BEIJING SENDIG TECHNOLOGY, LTD.

USER'S MANUAL

For the

911

A Portable Vibration Analyzer

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1. General

911 is an economical vibration data collector. It can be used in field vibration measurement, fault analysis, machinery condition monitoring as well as the storage of the characteristic values and waveforms of acceleration, velocity, displacement and high-frequency acceleration envelope. Its measurement data can be sent to a computer for archiving of equipment maintenance information database and signal analysis and fault analysis.

1.1 Configuration

Sendig 911 data collector consists a 911, MCMe software and accessories.

A picture of the front panel of the 911 is given on the right.

Note on the external sockets:

"Serial port" – for connection of communication line;

"Charging" – for connecting battery charger, use the same socket as "Serial port";

"Sensor" – for connecting accelerometer cable.

Functions of the buttons:

'O'—'Power On'; 'C'—'Power Off'; 'W'—'Save Waveform'; 'V'—'Recall Vibration Value'; 'Route'—'Route Menu'; 'Meas.'—'Measure Menu'; 'Func.'—'Function Menu'

1.2 Features

1.2.1 Automatic range selection during measurement

1.2.2 Automatic comparison with alarm threshold

1.2.3 12-bit AD resolution

1.2.4 Frequency range set automatically by computer software MCMe

1.2.5 Standard RS232c interface for communication with computer

SENDIG 911

1.2.6 Automatic power down, alarm on low battery voltage, power-off storage protection

1.2.7 Continuous measurement of acceleration, velocity, displacement and high frequency envelope

1.2.8 Dual measurement modes: vibration meter (continuous display of values of a single parameter) and data collector (continuously collection of all values of 4 parameters)

1.2.9 Fast qualitative diagnosis of machinery faults based on askew index and kurtosis index

1.3 Operational Environment

1.3.1 Environmental temperature: 5 - 40 (degrees Celsius)

1.3.2 Relative humidity: ≤85% (non-saturated)

1.3.3 No corrosive gas

1.3.4 No strong electromagnetic field interference and no strong vibration and shock

1.4 Safety

Sendig 911 data collector and its sensor should not be in direct contact with moving parts of the machinery. You should also observe the safety regulations of the workshop during the operation.

2. Specifications

2.0 Measurement condition: (all specifications below should be under these condition)

2.0.1 Temperature: 5^oC - 50^oC

2.0.2 Humidity < 85%

2.0.3 Non-causticity environment

2.0.4 Without strong electric-magnetic field & strong impact

2.1 Maximum measurement range / frequency range: (when the sensitivity of the sensor is 5pC/ ms^{-2})

Parameter	Maximum Measurement Range	Maximum Resolution	Frequency Range
Displacement Peak-Peak value	2 mm	1 micrometer	10 - 500Hz
Velocity RMS value	200mm/s	0.1 mm/s	10 – 1kHz
Acceleration Peak value	$250m/s^2$	$0.1\ m/s^2$	20 – 10kHz
High Frequency Acceleration Envelope RMS value	20unit	0.1unit	5-1kHz, Demodulated from15-40kHz acceleration

2.2 Accuracy:

Noise Level (without vibration input): ACC<0.25 m/s^2, VEL<0.5mm/s, Disp<3μm

Frequency response accuracy: ±5%, ±10% for ACC 4.5kHz - 10kHz

Non-linearity: ±5%

2.3 Type of sensors: Piezoelectric accelerometer.

2.4 Range of frequency analysis: 100, 200, 500, 1k, 2k, 5k, 10k (Hz).

2.5 The sampling frequency is 2.56 times of the analysis frequency range.

2.6 Anti-aliasing filter: 8-order ellipse

2.7 Power supply: Nickel-Hydrogen battery. Work for at least 8 hours continuously after fully charged. Storage capacity for 320 sets of data (including sequential number, peak of acceleration, RMS of velocity, peak-peak of displacement, and RMS of envelope) and 48 x 1024-points vibration waveforms.

Dimensions: 196 x 101 x 45 (mm)

Weight: 1100 grams (including battery)

3. Measurement Preparation

Connect the accelerometer through its cable with the "Sensor" socket of 911.

