display battery status.

Operation tips:

The gauge will shut down automatically when  displays, please charge it in time to avoid the influence of “use” and “accuracy of measurement

It will shorten charge time if the unit switch on and  is shut down.

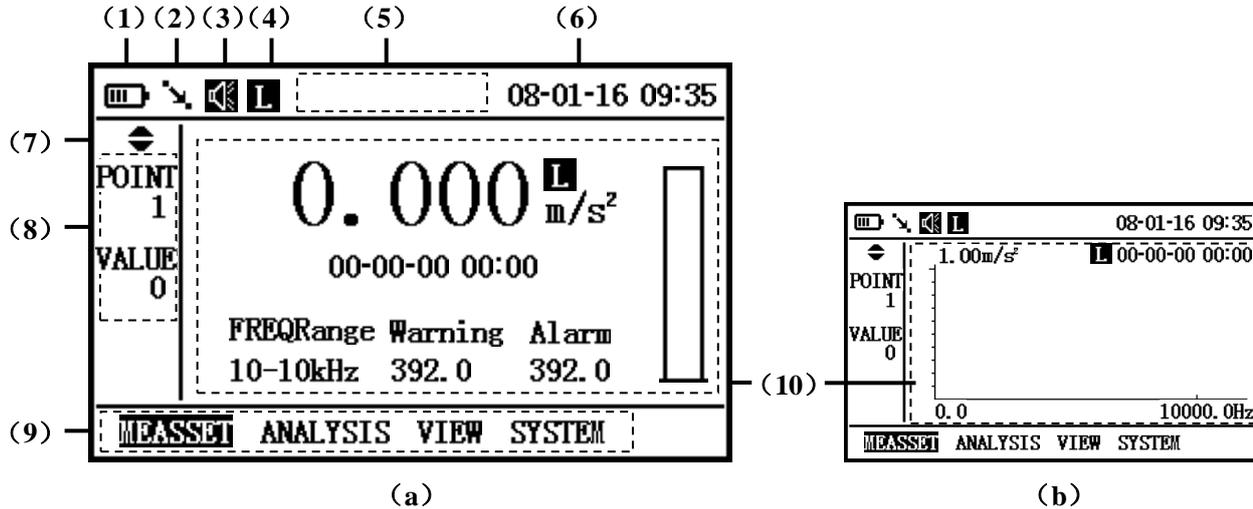


Figure 4-5 Main interface

(2) Point increment: Press  to switch on/off the “point increment” function.

Select , it is allowed to use “point increment” function. For example: when a testing operation of current point number is finished, the point number will increase automatically, and go into the waiting state of the next point number.

Select , point number will not increase automatically. When test are performed continuously, the

measurement results will be regarded as different testing results of the same testing point number.

(3) Buzzer: press  to switch on/off buzzer.

Select , it is prohibit using the buzzer.

Select  to switch on the buzzer.

(4) Selection of transducer: select transducer according to the “Sensor Unit” in the system menu.

Operation tips: TIME[®]7231 only support low sensitivity transducer.

(5) Status display region: display the status of the system. For example: after measurement completed, “Saving” will display on the screen.

(6) System time: display the current time.

(7) Up and down arrow keys  : when the arrow appears, it indicate that the corresponding region support the switching operation by pressing  and .

(8) Left view region: display the current selected number and the number of stored measuring data.

(9) Function selection region: display menu item that can be selected.

(10) Main view region: display the latest measured value or spectrum chart of the current point number.

- Numerical value display comprise: measured value, measured time, preset parameters and histogram, and histogram is the description of relationship of “alarming value”, “warning value” and “measured value”.
- Spectrum display comprise: spectrum chart of measurement and the corresponding ending time of measurement.

Operation tips:

Switch between numerical value display mode and spectrum mode of measurement can be performed by pressing  .

4.4.1 Measuring settings

The initial interface of measuring settings are displayed as figure 4.3. Measuring setting contains: parameters, velocity, displacement.

