

BEIJING SENDIG TECHNOLOGY, LTD.

USER'S MANUAL  
For the  
**904/907**  
**Vibration Analyzer**

A Portable Dual-Channel  
Microprocessor-Based  
On-site Balancer  
Spectrum Analyzer  
Vibration Data Collector (904)

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## THE 904/907 USER'S MANUAL

The only difference between 904 and 907 is that 904 can be used together with Machinery Condition Monitoring software (MCMc) and Spectrum based Diagnostic Expert System (SDES). In the following contents of this manual we use the word "SENDIG-907" in most case for both of 904 and 907.

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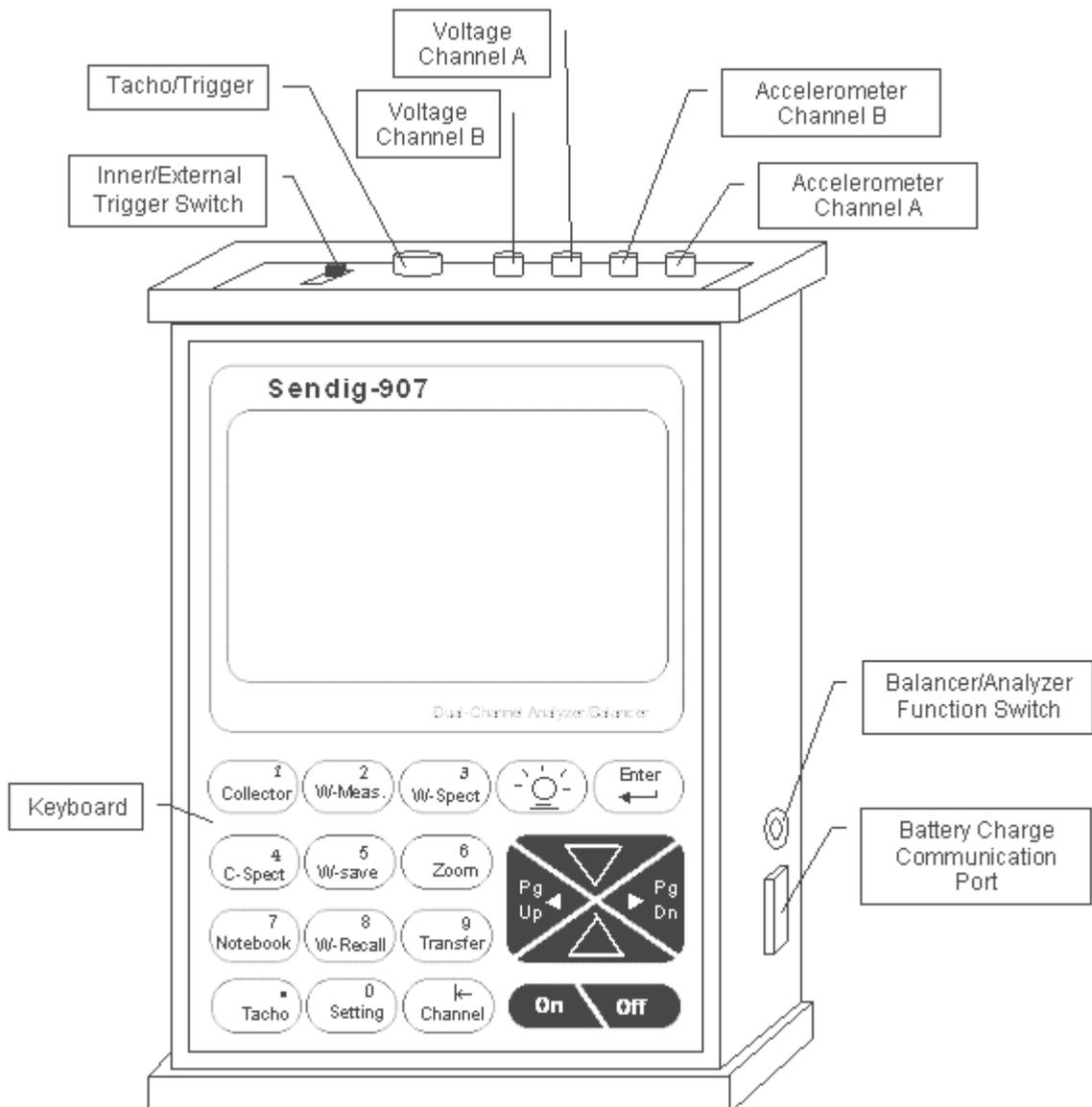
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# 1 GENERAL

Imbalance is one of the main causes of machine vibration. It is estimated that about 50 percent of all the faults are caused by imbalance of rotors. The best mean for getting rid of mechanical imbalance is on-site balancing. SENDIG-907 Machinery Analyzer/Balancer is especially useful for this purpose. It can measure the intensity of the vibration; diagnose vibration cause by analyzing the frequency spectrum. It can also be used to measure the rotation speed and vibration phase, and to calculate the imbalance weight and location.



## Features:

- Easy to use
- Vector illustration, the balancing process and result are shown clearly at a glance
- Storage of 10 rotors balancing data
- Selectable of trial mass remove or remain
- Decompose of balancing result to two assigned location
- Trial weight range calculated according to the weight of rotor, rotation speed,

- radius and required balance grade
- Trial mass validity judged automatically
- Measuring RPM, amplitude and phase
- On-site 400 lines FFT spectrum and diagnosis function
- Dual-channel simultaneous data collection
- Hardware envelop demodulation for bearing and gear diagnosis
- Transfer function for measuring natural frequency
- Waveform and spectrum display by large LCD
- Storage of vibration values and vibration waveform

### Operation condition

- Temperature range: from 5°C to 50°C
- Relative humidity:  $\leq 85\%$ , unsaturated
- Without caustic gases
- Without strong electric-magnetic field & strong impact

### Safety

The 907 are not permitted to contact with running part of machine.

### Specifications

- Rotation speed range for dynamic balancing: 180-24,000 r/min
- Auto-range and manual-range selectable
- Measurement accuracy:
  - Noise Level (without vibration input):  $ACC < 0.25 \text{ m/s}^2$ ,  $VEL < 0.5 \text{ mm/s}$ ,  $Disp < 3 \mu\text{m}$
  - Frequency response accuracy:  $\pm 5\%$ ,  $\pm 10\%$  for ACC 4.5kHz - 10kHz
  - Non-linearity:  $\pm 5\%$
- Sensors: Piezoelectric accelerometer, Magnetolectricity velocity, Eddy displacement and etc.
- 8<sup>th</sup>-order ellipse anti-aliasing filter, RPM band-pass filter
- Input signal: Accelerometer, and voltage
- Amplitude spectrum analysis: 100 lines to 400 lines (zoom), Hanning windowed
- Frequency span of spectrum analysis: 100, 200, 500, 1k, 2k, 5k, 10kHz(only for 1-channel sampling)
- Data storage: 62 waveforms of 1024-points and 240 data sets
- Amplitude ranges & Frequency Response for overall vibration measurement:

	Amplitude ranges	Frequency Response
Displacement	0.003 – 5 mm peak-peak	10 – 500 Hz
Velocity	0.2 – 200mm/s true RMS	10 – 1000 Hz
Acceleration	0.5 – 250m/s <sup>2</sup> peak	20 – 5000 Hz
Envelope	0.1 – 20unit true RMS	5-1000Hz from 15-40 kHz
Voltage	0.1 – 10V peak-peak	10 – 10000 Hz

- Notepad: 10 condition codes for visual inspection
- Output: RS232C for communication with PC
- Power: Ni-MH rechargeable battery for 8 hours continuous operation, low battery warning
- Operating Environment: 0~55 °C, 90% humidity non-condensing
- Rotating speed measurement with photocell sensor
- Dynamic Range: 60dB with 48dB adjustable gain range
- Dimensions: 21×13×4 cm; Weight: 1.2 kg (Include batteries)

## 2 BALANCE PRINCIPLES

### 2.1 What is 1-plane rotor imbalance?

Rigid rotor works under the speed far less than its first-order critical rotate speed and its deformation can be neglected. When the quality of the rigid rotor nearly focuses on a disc, namely the ratio of its axial length and its diameter is less than 0.5; we can do 1-plane balance on it and gain satisfactory result.

But for the flexible rotor, the deformation cannot be neglected. So its method of balance differs from rigid rotor. However, the rotor with single imbalance plane can also be balanced according to the method of 1-plane balance of rigid rotor. For above, whether the rigid or flexible rotor, its quality of imbalance always focuses on one disc, so both of them can be balanced according to the method of 1-plane rotor balance. In the plant and manufactory, such rotating machines are ubiquitous, such as pump, ventilator etc.

### 2.2 Principle of 1-Plane Balancing

SENDIG-907's 1-plane balance adopts the method of influence coefficient, which is also called balance method of 1-plane phase measuring. Just as its name implies, it's desirous to do the measurement with the phase of rotation-speed vibration when measuring the vibration amplitude of rotor. The rotation-speed vibration can be indicated as vector. The process of 1-plane balance is as follows:

- (1) Measure and gain the initial rotation-speed vibration vector ( $A_0$ ) under the normal operation condition.
- (2) Load the proper trial mass ( $M$ ) on the rotor and then measure vibration vector ( $A_{01}$ ) under the condition of the same rotate speed.
- (3) Calculate the balance mass ( $Q$ ) which should be load on the rotor according to the following formula:

$$Q = - M \times A_0 / (A_{01} - A_0)$$

During the balancing, all the vibration should be measured under the same rotate speed because of the imbalance force of rotor relates with the rotate speed.