The sensor should be correctly fixed when making vibration measurement. Clean the surface of the location of the machine under test. Then fix the sensor through the magnetic mount.

Set correctly the accelerometer sensitivity before measuring (refer to Section 5.2.1 for details).

Refer to the operation instructions for the MCM software for software operation.

Note: The attraction of the magnetic mount is very strong. Hold the sensor firmly and place or take off the sensor lightly on/from the test surface during measurement. NEVER pull the connection cable hard.

4. Operation

4.1 Route Key and Menu

Power on Sendig 911 by pressing the "O" button and it will automatically enter the route menu; see the right figure, without any operation. You can also enter the route menu from elsewhere by pressing the "Route" button. It will also enter the route menu after memory formatting (see clearing memory operation section in the function menus).

The 1st line is the sequential number of the point while the 2nd line displays the point name/identification. The range of the sequential number of the route is between 1 and 320. Press the ↑ or ↓ button to go from one point to another when the cursor is at the 2nd line.

```
Point:   1
ID:    Point1
Alarm Parameter:    Acc.
Data:New    WaveSave: No
Status:
Stronger Than Alarm!
```

Press the "Route" button in the route menu can move the cursor to the 3rd line where you can decide what is the alarm parameter. When a measured value of this parameter higher than the threshold, an alarm will be raised. The alarm parameter acts also as the waveform parameter when you save a measured waveform to send to computer software.

The 4th line displays whether there is a set of new measured data for this point and whether a new measured waveform is saved.

4.2 Meas. Key and Menu

Press the "Meas." button to enter the Meas. Menu:

4.2.1 Setting Accelerometer Sensitivity

Generally speaking, different accelerometer has different sensitivity. Make sure that the sensor sensitivity in Sendig 911 data collector is consistent with the accelerometer you use, normally can be found in the accelerometer certificate. Otherwise, the measurement will not be accurate.

```
Measure
Notebook
Sensor: 5.00 pC/ms⁻²
[Meas.] To select item
[Arrow] To change
```

Sensor: 5.00 pC/ms^{-2}

The setting method is: Press the "Meas." button and move the cursor to the 3rd line. Then press the ↑ or ↓ button to adjust to the right value.

Note: Press the ↑ or ↓ button once will change the value by 1; Presss and hold the ↑ or ↓ button for a moment will increase or decrease ten times fast. Release the ↑ or ↓ button and it will return to normal speed.

4.2.2 Notebook function

Press the "Meas." button and move to the 2nd line and then press Enter to enter to the notebook function:

Press the Meas. button and move the cursor to the 2nd line. Then use the ↑ or ↓ button to choose from: Normal, Not In Use, Seal Leaking, Much Noise, oil Level Low, Very Hot, Bear. Changed, Seal Changed, Pre. Flow Low, Other States. These are used to record the field observation.

```
Observation:
      Normal
Parameter:
      Temperature
Value:   20.00 / 20.00
[Enter] To return
[Meas.] To select item
```

Press the Meas. button to move the cursor to the 4th line. Then use the ↑ or ↓ button to choose temperature, pressure, load or current, and other parameter. This is the name of the parameter of the 5th line to be recorded.

Move the cursor to the 5th line, and then use the ↑ or ↓ button to change the value. The number behind the symbol "/" is the original value saved in the instrument.

4.2.3 Measurement

After the contents in the Route menu and Meas. menu are confirmed, you can move the cursor to the 1st line of the Meas. menu and then press Enter to start the measurement. It will then display the measured

vibration value one by one. You can then save the just measured waveform or do something else.

4.3 Func. Menu

Press the "Func" key to enter the Func menu:

You may press "Func" key to move the cursor to different lines.

4.3.1 Vibration Meter Measurement

When the cursor is at Vibration Meter in the 1st line, you can use the ↑ or ↓ button to choose from acceleration, velocity, displacement or envelope. Press Enter to make continuously measurement of vibration of this single parameter.

The following is the measurement screen when the measured parameter is velocity:

The "New" displays the true RMS value of real-time velocity. The "Ref" value is that sent from the computer, if communication conducted, or the stored value got from the previous measurement.