There is several parameters, tester can select proper parameters according to specific measurement requirement (see Table 4.2):

Table 4.2

Operation tips:

- (1) If the preset of warning value exceeds the preset of alarming value the system will set “warning value” = “alarming value” automatically.
- (2) If the preset value exceeds the default value of table 4.2, system will set “preset value” = “default value”.
- (3) If the preset value is less than the lower limit of measurement, system will set “preset value” = lower limit of “measurement”.

Parameters	Acceleration	Velocity	Displacement
Transmission Bands	10Hz-200Hz 10Hz-500Hz 10Hz-1kHz 10Hz-10kHz	10Hz-200Hz 10Hz-500Hz 10Hz-1kHz	10Hz-200Hz 10Hz-500Hz
Default warning values	392 m/s ²	80 cm/s	18.1 mm
Default alarming values	392 m/s ²	80 cm/s	18.1 mm

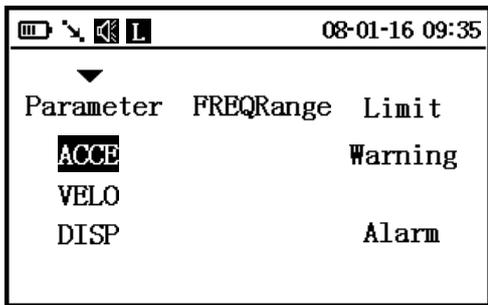


Figure 4-6 Measuring setting interface

4.4.2 Analysis

Analysis interface display as figure 4.4. It contains

1× spectrum: analysis spectral lines=200

2× spectrum: analysis spectral lines=400

4× spectrum: analysis spectral lines=800

The resolution of 1X spectrum, 2X spectrum, 4X spectrum in different transmission band see Table 4.3

Table 4.3

Transmission Band	1X spectrum resolution	2X spectrum resolution	4X spectrum resolution
10Hz-200Hz	1Hz	0.5Hz	0.25Hz
10Hz-500Hz	2.5Hz	1.25Hz	0.625Hz
10Hz-1kHz	5Hz	2.5Hz	1.25Hz
10Hz-10kHz	50Hz	25Hz	12.5Hz

“1×spectrum”、“2×spectrum” and “4×spectrum” all contains:

- Auto: select “Auto” function, then press  and  to move the cursor right and left, system will capture the peak value automatically.
- Manual: select “Manual” to view the amplitude of any test point in the spectrum chart, press  and



to move cursor left and right. The frequency of amplitude of selected test point displayed.

- Print: current displayed spectrum chart can be printed out via TA230.

Operation tips:

If you did not store the spectrum chart, when you enter “Analysis” function, submenu can not be entered.

TIME[®]7231 can print out spectrum chart via TA230;

X0: the position of initial frequency

Xmax: the position of ending frequency

Xdiv: frequency division

Ymax: upper limit of amplitude

Ydiv: amplitude division

during “Auto” analysis, the peak values that is more than a quarter of the max peak value will be captured and displayed, other value will be neglected, if you want to see details of more peak value, select “Manual” analysis.

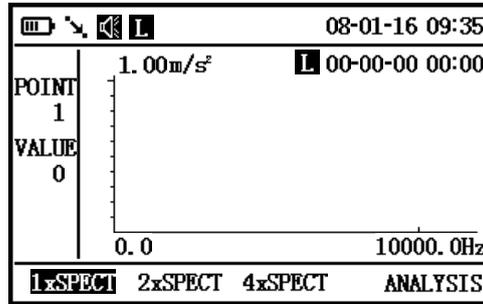


Figure 4-7 Analysis interface

4.4.3 View

Users can look through the measurement results stored in the memory by selecting “View”. The information of each measurement result comprises point number, testing time, measured values and prompt information (“!” indicates the measured results exceeds alarming value, “! ” indicates the measured results exceeds warning value(see Figure 4.5).It contains:

- PRINT
- DELETE

Both “PRINT” and “DELETE” contains :

- Current: Press  to print or delete selected measured results.
- Current page: press  to print or delete all the measured results displayed in the page.
- All: press  to print or delete all the measured results of the point.