### 2.3 Principle of 2-planes balancing

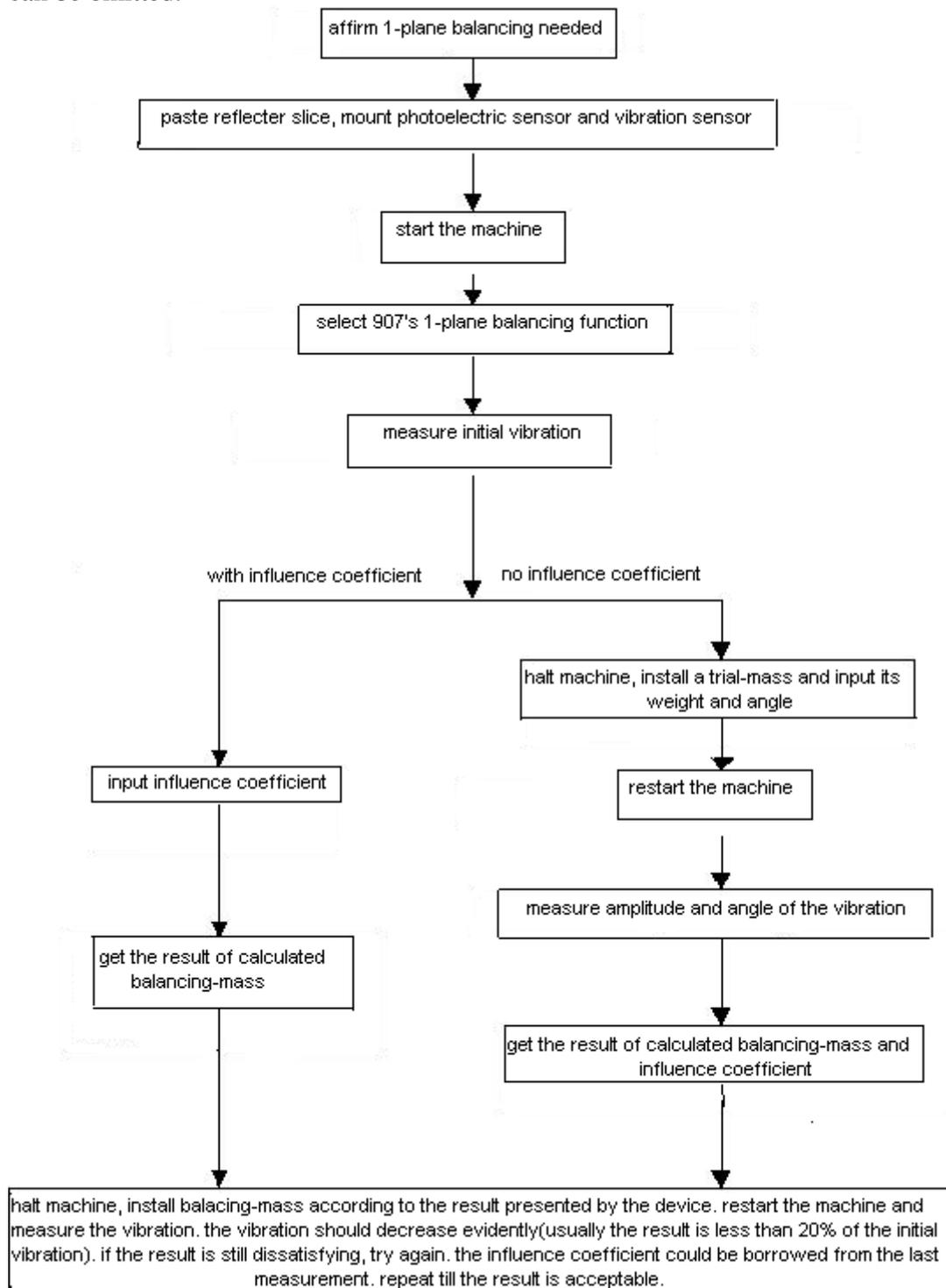
Almost all the balance of single span rotor can be achieved through the method of 2-planes dynamic balance. As a matter of fact, 1-plane dynamic balance is only one special example of 2-planes dynamic balance.

When doing 2-planes dynamic balance, two planes of adding mass and two points of vibration measure are needed. SENDIG-907's 2-planes dynamic balance also adopts the method of influence coefficient. But the difference from 1-plane dynamic balance is that the vibration of two measurement points should be measured when adding trial-mass to one of the planes. That's so-called interact effect. 2-planes dynamic balance has four influence coefficients.

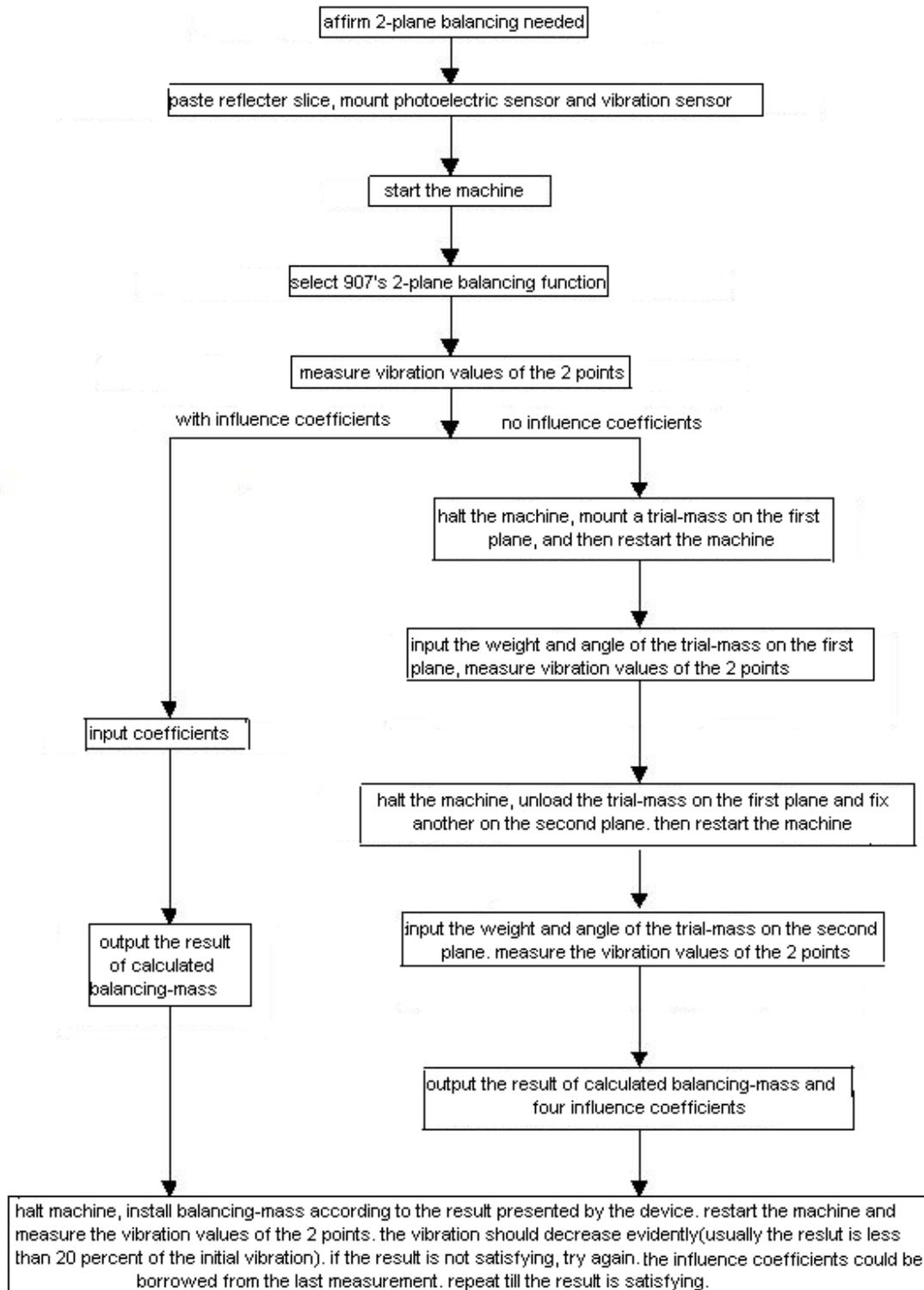
The steps to do 2-planes dynamic balance is as followings:

- (1) Measure initial value of two measurement points.
- (2) Load trial mass to first plane, then measure the vibration of two measurement points respectively.  
Load trial mass to second plane, and then measure the vibration of two measurement points respectively.
- (3) Get conclusion of the correction mass.

If the influence coefficient is known, it can be input directly and the above step (2) can be omitted.



### 1- Plane balancing



### 2-Plane balancing

## 3 BALANCING PREPARATION

Before using 907 for balancing, the following must be done firstly:

### <1> Confirm Dynamic Balance Needed

Affirm that machine has fault of imbalance and that it can be eliminated by the method of balancing. Once the machine has heavy vibration, we should do frequency analysis with the vibration signals firstly. Generally, the probability of imbalance is higher. So, when the vibration includes a high rotation-frequency spectrum peak and less harmonic frequency peak, meantime without evidence of other faults, very possible it is the fault of imbalance.

### <2> **Mount Sensors**

*Vibration Sensors:* It should be disposed in the horizontal direction (or vertical if horizontal not possible) on the bearing base, or on the base frame. Because dynamic balance is vector calculus, the position and direction of the sensor should keep unchanged in the balancing process.

*Photoelectric sensors:* Paste a reflecting or unreflecting adhesive paper (according to the condition of the rotor's surface) to a visible place of the rotor or its axis. Photoelectric sensor can give SENDIG-907 1 electric pulse per turn of the running rotor. Not only the rotate speed can be measured but also the vibration signals can be compared with pulse signals. So the phase of the rotation-frequency vibration can be obtained. During the balancing process, the position of the reflecting adhesive paper, the position and direction of the photoelectric sensor should keep unchanged.

### <3> **Connect Sensor Cables**

The photoelectric sensor should be connected to the Tacho/Trigger socket of **SENDIG-907**. For 1-plane balancing, 1 vibration sensor should be connected to the Accelerometer Channel A or Voltage Channel A socket. For 2-plane balancing, a second accelerometer should be connected to the Accelerometer Channel B or Voltage Channel B socket.

### <4> **Start Machine**

Start the machine and wait till it reaches its normal rotation speed (could be measured with the RPM measurement function).

### **NOTICE:**

- 1 Because of the strong pull force of the magnetic mount, when remove the sensor from the measurement surface, use your hand carefully. Do not remove the sensor by dragging the cables.**
- 2 Before measurement, the sensitivity of the sensors must be inputted to 907 correctly.**
- 3 The *internal/external* trigger switch should be set to “external”.**

## 4. BALANCING OPERATIONS

### 4.1 1-Plane Balancing

#### **4.1.1 WITHOUT INFLUENCE COEFFICIENT:**

### Step 1: Setting Parameters

Press "POWER ON" on the panel for a moment, without any operation, the 1<sup>st</sup> page appears. Then you can set the parameters.