4.3.2 Evaluation of Machinery Health

Press the "Func." button to 'ISO2372 evaluation' in the 2nd line. Then press Enter to get:

This is based on ISO2372 standard as illustrated in the following table:

```
Vibration Meter: Vel.


ISO2372 Evaluation
Fault Diagnosis
Format Memory
```

```
Parameter: Vel.
Freq. Range:   1K Hz
New :      0.1 mm/s RMS
Ref :      0.1 mm/s RMS


[Func.] to stop
```

```
ISO2372 Evaluation
Machine Type:
     / 1.1 / 2.2 mm/s
Conclusion:
[Arrow] to change
[Enter] to Evaluate
```

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

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 different place around the machine.

Use the ↑ or ↓ button to choose the sort of machine, and then press Enter to measure and evaluate.

The 3rd line displays the neighboring low limit, if exist, the current measured value and the neighboring high limit, if exist, of the velocity RMS.

The 4th line display the evaluation conclusion based on the measurement and the result can be one of good, satisfying, not satisfying, and forbidden

The 5th and 6th lines are for prompting.

4.3.3 Fault Diagnosis

Press the "Func" button and position the cursor at the line of Fault Diagnosis. Press Enter to measure and diagnose fault with the parameter of

Vibration Meter: Acc. or Vel. or Disp. or ENV. The display following measuring will be as follows:

The experience-based diagnosis conclusion is based on the measured dimensionless kurtosis and askew index including

"Abrasion", "Shafting abnormity", "Local defect" and "Normal".

```
Vibration Meter: Vel
Diagnosis conclusion:
       Normal
   Shafting abnormity
Kurtosis index  :  xxx
Askew index     :  xxx
```

4.3.4 Format Memory

Press the "Func" button continuously to move the cursor to "Format Memory" at the last line. Press Enter and the following screen will appear:

Press Enter again and all settings and parameters will be restored to the factory defaults.

```
Warning ... :
Will delete all data!
[Enter] to confirm
[other key] to quit
```

4.4 W (Save Waveform) Menu

Press the W button after measurement and the following screen will appear:

Press Enter to save waveform or press other buttons to quit without saving.

```
VEL.    Waveform
Point: 23
ID: POINT***********
Freq. Range:   1K Hz
Waveform No.        Saved
[Enter] to save.
Other KEY to Quit.
```

4.5 V (Vibration Value) Menu

Press the V button after measurement and the following screen will appear:

The measured overall vibration of the point will be given in the left part and the right part can be either the setting got from computer or the previous measurement.

```
Point: ****
ID:
A:    /     m/s-2  Peak
V:    /     mm/s   RMS
D:    /     um     Pk-Pk
E:    /     unit   RMS
```

5. Software

Please refer to user's manual of MCMe2 and MCMe 3 software. However, the 100-line spectrum analysis and 3-D spectrum analysis are not applicable because 911 itself does not calculate spectrum.

6. Trouble-Shooting

Symptom	Trouble-shooting
The magnetic mount has no attraction force	Take off the protective iron cover on the bottom of the magnetic mount.
Cannot power on.	1) Press and hold the O (open) button for around 5 seconds; 2) The voltage of the battery may be low. Recharge the battery.
Spurious point name appears	1) Format the memory 2) The battery voltage may be low. Recharge battery and power on again.
Measurements not stable	1) The accelerometer cable does not connect well, firm it at both ends; 2) There exists short circuit or break in the accelerometer cable.
Communication fault	1) The communication cable does not connect well, firm it at both ends; 2) Wrong model type selected in MCMe software, re-select the model 911 3) Computer software faults. Re-install MCMe or scan for virus.

If other faults are found, make detailed records and contact Beijing SENDIG Technology Ltd..

7. Maintenance

7.1 Battery Charging

Nickel-Hydrogen rechargeable battery is used in Sendig 911 data collector. It will take 8 hours to fully charge the battery and then it will be ready for 8 hours of continuous operation.

7.2 Calibration

Sendig 911 and accelerometer should be calibrated periodically. The cycle of calibration is normally one year.

8. Transport and Storage

8.1 Transport

Avoid acute impact during transport.

8.2 Storage

Sendig 911 should be stored in a clean and dry place when not in use.