Operation tips:

If measured value are not stored, user can not switch to main menu region as well as submenu.

The switch between left view region and main view region can be performed by pressing .

When you just enter into “View”,  is located in the left view region, press  and  to select

different test point. When you want to view specific test point ,press  to switch to main view region, then

press  and  to move the cursor up and down, Press  and  to page up.

For each test point number, system can store 100 measured value and 1 spectrum chart. After each measurement is finished, the corresponding values and spectrum chart are stored in real time; when another measurement performed in the same point number, the former spectrum chart will be replaced by the latest one, and the measured value are stored in memory in sequence. If memory reach up to 100 measured results , when another measurement carried out ,the new test result will replace the earliest in the stored 100 measured results.

So it recommends keep the data to avoid the loosing of the important data.

   		08-01-16 09:35	
POINT	9.	3.8963 mm	08-01-09 08:52
	2	10. 23.7076 mm !!	08-01-09 09:00
VALUE	11.	13.302 cm/s	08-01-09 09:01
	26	12. 58.22m/s ² !	08-01-09 09:12
		13. 20.56m/s ²	08-01-09 09:16
PRINT		DELETE	VIEW

Figure 4-8 View interface

4.4.4 System

System menu comprise:

- Time setting: Key in number to set the “Year”, “Month”, “Date”, “Hour” and “Minute”.
- Auto shut down: Key in the time of auto shut down, the range is 1 to 30 minutes. The default time is 30 minutes.
- Sensor: Select “High sensitivity” or “ Low sensitivity”.
- Upload: Upload the stored measurement results. If there is invalid operation, it will exit the “Upload” function.

- About: Display the “Software version”.

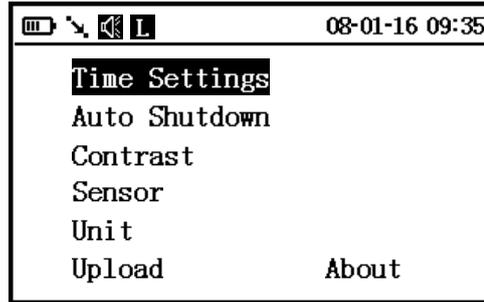


Figure 4-9 System interface

5. How to use the accessories

TIME[®]7231 has accessories such as printer, corresponding software and probe groupware. If equipped with printer, the printing operation can be performed. The data stored in TIME[®]7230 can be uploading to PC and do analysis with corresponding software. If PC is equipped with printer, the data can also be printed out from PC.

TIME[®]7230 connects to printer or PC through a communication cable. One end is connected to TIME[®]7230 through RS232 serial port, and the other end is connected to printer or PC through a 9-pin connector.

How to use the software can refer to the specifications of the corresponding software.

6. Trouble shooting

- When the battery can not charge, check the charging indicating light.
- The measurement value is unstable.
 1. Make sure the vibration frequency of the vibration object is in the frequency range of 10Hz—10kHz.
 2. If the magnetic base is used, pay attention to:
 - a. Make sure the surface of the tested object is flat, and roughness is smaller than Ra1.6.
 - b. Make sure the iron wafer below the magnetic base is taken off, and the magnetic force is enough.
 - c. Make sure the magnetic base is screw into the vibration transducer.
- Meter can not measure.
 1. Make sure the components is well installed, refer to chapter 4.
 2. Make sure the frequency range of the parameter is satisfied with the measurement requirements.
- Printer does not work.
 1. Make sure the printer is in “Ready” status.
 2. Make sure the printer is connected well to the power.
 3. Make sure the printer is connected well to the meter.