Line 1: Input rotor number. When the cursor is on the 1<sup>st</sup> line the note displays "**Which Rotor to Balance**". Input rotor number with a number key. The range of rotor number is from 0 to 9. After the input, the cursor goes to the 3<sup>rd</sup> line automatically. Press  $\uparrow$  or  $\downarrow$  key to move the cursor between lines (the following are the same).

Line 2: Title, the cursor cannot arrive.

Line 3: Type of operation: **How Many Plane to Balance**. Input "1" with the number key indicating that 1-plane balancing is to be performed and then the cursor go to the 4<sup>th</sup> line automatically.

Line 4: Type of input: **SEN** for charge-output accelerometer and **VOL** for any voltage input. **Enter to Select**. Due to all data of the previous data will cleared when the input changed, the following warning will show in the 11<sup>th</sup> and 12<sup>th</sup> line:

**ARE YOU SURE?**  
**ENTER=YES OTHER=NO.**

If press any key except **ENTER**, no operation is performed. If press **ENTER**, the input mode will be altered. The displayed is the selected.

Line 5: Measuring mode. There are 3 options: **VEL, DIS, ACC**. **Enter to Select**. Due to all previous measured data will be cleared when the measuring mode is changed, the following warning will show in the 11<sup>th</sup> and 12<sup>th</sup> line:

**ARE YOU SURE?**  
**ENTER=YES OTHER=NO.**

If press any key except **ENTER**, no operation is performed. If press **ENTER**, the measuring mode will be altered.

Line 6: Input sensitivity of sensor A. The sensitivity can be usually obtained from the sensor certificate. After the 5<sup>th</sup> (including dot) digit is inputted, the cursor goes to the 7<sup>th</sup> line automatically. If the length of the data input is less than 5, press **ENTER** or  $\downarrow$  after the input and then you go to the next line.

Line 7: Input sensitivity of sensor B. When 1-plane balancing is performed, this parameter is not needed.

Line 8: Input the weight of a trial unit. This is useful if some fixed weight unit is used during the balancing.

Line 9: Tell whether the influence coefficients are known. **ENTER to Select**. Press **ENTER** repeatedly, **YES** and **NO** is shown circularly. **NO** indicates the coefficients are not known.

Line 10: **ENTER to Clear All Data of the Rotor**. Press **ENTER**, the following

```

ROTOR NUMBER: 1
-----SETTING-----
NUMBER OF PLANE: 1
INPUT MODE: Vel
MEAS. MODE: Dis
SEN a: 5.000pC/ms-2
SEN b: 5.000pC/ms-2
WEIGHT UNIT=11.22 g
HAVE INFL COEF? NO
CLEAR DATA

NOTE:

```

is shown on the 11<sup>th</sup> and 12<sup>th</sup> line:

**ARE YOU SURE?**

**ENTER=YES OTHER=NO.**

If press **ENTER**, the measured data will be cleared, the balance grade and the sensor sensitivities will change to default values. Press any key except **ENTER**, no data are cleared.

Before a balancing operation is performed, each line of this page must be rightly configured. You may skip a line by press  $\uparrow$  or  $\downarrow$ . Press **Pg Dn** to go to the next page.

### Step 2:Initial measurement:

When the following page is opened, the cursor is on the 2<sup>nd</sup> line. **Speed (r/min)** is shown on the right side of MEASURE. If you hope to see some measurement, move the cursor to there, and then the value is displayed. You can also edit the value. When the cursor is on the 2<sup>nd</sup> line the note displays **Enter to Measure**. Press **ENTER**, to measure the rotation speed. The RPM value on the right side of the 3<sup>rd</sup> line will update continually. When the rotation speed becomes stable, press **ENTER** for a moment, the 907 begins measuring vibration. The data in the 4<sup>th</sup> line (the left is amplitude while right is phase) will update continually. **“Stop Meas”** now displays on the right side of MEASURE. When the rotation speed, amplitude and phase all become stable, press **ENTER** for a moment to finish the measurement.

You may also manually input value here without measurement.

When the cursor is at the 4<sup>th</sup> line, you may input amplitude and phase. If the length of the digit inputted is less than 5, press **ENTER** to finish.

The 5<sup>th</sup> line is unreachable for 1 plan balancing.

### Step 3: Estimate weight of trial, and then fix a trial mass on plane I

Firstly, calculate the weight range of trial mass according to the formula recommended by the ISO.

In this page, when the cursor is on the 2<sup>nd</sup> line the note displays **Input How Heavy the Rotor is, ENTER**. After the 5<sup>th</sup> digit is inputted, the cursor goes to the 3<sup>rd</sup> line automatically. If the length of input is less than 5, press **ENTER** or  $\downarrow$  to go to the 3<sup>rd</sup> line.

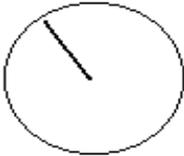
In the 3<sup>rd</sup> line, input maximal rotation speed with the number keys.

In the 4<sup>th</sup> line, Input the maximal radius at

```

--INITIAL MEASUREMENT--
MEASURE: speed (r/min)
ROTATION SPEED: 4830
Aa: 4.645 um /Pa: 120°
Ab:          um /Pb: °

```



NOTE:

```

-----TRIAL ESTIMATION-----
WEIGHT OF ROTOR:  3.000 kg
MAXIMAL RPM: 6000
TRIAL RADIUS: 25.00 mm
BALANCE GRADE: 1.000
CALCULATE
TRIAL MASS RANGE:
FROM 1.243 g TO 2.486 g

```

NOTE:

which trial masses fixed.

In the 5<sup>th</sup> line, input the required balance grade according to ISO1940.

In the 6<sup>th</sup> line, press Enter to calculate weight range of trial mass.

Stop the machine, fix a trial mass on plane I according to the calculation, and then restart the machine.

In the next page, the cursor is on the 2<sup>nd</sup> line, input the angle at which the trial I lies. Notice that the phase should be between 0°-360°. In the 3<sup>rd</sup> line please input how many weight units you used for trial I.

In the 4<sup>th</sup> line, please select whether trial mass is removed afterward. Press **ENTER** repeatedly, **REMOVE** and **REMAIN** are shown circularly.

**Speed (r/min)** is displayed on the right of MEASURE. If you want to see certain measured value, move the cursor there, and then the value is displayed, the value can also be edited.

When the cursor is on the 5<sup>th</sup> line, press **ENTER** to start the measurement of rotation speed. The data at the 6<sup>th</sup> line will update continually. When the rotation speed becomes stable, press **ENTER** for a moment, the 907 begins measuring vibration. The data in the 8<sup>th</sup> line (the left is amplitude while right is phase) are updated continually. "**Stop meas**" is shown on the right of MEASURE. When the rotation speed, amplitude and phase all become stable, press **ENTER** for a moment to finish.

If the cursor is moved down without measurement to the 6<sup>th</sup> line, the note displays **Incapable of input, SKIP IT**. Move the cursor to other places directly.

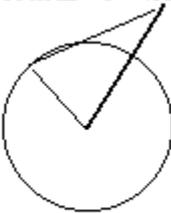
When the cursor is at the place showing amplitude in the 7<sup>th</sup> line, the note displays **Input Amplitude, ENTER** and then **Input Phase, ENTER**.

The 8<sup>th</sup> line is unreachable.

Press **Pg Dn** to the next page to display the result of trial I measurement. The 2<sup>nd</sup> line shows how much the phase changes; the 3<sup>rd</sup> line displays how much the amplitude changes. If the data shown on the 2<sup>nd</sup> line is larger than 25.0, **YES** is shown on the 6<sup>th</sup>

```
--TRIAL I MEASUREMENT-
TRIAL LOCATION: 60.°
TRIAL WEIGHT: 3.000 U
AFTER MEAS: REMOVE
MEASURE: speed (r/min)
ROTATION SPEED: 8765
Aa: 4.645 um / Pa: 120°
Ab:          um / Pb:  °
```

```
-----TRIAL I RESULT-----
Pa CHANGE: 300 °
Aa CHANGE: 60.00 %
Pb CHANGE:  °
Ab CHANGE:  %
TRIAL I VALID? YES
```



NOTE:

```
-----COEFFICIENT-----
CALCULATE
Plane I to Point a:
1.235 mm/s/Unit 174°
Plane I to Point b:
mm/s/Unit  °
Plane II to Point a:
mm/s/Unit  °
Plane II to Point b:
mm/s/Unit  °
```

line indicating that the trial is valid, the note displays **Trial I is Feasible**, you may press **Pg Dn** to the next page. Otherwise, **NO** is shown on the 6<sup>th</sup> indicating that the trial is not suitable. If the change of phase is less than 25.0 while the change of amplitude is more than 25.0, the note displays **Trial I should be moved**. If the changes of both phase and amplitude are less than 25.0, the note displays **Change Location or Increase its Weight**. Under these two conditions, **NO** is shown on the 6<sup>th</sup> line. Press **Pg Up** to the last page, stop the machine, adjust the trial mass accordingly to the note. Repeat the trial I measurement.

#### Step 4: calculate influence coefficients and balancing mass

Influence coefficients are calculated firstly. When the page is opened, the cursor is on the 2<sup>nd</sup> line. The note displays **ENTER to Calculate**, all the places showing values are vacant. Press **ENTER**, the influence coefficients are calculated and shown in the 4<sup>th</sup> line. Press **Pg Dn** to next page and then balancing mass is calculated.

In the next page, the cursor is on the 2<sup>nd</sup> line. The note displays **ENTER to Calculate**. All the places showing values are vacant. Move the cursor to display the original measured value. The value may also be edited. Press **ENTER**, the balancing mass is calculated and shown in the 3<sup>rd</sup> line. The location of balancing mass is also shown with vector chart.

You may input manually the balancing result without calculation. When the cursor is at the place showing weight in the 3<sup>rd</sup> line, the note displays **Input Weight**, **ENTER**, and then **Input Phase**, **ENTER**.

The 4<sup>th</sup> line is unreachable.

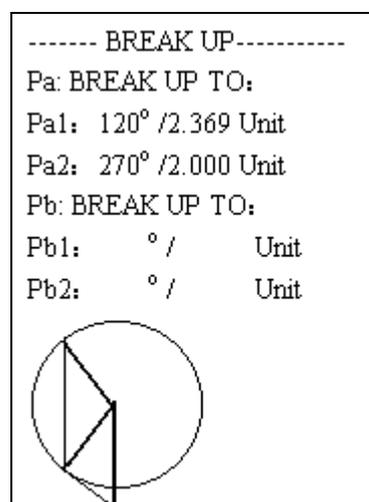
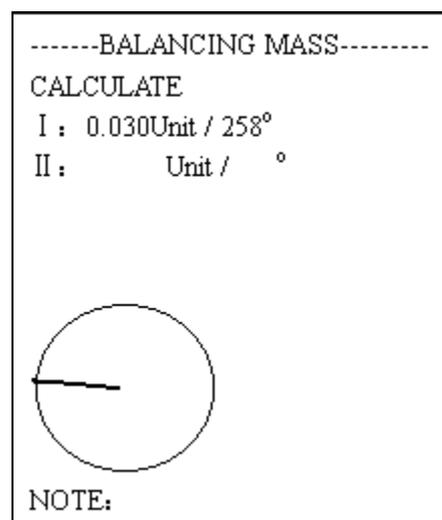
Press **Pg Dn** to the next page after the calculation or input.

#### Step 5: discompose vector

If decomposing is not required, press **Pg Dn** to skip this page.

In this page, the vector of balancing mass can be found in the vector graph just on the circle.

When the cursor is on the place showing angle in the 3<sup>rd</sup> line, input the first angle Pa1 (the first angle is at the anti-clockwise side of the balancing mass vector) with the number key. After the 3<sup>rd</sup> digit is input, or pressing **ENTER** or  $\downarrow$ , the cursor goes to the place showing angle at the 4<sup>th</sup> line.



When the cursor is on the place showing angle in the 4<sup>th</sup> line, input the second angle Pa2 (the second angle is at the clockwise side of the balancing mass vector) with the number keys.

After both angles are input, then 907 calculates. The weights of the balancing masses to fix on the selected angles are shown on the right side of the 3<sup>rd</sup> and 4<sup>th</sup> lines. Assure that the sums of the two angles depart from the balancing mass should be less than 180 degree.

Stop the machine, fix balancing mass on the rotor according to the result presented by 907. The balancing mass is removed or remained should consist with the settings in the step 3. Restart the machine. When the rotation speed becomes steady, press **Pg Dn** to the next page.

### Step 6: Verification

In this page, in the 2<sup>nd</sup> line, **Speed (r/min)** is shown at the right of MEASURE. Press ENTER, 907 begins measuring rotation speed while **Vibration** is shown at the right side of MEASURE in the 2<sup>nd</sup> line. When the rotation speed becomes stable, press **ENTER** for a moment and then 907 begin measuring

vibration. **Stop meas** is shown at the right of MEASURE in the 2<sup>nd</sup> line. When rotation speed, amplitude, and phase all become stable, press **ENTER** for a moment to finish the measurement. **Next step** is shown on the right of MEASURE in the 2<sup>nd</sup> line. The 3<sup>rd</sup> line displays rotation speed, the 4<sup>th</sup> line displays vibration vector of point I. The 6<sup>th</sup> line displays how much the vibration of point I has changed. The user could see whether the result is usable. If the result is not acceptable, repeat the operation. The influence coefficients could be borrowed from the last measurement.

#### 4.1.2 WITH INFLUENCE COEFFICIENTS:

### Step 1: Setting Parameters

Press down "POWER ON" on the panel for a moment, without any operation, the 1<sup>st</sup> page is opened. Now it is time to set parameters.

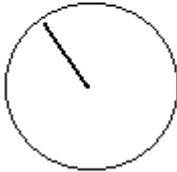
The operation of lines except line 9 is the same as that without influence coefficients.

Line 9: confirm whether the influence coefficients are known. When the cursor is on the 9<sup>th</sup>

```
-----VERIFICATION-----
MEASURE: speed (r/min)
ROTATION SPEED: 3660
Aa: 4.645 um Pa: 250°
Ab:      um Pb:    °
a: 90% CHANGED
b:  % CHANGED
NOTE:
```

```
ROTOR NUMBER: 1
-----SETTING-----
NUMBER OF PLANE: 1
INPUT MODE: Vel
MEAS. MODE: Dis
SEN a: 5.000 pC/ms-2
SEN b: 5.000 pC/ms-2
WEIGHT UNIT=11.22 g
HAVE INFL COEF? YES
CLEAR DATA
NOTE:
```

```
--INITIAL MEASUREMENT--
MEASURE: speed (r/min)
ROTATION SPEED: 4830
Aa: 4.645 um /Pa: 120°
Ab:      um /Pb:    °
```



```
NOTE:
```

line, the note displays **ENTER to Select**. Press **ENTER** repeatedly, **YES** and **NO** is shown circularly. Here **YES** is selected to indicate the coefficients are known.

### Step 2:Initial measurement:

When the cursor is on the 2<sup>nd</sup> line, **speed (r/min)** is shown on the right of MEASURE, all the places showing value are vacant, if you want to see some previously measured value, move the cursor to where it lies, and then it is displayed. The value is also capable of being edited, say manually input. When the cursor is on the 2<sup>nd</sup> line press **ENTER**, the 907 begins measuring the rotation speed. The data on the right of the 3<sup>rd</sup> line is updated continually. Now **vibration** is shown on the right of MEASURE. When the rotation speed becomes stable, press **ENTER** for a moment, the 907 begins measuring vibration. The data in the 4<sup>th</sup> line (the left is amplitude, the right is phase) are updated continually. “**Stop meas**” is shown on the 2<sup>nd</sup> line. When the rotation speed, amplitude and phase all become stable, press **ENTER** for a moment to finish the measurement. **Next step** is shown on the right of MEASURE.

If the cursor is moved down without measurement, a note displays **Incapable of input, SKIP IT** will be on the 3<sup>rd</sup> line. Move the cursor to other places directly.

When the cursor is at the place showing amplitude in the 4<sup>th</sup> line, the note displays **Input Amplitude, ENTER**. After the 5<sup>th</sup> (including dot) digit is input, or pressing **ENTER** or ↓, the cursor goes to the place showing phase. The note displays **Input Phase ENTER**.

The 5<sup>th</sup> line is unreachable.

Press **Pg Dn** to the next page after the measurement or input.

### Step 3: input influence coefficients

When the page is opened, the cursor is on the 2<sup>nd</sup> line. All the places showing value are vacant. Move the cursor down to the place showing amplitude in the 4<sup>th</sup> line. The note displays “**input amplitude, ENTER**”. You may use the storage value or input a new one. After the input, the cursor goes to the place showing phase and note displays “**input phase, ENTER**”.

Press **Pg Dn** to the next page.

### Step 4: calculate

Balancing mass is calculated here. When the page is opened, the cursor is on the 2<sup>nd</sup> line. The note displays **ENTER to Calculate**. All the places showing values are vacant. You may move the cursor to a place,

```

-----COEFFICIENT-----
CALCULATE
Plane I to Point a:
1.235 mm/s/Unit 174°
Plane I to Point b:
      mm/s/Unit   °
Plane II to Point a:
      mm/s/Unit   °
Plane II to Point b:
      mm/s/Unit   °

NOTE:

```

then the previous value is displayed. The value is also editable. Press **ENTER** at 2<sup>nd</sup> line, the balancing mass is calculated and shown in the 3<sup>rd</sup> line. The location of trial mass is also shown with vector graph.

The 4<sup>th</sup> line is unreachable for single plane balancing.

#### Step 5: decompose vector

The operation of this step is the same as that without influences.

#### Step 6: verification

The operation of this step is the same as that without influences.

## 4.2 2-PLANES BALANCING

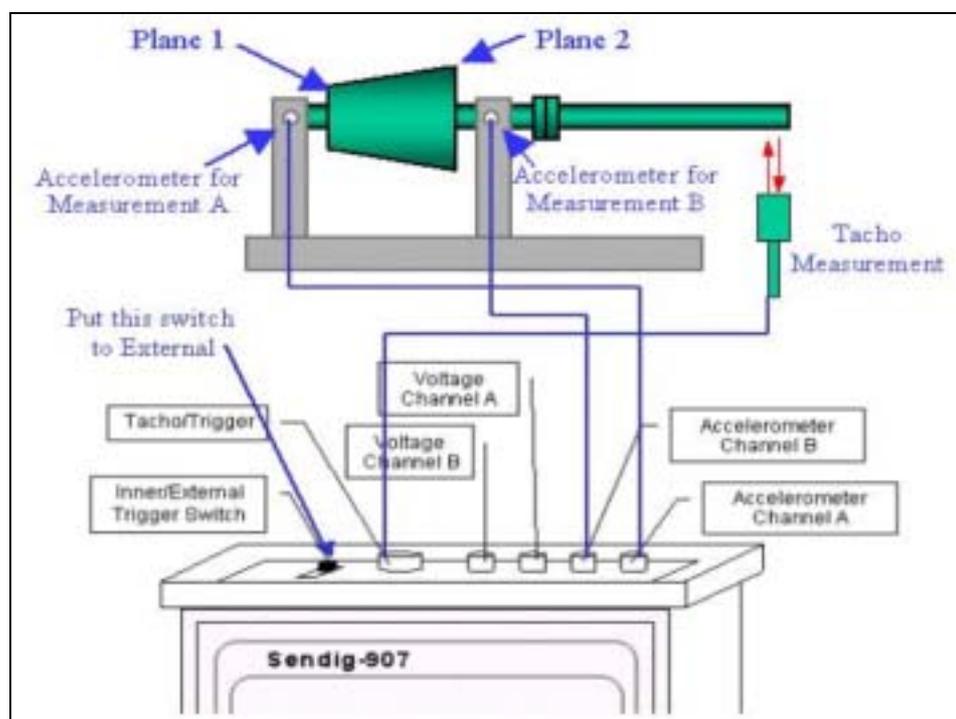


Illustration of accelerometer location and cable connection

### 4.2.1: WITHOUT INFLUENCE COEFFICIENTS:

In line 1 of 1<sup>st</sup> page "SETTING", the note displays "**Which Rotor to Balance**". Input rotor number with a number key (from 0 to 9). After the input, the cursor goes to the 3<sup>rd</sup> line automatically. If no changes are needed, press  $\uparrow$  or  $\downarrow$  to move to other line (the following are the same).

Line 2: title, the cursor cannot arrive.