If some trouble can not be overcome, please contact to TIME Group Inc.

7. Maintenance

1. Operating environment: Strictly avoid collision, heavy dust, dampness, strong magnetic field, oil, grease and dirt.
2. How to clean the main body of the meter: Because alcohol and other chemical liquid can erode the main body of TIME[®]7230, especial the display window, little water can be used to clean to meter smoothly.
3. How to use the connector: Don't plug the connector of the transducers, printer or PC, when TIME[®]7231 is power on.
4. Calibration: The vibration meter is a high-precision instrument and the environment will influence on it. So it should be calibrated periodically (half a year or one year). If the sensitivity has changed, it can be adjusted by rotating the knob which is use to adjust the sensitivity.
5. Electromagnetic influence: when the electromagnetic field is over 10 V/m, the accuracy of testing will be influenced.

Attention:

While measure with Magnet Base, must placed the Magnet Base on the workpiece before connecting the Sensor to Magnet Base, this is to prevent the Sensor damaged by the strong impact force.

Appendix 1: Vibration standard

a. Rank of machine vibration (ISO2372)

Vibration amplitude	Machine sort			
Vibration Velocity V_{rms} (mm/s)	I	II	III	IV
0.28	A	A	A	A
0.45				
0.71				
1.12	B	B	B	B
1.8				
2.8	C	C	C	C
4.5				
7.1	D	D	D	D
11.2				
18				
28				
45				

Note: (1) Class I is small motor (power less than 15kW). Class II is medium motor (power between

15kW~75kW). Class III is high power motor (hard base); Class IV 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. 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.

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

Rev (rpm)	Vibration 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.

d. Maximum vibration of squirrel-cage induction drive motor (API STD 541)

Synchronous rev	Vibration displacement (p-p)(um)
-----------------	----------------------------------

(rpm)	Stretch base	Hard base
720~1499	50.8	63.6
1500~2999	38.1	50.8
≥3000	25.4	25.4

*American Petroleum Institute (API) established this standard.

e. 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 (N)	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.

Appendix 2 Vibration frequency and possible reason

Vibration frequency	Most possible reason	Other possible reason	Note
Synchronous with f_s *	Imbalance	1) Eccentric of gear, belt sheave and bush 2) Shaft is not in the middle or curving (if vibration on the shaft direction is high), 3) Belt fault 4) Syntony 5) Reciprocate force	
Double f_s	Mechanical loose	1) Shaft is not in the middle or curving (if vibration on the shaft direction is high), 2) Belt fault 3) Syntony 4) Reciprocate force	
Triple f_s	Not in middle		
N multiple	Gear fault, liquid force,	$1 \times N \times f_s$ (N is the tooth number of the fault gear).	If loose is worse, there maybe higher multiple frequency.

of f_s	mechanical loose, reciprocating force	$2 \times N \times f_s$ (N is the paddle number of the fault pump or fan)	
$< f_s$	Oil film eddy turbulence	1) Drive belt fault 2) Interferential vibration 3) Beat frequency	
Synchronous with power frequency	Armature fault	Electric fault such as rotor broken, rotor eccentric, three phase imbalance and air clearance not symmetry	
Double the power frequency	Torsional impulse		Seldom
High frequency (not multiple of f_s)	Shaft is not lubricate	1) Cavitations and turbulent flow 2) Frictional force	Amplitude and frequency of vibration are always not steady.

* f_s is the frequency according with the rev of main shaft.



TIME VIBRATION TESTER TIME®7231

PACKING LIST

No.	Description	Qt.	Note	No.	Description	Qt.
1	Main unit	1		14		
2	Probe	1		15		
3	Leather wrap	1		16		
4	Poweradapter	1		17		
5	Magnetic base	1		18		
6	Instruction manual	1		19		
7	Warranty card	1		20		

8	TIME certificate	1		21		
9				22		
10				23		
11				24		
12				25		
13				26		