Line 3: select type of operation. When the cursor is on the 3<sup>rd</sup> line, the note displays **How Many Plane to Balance**. Input "2" with the number key to indicate that 2-plane balancing is to be performed.

```

ROTOR NUMBER: 1
-----SETTING-----
NUMBER OF PLANE: 2
INPUT MODE: Sen
MEAS. MODE: Dis
SEN a: 5.000 pC/ms-2
SEN b: 5.000 pC/ms-2
WEIGHT UNIT=11.22 g
HAVE INFL COEF? NO
CLEAR DATA

```

NOTE:

And then the cursor goes to the 4<sup>th</sup> line automatically.

Line 4: select type of input. There are 2 types of input modes altogether: **SEN** and **VOL**. When the cursor is on the 4<sup>th</sup> line the note displays **Enter to Select**. Due to all data of the previous data will be cleared when the input mode is changed, the following warning will be shown in the 11<sup>th</sup> and 12<sup>th</sup> line:

**ARE YOU SURE?**  
**ENTER=YES OTHER=NO.**

That is to say, each time the input mode is altered, **ENTER** must be pressed 2 times. If press any key except **ENTER**, no operation is performed.

Line 5: select measuring mode. There are 3 types of measuring mode altogether: **VEL**, **DIS**, **ACC**. When the cursor is on the 5<sup>th</sup> line the note displays **Enter to Select**. Due to all data of the previous data will cleared when the measuring mode is changed, the following will be shown in the 11<sup>th</sup> and 12<sup>th</sup> line:

**ARE YOU SURE?**  
**ENTER=YES OTHER=NO.**

If press any key except **ENTER**, no operation is performed. If the alteration is really needed, press **ENTER**, the measuring mode will be altered.

Line 6: input sensitivity of sensor A. The manufacturer usually offers the sensitivity. After the 5<sup>th</sup> (including *dot*) digit is input, the cursor goes to the 7<sup>th</sup> line automatically. If the length of the data input is less than 5, press **ENTER** or ↓ after the input and then the cursor goes to the 7<sup>th</sup> line.

Line 7: input sensitivity of sensor B by the same method as above.

Line 8: input the weight of each trial mass unit.

Line 9: confirm whether the influence coefficients are known. Press **ENTER** repeatedly, **YES** and **NO** is shown circularly. The one being shown is selected. Here **NO** indicates the coefficients are not known.

Line 10: clear all data of the rotor being operating on. Press **ENTER**, the following is shown on the 11<sup>th</sup> and 12<sup>th</sup> line:

**ARE YOU SURE?**  
**ENTER=YES OTHER=NO.**

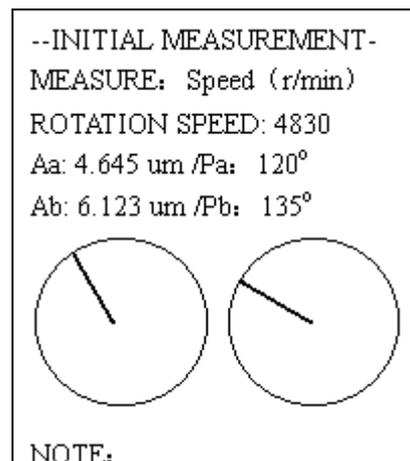
If you surely want clearing, press **ENTER**, the measuring data will be cleared and the balancing grade and sensor sensitivities change to default values. At the same time the 11<sup>th</sup> and 12<sup>th</sup> line are cleared. If press another key, no data will be cleared.

Before a balancing operation is performed, each line of this page must be configured. If no change required for certain line, skip it by press ↑ or ↓. After the configuration, wherever the cursor lies, press **Pg Dn** to go to the next page.

### **Step 2:Initial measurement:**

When the cursor on the 2<sup>nd</sup> line, **Speed (r/min)** is shown on the right of **MEASURE**. All the places showing values are vacant. If you hope to see the previous

value, move the cursor to where it lies, and then the original value is displayed. The value is also editable. When the cursor is on the 2<sup>nd</sup> line, press **ENTER** to measure rotation speed. The data on the 3<sup>rd</sup> line is updated continually. Now **vibration** is shown on the right of MEASURE. When the rotation speed becomes stable, press **ENTER** for a moment, the 907 begins measuring vibration. The data in the 4<sup>th</sup> and the 5<sup>th</sup> line (the left is amplitude, the right is phase) are updated continually. **Stop meas** is shown on the right of MEASURE. When the rotation speed, amplitude and phase all become steady, press **ENTER** for a moment, the measurement is finished. **Next step** is shown on the right of MEASURE again.



If the cursor is moved down without measurement to the 3<sup>rd</sup> line, the note displays **Incapable of input, SKIP IT**.

When the cursor is at the place showing amplitude in the 4<sup>th</sup> line, the note displays **Input Amplitude, ENTER**. After the 5<sup>th</sup> (including dot) digit is input or press **ENTER** or ↓, the cursor goes to the place showing phase in the 4<sup>th</sup> line. After the 3<sup>rd</sup> (including dot) digit is input or press **ENTER** or ↓, the cursor goes to the place showing amplitude in the 5<sup>th</sup> line.

When the cursor is in the 5<sup>th</sup> line, you may input too the amplitude and phase manually for the second point measurement.

Press **Pg Dn** to the next page after the input or measurement.

### Step 3: Estimate trial mass, and measure the vibration

Firstly, calculate the weight range of trial mass according to the formula recommended by ISO.

When the page is opened, the cursor is on the 2<sup>nd</sup> line ask you to input the weight of the rotor.

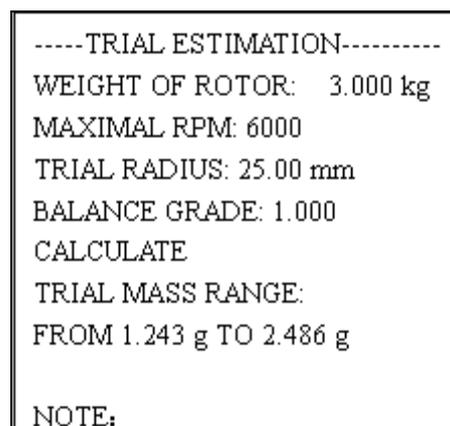
The 3<sup>rd</sup> line ask you to input maximal rotation speed with the number keys.

The 4<sup>th</sup> line, ask you to input the maximal radius at which the trial masses are fixed

The 5<sup>th</sup> line, ask you to input required balance grade according to ISO1940.

When the cursor is on the 6<sup>th</sup> line, press **Enter**, the weight range of trial mass is displayed in the 8<sup>th</sup> line.

Stop the machine, fix a trial mass on plane I according to the weight range estimation, and then restart the machine. When the rotation speed becomes steady, press **Pg Dn** to the next page.



In the “Trial I Measurement” page, the places in the 7<sup>th</sup> ~9<sup>th</sup> showing values line are vacant. If you hope to see the previous value, move the cursor to where it lies, and then the original value is displayed. These values are also editable.

When the cursor is on the 2<sup>nd</sup> line, input the angle at which the trial locates. Notice that the angle should be between 0°-360°.

In the 3<sup>rd</sup> line, input how many weight unit used for trial I

The 4<sup>th</sup> line requires you to determine whether trial mass should be removed later. Press **ENTER** to select from **REMOVE** and **REMAIN**.

On the 5<sup>th</sup> line, press **ENTER** to measure rotation speed. When the rotation speed becomes stable, press **ENTER** for a moment, the 907 begins measuring vibration. When the rotation speed, amplitude and phase, in the 7<sup>th</sup> and the 8<sup>th</sup> line, all become steady, press **ENTER** for a moment to finish the measurement.

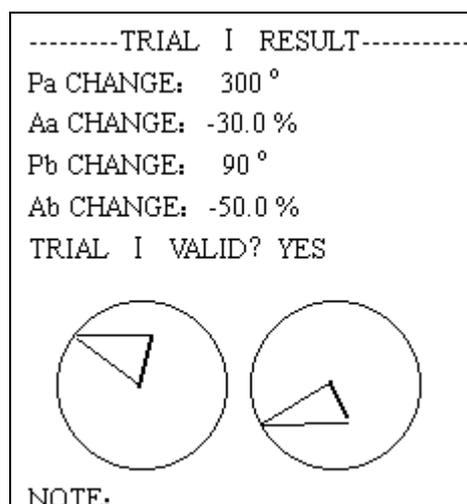
In next page, the 2<sup>nd</sup> and 3<sup>rd</sup> line display the change of vibration phase and amplitude of point A before and after the fixing of trial mass I. The 4<sup>th</sup> and 5<sup>th</sup> line display the change of vibration phase and amplitude of point B before and after the fixing of trial mass I. If the data shown on the 2<sup>nd</sup> and the 4<sup>th</sup> line are both larger than 25.0, **YES** is shown on the 6<sup>th</sup> line indicating that the trial I is valid, the note displays **Trial I is Feasible**.

Stop the machine and fix another trial mass on plane II. Whether the first trial mass is removed or not is determined by the setting of the last page. Restart the machine and go to the next page.

If one or both of the data on the 2<sup>nd</sup> and 4<sup>th</sup> line less than 25°, **NO** is shown on the 6<sup>th</sup> line indicating that the trial I is not suitable. If the phase change is less than 25° while the amplitude change is more than 25%, the note displays **Trial I should be moved**. If the changes of both phase and amplitude are less than 25, the note displays **Change Location or Increase its Weight**. Increasing weight should be considered firstly. After adjust the trial mass I according to the note suggest, restart the machine and repeat the trial A measurement till satisfying result obtained.

#### Step 4: fix a trial mass on plane II and measure the vibration

In this page, the places on the 6<sup>th</sup> ~8<sup>th</sup> lines showing values are vacant. If you hope to see the previous value, move the cursor to where it lies, and



--TRIAL II MEASUREMENT--

TRIAL LOCATION: 60.°

TRIAL WEIGHT: 3.000 U

AFTER MEAS: REMOVE

MEASURE: speed (r/min)

ROTATION SPEED: 8765

Aa: 4.645 um / Pa: 120°

Ab: 6.123 um / Pb: 135°

then they are displayed. These values are also editable.

When the cursor is on the 2<sup>nd</sup> line, input the angle at which the trial locates. Notice that the angle input should be between 0°-360°.

In the 3<sup>rd</sup> line, input how many weight unit used for trial II

The 4<sup>th</sup> line requires you to determine whether trial mass should be removed later. Press **ENTER** to select from **REMOVE** and **REMAIN**.

When the cursor is on the 5<sup>th</sup> line, the note displays **Enter to Measure. Speed (r/min)** is shown on the right of MEASURE at first. Press **ENTER**, the 907 begins measuring rotation speed. The data on the right of the 6<sup>th</sup> line is updated continually. Now **vibration** is shown on the right of MEASURE. When the rotation speed becomes stable, press **ENTER** for a moment, the 907 begins measuring vibration. The data in the 7<sup>th</sup> and the 8<sup>th</sup> line, amplitude and phase are updated continually. “**Stop meas**” is shown on the right of MEASURE. When the rotation speed, amplitude and phase all become steady, press **ENTER** for a moment to finish the measurement.

If the cursor is moved down without measurement to the 6<sup>th</sup> line, the note displays **Incapable of input, SKIP IT**.

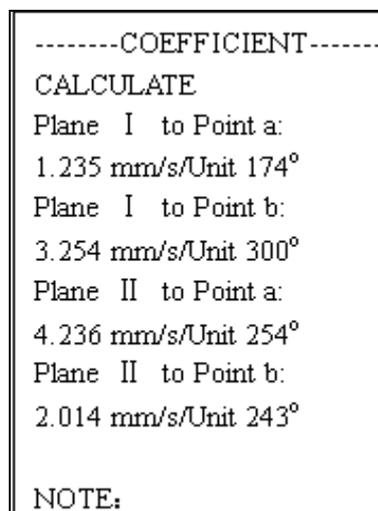
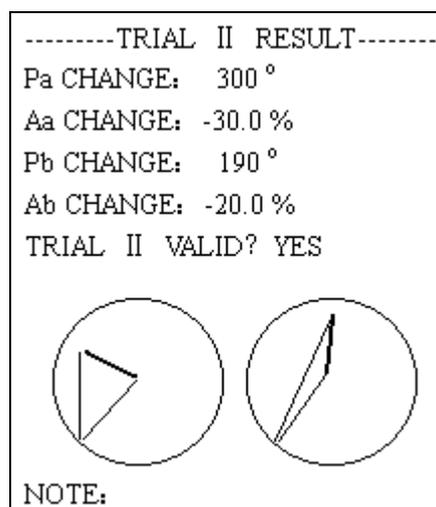
When the cursor is at the place showing amplitude in the 7<sup>th</sup> line, you may also manually input Amplitude and Phase for point A if necessary.

In the 8<sup>th</sup> line, you may manually input Amplitude and Phase for point B.

Then press **Pg Dn** to the next page after the input or measurement.

This page displays the result after fixing trial II. The 2<sup>nd</sup> and 3<sup>rd</sup> line display the change of vibration phase and amplitude of point A before and after the fixing of trial mass II. The 4<sup>th</sup> and 5<sup>th</sup> line display the change of vibration phase and amplitude of point B before and after the fixing of trial mass II. If the data shown on the 2<sup>nd</sup> and the 4<sup>th</sup> line are both larger than 25.0, **YES** is shown on the 6<sup>th</sup> line indicating that the trial II is valid, the note displays **Trial II is Feasible**.

If one or both of the data on the 2<sup>nd</sup> and 4<sup>th</sup> line less than 25°, **NO** is shown on the 6<sup>th</sup> line indicating that the trial II is not suitable. If the phase change is less than 25° while the amplitude change is more than 25%, the note displays **Trial II should be moved**. If the changes of both phase and amplitude are less than 25, the note



displays **Change Location or Increase its Weight**. Increasing weight should be considered firstly. After adjust the trial mass II according to the note suggest, restart the machine and repeat the trial A measurement till satisfying result obtained.

### Step 5: calculate influence coefficients and balancing mass

Influence coefficients are calculated firstly. On the 2<sup>nd</sup> line, press **ENTER** to calculate the influence coefficients. Press **Pg Dn** to next page.

And then balancing mass is calculated. When the page is opened, all the places showing values are vacant. If you hope to see certain value, move the cursor to where it lies. The values are also editable. Press **ENTER** on the 2<sup>nd</sup> line, the balancing mass is calculated and shown.

If the cursor is moved down without calculation to the 3<sup>rd</sup> and 4<sup>th</sup> line, you may input weight and phase for following calculation like decomposition.

### Step 5: discompose vector

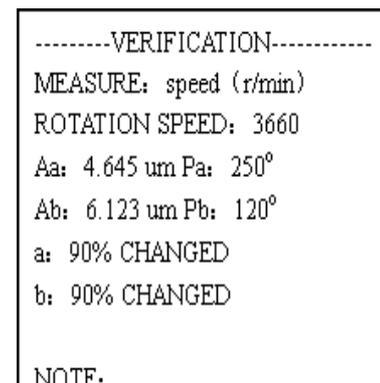
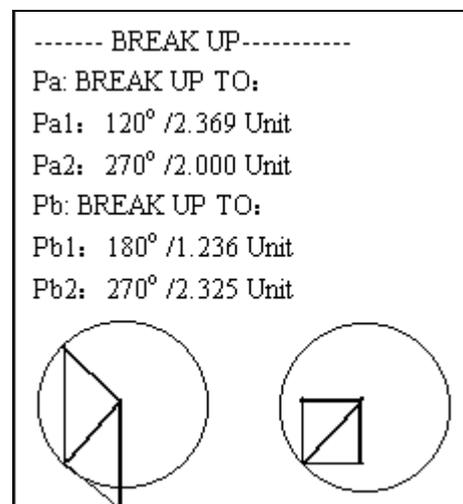
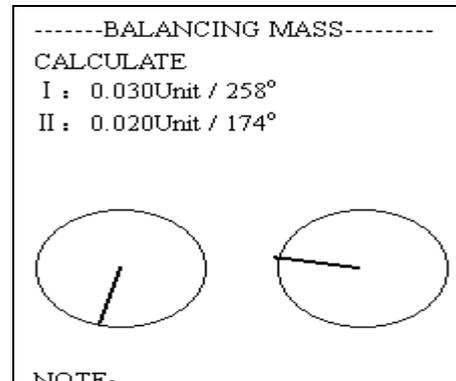
If the discomposing is not needed, press **Pg Dn** to skip this page directly.

After the page is opened, the vector of balancing mass is just ends on the circle. The 3<sup>rd</sup> and the 4<sup>th</sup> line are relative to the vector graph on the left while the 6<sup>th</sup> and 7<sup>th</sup> line are relative to the graph on the right.

Method of discomposing is the same as in 1 plane balancing so is omitted here.

### Step 6: Verification

When the page is opened, the cursor is on the 2<sup>nd</sup> line, all the places showing values are vacant. Press **ENTER** let the 907 measure rotation speed. When the rotation speed becomes stable, press **ENTER** for a moment, the 907 begins measuring vibration. When the rotation speed, amplitude and phase all become steady, press **ENTER** for a moment, the measurement is finished. The 3<sup>rd</sup> line displays rotation speed, the 4<sup>th</sup> line displays vibration values of point A; the 5<sup>th</sup> line displays vibration values of the point B. The 6<sup>th</sup> line display how much the vibration of point A has changed. The 7<sup>th</sup> line display how much the vibration of point B has changed. If the result is not acceptable, repeat the operation. The influence coefficients could be borrowed from the last



measurement.

#### 4.2.2 WITH INFLUENCE COEFFICIENTS:

##### Step 1: Setting Parameters

Press down “POWER ON” on the panel for a moment, without any operation, the 1<sup>st</sup> page is opened. Now it is time to set parameters.

The operation of this page except line 9 is the same as that without influence coefficients.

In line 9: **YES** should be selected to indicate the coefficients are known.

##### Step 2:Initial measurement:

The operation of this page is the same as that without influence coefficients.

##### Step 3: Input influence coefficients

In this page, move the cursor down to the 4<sup>th</sup> line, then input the coefficient of plane I to point A. Then input the other 3 coefficients.

After all the influence coefficients are input, press **Pg Dn** to the next page. Do not press ENTER at the 2<sup>nd</sup> line.

##### Step 4: Calculation, decomposition and verification

The operations of these pages are the same as that without influence coefficients.

```

ROTOR NUMBER: 1
-----SETTING-----
NUMBER OF PLANE: 2
INPUT MODE: Sen
MEAS. MODE: Dis
SEN a: 5.000 pC/ms-2
SEN b: 5.000 pC/ms-2
WEIGHT UNIT=11.22 g
HAVE INFL COEF? YES
CLEAR DATA

NOTE:
  
```

```

-----COEFFICIENT-----
CALCULATE
Plane I to Point a:
1.235 mm/s/Unit 174°
Plane I to Point b:
3.254 mm/s/Unit 300°
Plane II to Point a:
4.236 mm/s/Unit 254°
Plane II to Point b:
2.014 mm/s/Unit 243°

NOTE:
  
```

## 5. VIBRATION ANALYZER / DATA COLLECTOR

907 is a user-friendly instrument capable of recording and analyzing vibration information. In the Free-Shot mode, you can measure ENVE, ACC, VEL and DIS (The sensor connected in the “Accelerometer” socket) or VOL (The sensor connected in the “Voltage” socket) and display new measured and old data comparatively.

In the Ext-Trig mode, 907 must have a trigger impulse signal connected in the “Trigger/RPM” socket, and the vibration signal is recorded only when the trigger impulse signal appears. Different from the Free-shot, user can get position-related information. Furthermore, you can measure rotate speed and balance a rotor.

The 907 keyboard has 20 buttons. Among them, **Collector**, **C-Spectrum**, **Notebook**, **W-Meas**, **W-spectrum**, **W-Save**, **Zoom**, **W-Recall**, **Transfer**, **Tacho**, **Setup**, **Channel** are the buttons for data collector / analyzer. **Enter**, ↓, ↑, ←, → are auxiliary buttons.

The button at right side of 907 is used for switch between the functions of balancing and collector/analyzer.

**Notice:**

1. If the device is not used for minutes, it will power off automatically. When the device is in the mode of measuring rotation speed, it won't automatically shut off. The user may push down the "Off" button to shut it off. The data will be automatically saved when the device is shut off.

2. If the 907 has not been used for a long time, it should be charged firstly and its memory should be formatted. The user may format the memory according to the screen of Setting parameter. The 907 should be shut off when being charged. It costs about 8 hours from empty power to full.

**(1) Data collector**

Only 904 can be used as data collector. After pressing **On**, the screen appears:

**Notice:**

1. If nothing is shown in the screen, press "Off", and then press "On" for a moment again.

2. The instrument has 2 channels, A and B (auxiliary). The function of data collector only operates on channel A. Wave measuring on channel B or on the both channels could only be done by the function of signal analysis.

3. The function of data collector may be used as spectrum analysis of channel A.

4. How to fix the sensor will influence measurement in the way:

- Screw: highest precision, best frequency range, best fidelity;
- Magnetic base: moderate precision, frequency range and fidelity;
- Hold the probe: lowest precision, frequency range and fidelity;

5. When collecting data or waveforms, the user should check up if every parameter is correctly set and if the sensors are fixed correctly.

6. After setting parameter, the measurement must be performed immediately. Otherwise, the parameter you set may be lost.

#1	P0##.....	
Alm-mode:	VEL	
Freq-Range:	1000(Hz)	
Sensor:	5.00	Alm_S=3.0
Alarm-Status:	OK!	
	NEW data	OLD data
ACC:	/	m.s <sup>2</sup>
VEL:	/	mm/s
DIS:	/	um
HFA:	/	m.s <sup>2</sup>

**Screen of "Data collecting":**

The functions of data collecting menu include:

- Setting parameters for alarming and waveform saving.
- Measuring vibration and displaying the results.
- Showing the state of measurement with NEW/OLD flag.
- Calculating the frequency spectrums automatically.

Before use 904 to collect data, you should set parameter as following:

### (1.1) Find the sequence number and measuring point

The sequence number is 1 after the memory is formatted and it is displayed on the top left of the screen. The range of sequence number is from 1 to 240.

The digits behind the sequence number are the name of measuring point. After the memory is formatted, the names of measuring points is P0##..... Each name of measuring point is made up of 16 digits. You may use computer software MCM to set the measuring point name.

You may manually move the cursor to name of measuring point and use ↓ or ↑ to change it.

### (1.2) Set alarm mode

The purpose of the “Alm-mode” in the second line is:

- To decide which parameter to be used for raising the alarm;
- To decide which parameter to be used for spectrum calculating.
- To save 100-line spectrums for this parameter.

There are five options of alarm parameters: **ACC** (acceleration), **VEL** (velocity), **DIS** (distance), **HFA** (high frequency acceleration) and **VOL** (voltage). Move the cursor to the place after “Alm-mode”, then select the parameter by ← or →.

**Notice:** The parameter set here is also used for the dynamic balancing.

The definition of overall vibration value may be briefly explained as:

**DIS** (Displace) ----- Equivalent Peak-to-peak value, the maximum vibrating distance between the positive amplitude and the negative one of the vibration. DIS is usually used on the occasion where the gap of the machine parts is critical. Its unit is  $\mu\text{m} = 1/1000 \text{ mm}$ .

**VEL** (Velocity) ----- True root-mean-square (rms.) of velocity, often written as  $V_{\text{rms}}$ . It is usually used for the evaluation of machine condition. Its unit is mm/s.

**ACC** (Acceleration) ----- Equivalent peak value of acceleration,  $A_p$ , which equals to the value of root-mean-square acceleration ( $A_{\text{rms}}$ ) multiplying 1.414. Its unit is  $\text{m/s}^2$ .

**ENVE** (HFA=High Frequency Acceleration Envelope) ----- RMS of the envelope signal of high frequency acceleration after filtering off low frequency (<1kHz).

**VOL** (Voltage) ----- VOL adopted when using other sensors that output voltage signals. Its unit is V.

To select a suitable parameter for fault diagnosis, the user must consider its sensitivity to frequency range as listed in the following. The most important principle to choose is to provide the biggest information.

Frequency Band		← 10      100      1000      10000Hz →
Parameter	Displacement	—————
	Velocity	—————
	Acceleration	—————
	HFA	—————

### (1.3) Set frequency range

The frequency range in the 3<sup>rd</sup> line is used for spectrum analysis.

In 907, the frequency range is used for FFT frequency spectrum analysis. The options are as the following: **100Hz**, **200Hz**, **500Hz**, **1000Hz**, **2000Hz**, **5000Hz**, **10000Hz**. Use ↑ or ↓ to move cursor to the 3<sup>rd</sup> line, then modify it by ← or →.

### (1.4) Set the sensitivity of the sensor

Different accelerometer has different sensitivities. Before using 907, the user must affirm that the value of the sensor sensitivity in 907 is the same as that the sensor manufactures presented. Press ↑ or ↓ to move cursor to the place behind “**Sensor**” in the 4<sup>th</sup> line. Press **Enter**, then nothing is displayed in the cursor. Use number keys to input the right sensitivity, and then press **Enter** to confirm.

### (1.5) Alarm multiple factor

The function of alarm multiple factor is to raise an alarm when the new measured value of alarm parameter is higher than the alarm multiple factor multiplied reference value, i.e., it shows “Signal Too Strong” or “Bad” in the 5<sup>th</sup> line.

**Notice:** Alarm multiple factor is on the right of the 4<sup>th</sup> line behind “**Alm\_S**”.

To input, move cursor to the place behind **Alm\_S** by ↑ or ↓. Press **Enter**, then nothing displayed in the cursor place. Use number keys to input the value of alarm factor, and then press **Enter** to confirm.

### (1.6) The display of overall vibration value

The measured vibration values are at the lower part in the screen. When accelerometer is used, the “Alm-mode” is among **Acc**(acceleration), **Vel**(velocity), **Dis** (distance) and **HFA**(high frequency acceleration). Press **Enter** to begin measuring, the display of vibration value in the screen is as the following:

	NEW data	OLD data
ACC:	/	m.s <sup>-2</sup>
VEL:	/	mm/s
DIS:	/	um
HFA:	/	m.s <sup>-2</sup>

When the “Alm-mode” is **Vol** (voltage), press **Enter** to begin measuring. The measurement result is shown in the screen as the following:

	NEW data	OLD data	
VOL:	/		V <sub>p</sub>
VOL:	/		V <sub>rms</sub>
VOL:	/		V <sub>p-p</sub>

When the memory has just formatted and no measurement has been taken, the data under **New data** will be empty. The column **Old data** will include the values that the computer has transferred or the values have measured before the memory is formatted. After a measurement is finished, the column **new data** displays the new measured values.

**Notice:** The comparison of “new” and “old” data is valid only when a new measurement has been taken and you have not changed the point name to another.

### (1.7) Measurement

Firstly, fix the accelerometer to measurement location and connect the cable well. After power on the 904; confirm that all parameters are properly set. Then press [Enter] to measure. Now the alarm line in the fifth line is changed to “**Wait .....**”. After a while the screen displays the overall values of **Acc**, **Vel**, **Dis** and **HFA** in the column of “New data” successively.

When “**Alm-mode**” is “**Vol**”, it displays the “**Peak**”, “**Rms**” and “**P-P**” of the measured voltage successively.

After the measuring value is displayed, the device begins to calculate the frequency spectrum. Then the screen displays one of the following measurement results in the fifth line:

No Problem Found  
 Not A stable signal  
 Signal Too Strong  
 Signal Too Weak

**Notice:** Don't press any key or move the sensor before measurement results are obtained. Otherwise, the result of frequency spectrum analysis will be incorrect.

## (2) Data Collect Spectrum

Press “**C-Spect**” key, you will see the amplitude FFT spectrum of channel A, the real line. This spectrum graph includes also the “**OLD**” spectrum received from computer or the spectrum memorized so you can compare them, the dash line. If the measurement point is changed, then spectrum just measured will replace the “**OLD**” spectrum received from computer or the spectrum memorized.

Use ← or → to read the frequency and amplitude of spectrum.

Notice that only when the point not changed it is possible to see two spectra. If you changed the point and then go back, only one spectrum is visible, the new one.

The user may look at the spectrum details by first move cursor to a specific frequency and then press “ZOOM” key.

### (3) Use Notebook

Machinery vibration is usually related to other operation parameters. For example, the pressure of lubricating oil and the temperature of bearing reflect the state a bearing, and influence the vibration of a machine. The high temperature of motor winding usually indicates short circuit or overloaded and influence the vibration of a machine. To comprehensive evaluation of machinery condition, it is very important to record the parameter change together with vibration.

The function of **Notebook** is to save these technological parameters. When press “**Notebook**” key. The screen displays the following.

```

Type: Temperature
Old: xx.xxxx
New: xx.xxxx
Note: 0=OK
  
```

Now the type of the parameter could be changed by ← or →. Options include:

- Temperature**
- Pressure**
- Load or Current**
- Other Parameter**

Use ↑ or ↓ to move the to the line of “New”, then press **Enter**, the space is cleared. Now input the value by the number keys. Then press **Enter** to confirm.

The user may also save vague observations of machinery condition in the last line. The 907 has ten vague observation code options:

- 0: Ok**
- 1: Not In Use**
- 2: Seal Leaking**
- 3: Much Noise**
- 4: Oil Level Low**
- 5: Very Hot**
- 6: Bear Changed**
- 7: Seal Changed**
- 8: Pre. Flow Low**
- 9: Other States**

At the place behind “Note”, select it by ← or →.

#### (4) Set Parameter For Analysis

Press “**Setting**” key to set up all parameters for signal analysis. The display is like the right figure:

The first line shows the present **point name**, which is determined by the “Collector” menu.

**Channel mode** has two options of “SINGLE” and “DUAL”, i.e., single channel and dual channel. You may select it by ← or → key.

**Input mode** has two options: **SEN** and **VOL**, i.e., sensor mode and voltage mode. Select it by ← or → key.

When the input mode is **SEN**, **Wave-Mode** has four options, i.e., **ACC** (acceleration), **VEL** (velocity), **DIS** (distance) and **ENVE** (high frequency acceleration envelope). If input mode is **VOLT**, the wave mode can only be **VOLT**.

Trigger mode has two options of “**Yes**”(having trigger) and “**No**”(free sampling). When “**Yes**” is chosen, you must really have trigger signal. Otherwise, the instrument will always wait for triggering before collecting until you power off it.

**Notice:** Switch the “**Inner/External Trigger Switch**” to External if you are using a tacho sensor.

**Freq-Range** has 7 options for single channel: 100Hz, 200Hz, 500Hz, 1000Hz, 2000Hz, 5000Hz, 10000Hz and 6 options for dual channel: 100Hz, 200Hz, 500Hz, 1000Hz, 2000Hz, 5000Hz. Use ← or → to select a suitable one.

**Sen-ScaleA** is the accelerometer sensitivity of channel A, while **Sen-ScaleB** is that of channel B. Press ↑ or ↓ to move the cursor to the place then press **Enter**. Then input by number keys. Press **Enter** to confirm.

**Format Memory:** All waveforms will be cleared and all parameters will be reset to the defaults. 907 will name all points with natural sequence. The sensitivity of sensor and the alarm multiple factor will be reset to the default value (5.00 and 3.00). The screen will return to the menu of **Collector**.

The last line is **Auto-Range** or **Man-R** (Manual Range). Man-R means you may manually control the measurement range for single and dual channel measurement. This is especially useful when you need to measure an unstable signal.

The method of operation is as the following. Firstly press ← or → to choose between Auto-Range and Man-R. When the display is

```
Man-R  DA:10  DB: 20
```

It means that channel A signal may be amplified 10 times while channel B amplified 20 times. If you

```
Name:  P0###.....
Channel-Mode: SINGLE
Input-Mode: SEN
Wave-Mode: DISP
Trig-Mode: NO
Freq-Range: 1000(Hz)
Sen-ScaleA: 5.00
Sen-ScaleB: 5.00
Format Memory
Auto-Range
```

```
Name:  P0###.....
Channel-Mode: SINGLE
Input-Mode: SEN
Wave-Mode: DISP
Trig-Mode: NO
Freq-Range: 1000(Hz)
Sen-ScaleA: 5.00
Sen-ScaleB: 5.00
Format Memory
Auto-Range
```

press **Enter**, there is no number in the cursor, then press number keys to input the needed amplifying multiple.

**Notice:** The range of amplifying multiple is from 1 to 255.

## (5) Measurement of Vibration Waveform

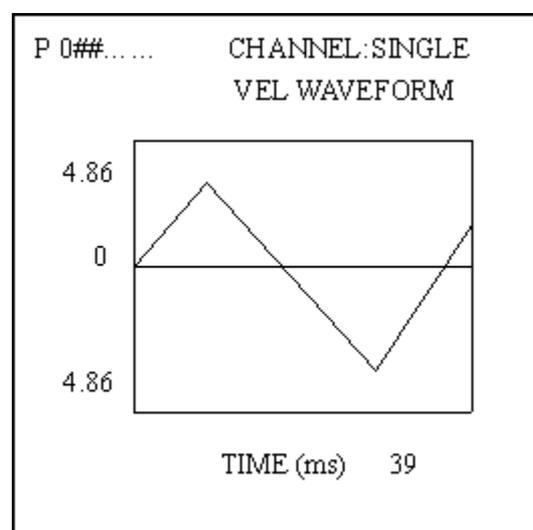
Connect the sensor cable to the socket of 907, and fix the sensor to the object that will be measured. After power on, select a point name in the **Collector** menu. Secondly, confirm all parameters of the **Setting** menu. After pressing **W-Meas**, 907 starts to measure waveform and displays the waveform continuously. The display is as the following graph:

You may press **Enter** for a while to stop the measurement and the refresh of waveform display. Then, you may press ← or → to see the other part of the waveform (totally 10 screens for the whole).

## (6) Save waveform

Only the just measured waveform can be saved. The method is to press **W-Save** to enter the menu as the following.

```
Vel. Waveform Single
Freq:1000Hz Trig: No
Press Enter to Save,
Other Key to Quit
```



After confirm that every thing is OK, press **Enter**. After waveform is saved, the screen displays the save number of the waveform. 907 may save 62 waveforms. The screen will display **Memory Overflow** when the space is full.

## (7) Recall Saved Waveform

This function is to display the waveform stored in 907 so that the user can observe and analyze it. Press ↑ or ↓ key, the user may change the stored waveform while press ← or → to see the other part of the waveform (totally 10 screens for the whole waveform).

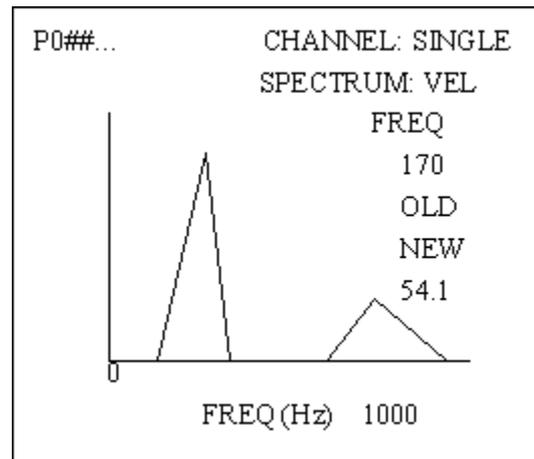
**Notice:** The recalled waveform number increases no matter what button that you press, ↑ or ↓. If it reaches the biggest number, it will return to the smallest in circles.

## (8) Spectrum Analysis

Once a waveform is measured, you may analyze the frequency spectrum at once by press **W-Spect**.

If you just **recall a waveform** and then press **W-Spect**, you will see the spectrum of the stores waveform.

The screen of spectrum displays as the following graph. The original location of the cursor is in the place of zero frequency. Press ← or → to move the cursor. The frequency and the amplitude of the cursor location is displayed at the right of the screen. If you want to see spectrum of another channel of dual channel mode, press **Channel** key.



## (9) Spectrum Zoom

You may observe the details of amplitude spectrum by ZOOM function. After moving the cursor to a interesting frequency, press **Zoom** to see the 4 times detailed spectrum. This is applicable for both **C-Spect** and **W-spect**.

## (10) Transfer Function

Transfer function is the spectrum in proportion to the ratio of output and input signal amplitudes (B/A) in every frequency.

**Notice:** valid only for dual channel measurement.

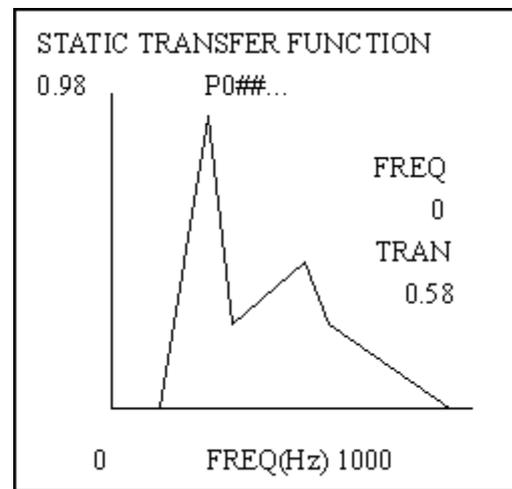
## (11) Rotation Speed Measurement

907 measures rotation speed by using a photoelectric sensor to detect the light reflected from a piece of reflecting paper on the rotating axis. The measuring method is as the following:

- 1). Connect the photoelectric tacho sensor with 907, and make the lighting end of the sensor to aim at the piece of reflecting paper affixed on the rotating axis.
- 2). Power on 907. Press "**Tacho**" key.

If you want to stop the measurement of rotational speed, press another key for a while, then release it.

The rotational speed may be saved with waveform in order to diagnose machinery faults. The method is



Speed(r/min)	****
Freq (Hz)	****

to measure the rotational speed first and then measure the vibration.

## (12) Special Explanation

### **Acceleration envelope analysis**

907 use high-pass filter and the demodulation method to separate the envelope signal. You may measure the RMS value of envelope as well as analyze its waveform and spectrum by selecting ENV as “Alm\_mode”.

### **Measure by eddy displacement sensor or velocity sensor**

Connect the sensor with the VOL input socket and use VOL as “Input mode” in “Setting” menu or “Alm\_mode” in “Collector” menu.

### **Save collector data and waveform**

The storage of data obtained by “Collector” is automatic. After you have measured, 907 will save the overall vibration value and 100-line spectrum at the moment you change to another point. Because the new data and the old data (reference value or alarming value) occupy the same space of memory, the old data will lose after you saved the new one.

Press “W-Save” to save the waveform in order to transfer it to computer for detailed further analysis.

### **Battery Charge**

907 use chargeable batteries. The battery can be fully charged within about 6 hours. The battery could run for about 8 hours continuously if they are fully charged.

### **Maintenance**

907 is 3-years warranted except battery, sensors and cables. The warrant of piezoelectric accelerometer is 1 year.

### **Calibration**

The 907 sensors need to be calibrated circularly. Usually the period is 1 year.

### **Service**

If something wrong, please record fault symptom and communicate with Beijing SENDIG Co. Ltd. ([www.sendig.com](http://www.sendig.com))

**APPENDIX****BALANCE GRADE OF RIGID ROTORS**

(Abstracted from ISO 1940/1-1986 Requirement of balance grade of rigid rotors—machine vibration)

Balance grade	G (mm/s)	Examples of the rotor type
G4000	4000	Rigidly fixed crooked-axis transmission set of low-RPM diesel engine, with odd amount of gases, specially used for ship
G1600	1600	Rigidly fixed crooked-axis transmission set of great 2-stroke engine.
G630	630	Rigidly fixed crooked-axis transmission set of great 4-stroke engine Flexibly fixed crooked-axis transmission set of diesel engine specially used for ship
G250	250	Rigidly fixed crooked-axis transmission set of high-RPM 4-gas diesel engine.
G100	100	Crooked-axis transmission set of high-RPM diesel engine with 6 or more gases The whole engine of a truck or an auto (diesel or gas engine)
G40	40	Wheels, flange, transmission axis of an auto Flexibly fixed crooked-axis transmission set of high-RPM 4-stroke engine with 6 or more gases Crooked-axis transmission set of an auto, a truck
G16	16	Transmission axes with special requirements (axle-rotating axes, all-way axes) Parts of crusher Parts of agricultural machine Engines of auto, truck and locomotive (the whole of diesel or gas engine) Crooked-axes transmission set of provider with 6 or more gases under special conditions.
G6.3	6.3	Parts of master engine Tub wheel of centrifugal machine Roller of paper-machine, roller of presswork Fan Rotor of assembled aviation turbo line Flywheel Pump wheel Parts of lathe and general mechanical General or great armature without special requirements (the height of electricity's axes center is at most 80mm) Small armature which is often yielded a great deal and used under the conditions of not being sensitive to vibration or there is sets for isolate vibration. The whole of a engine with special demands.
G2.5	2.5	Rigid rotor of turbine generator Disks and drums of a computer Turbo compressor Transmission set of a lathe General or great armature with special demands
G1	1	Transmission set of tape recorder and gramophone (photograph) Transmission set of grinding machine. Small armature with special demands
G0.4	0.4	Main axes, grinding wheel and armature of a precise grinding machine Gyroscope