



KM Instrument

KMbalancer[®] //+ Vibration Analyzer and Dynamic Balancer



Users Manual

Version 1.0

Catalog

KMbalancer® II+ Vibration Analyzer and Dynamic Balancer	1
1. Overview	1
1.1 Introduction.....	1
1.2 Safety Advice.....	1
1.3 Summary of Parts	1
1.3.1 Outline of KMbalancer® II+ and Defining of Keys	2
1.3.2 External Connection	3
1.4 Turn On and Off the KMbalancer® II+.....	4
1.4.1 Turn On the KMbalancer® II+	4
1.4.2 Turn Off the KMbalancer® II+	4
1.5 Application	5
1.6 Battery Maintenance	6
2. Route	7
2.1 Prepare Data Acquisition	7
2.2 Route Acquisition	7
2.2.1 Navigate a Route Manually	7
2.2.2 Start Data Collection.....	9
2.2.3 Query Progress of Collection	10
3. Analysis	11
3.1 Single Channel Analysis	11
3.1.1 Single Channel Acquisition Parameter Setting.....	12
When the user-defined acquisition parameters are selected and the function key	
【Delete】 is highlighted, press the 【Delete】 key (F2) at this time, and the	
system will delete this piece of data.....	14
3.1.2 Collecting Single Channel Data	14
3.2 Dual Channel Analysis	20
3.2.1 Dual Channel Acquisition Parameter Setting.....	21
3.2.2 Dual Channel Data Acquisition	22
3.3 Pressure Acquisition and Analysis.....	23
3.4 Overall Assessment	23
3.5 Rotational Speed Measurement	25
4. Balance Guide.....	26

4.1 Dynamic Balance Data List	26
4.2 Dynamic Balance Parameter Setting	28
4.3 Create Dynamic Balance Node.....	31
4.4 Single-plane Dynamic Balance.....	32
4.4.1 Initial Vibration Measurement.....	32
Cursor switching, moving, and cursor measurement information in the time-domain and spectral interface are as described above, so they will not be repeated.....	40
4.4.2 Trial Weight Measurement	40
After the acquisition of initial vibration, enter into add trial weight process.....	40
In the initial vibration form in Figure 4.11, click the function key 【Next step】 (F5) to enter into trial weight interface.....	40
4.4.3 Unbalance Measurement after Correction	45
In this interface, you can judge if balancing effect has been achieved by acquiring data with 【Acquisition】 key, click 【Finish】 (F5) to finish it. You can continue to conduct trim balancing if you are not satisfied with the balancing effect.....	46
4.4.4 Fine Balance	46
4.5 Two-plane Dynamic Balancing	50
4.5.1 Initial Vibration Measurement.....	50
Entering two-plane dynamic balancing starts with an initial vibration measurement (the signal type set for this time is displacement).....	50
4.5.2 Trial Weight Measurement	51
4.5.3 Unbalancing Measurement After Correction.....	55
This section introduces the unbalance measurement after correction.....	55
4.5.4 Fine Balance.....	56
5. Pressure Zero.....	56
6. Data Viewing	57
6.1 Viewing Measurement Points of Route	57
6.2 Viewing Provisional Measurement Points.....	60
7. System.....	63
7.1 System Setting Interface	63
7.1.1 LCD Display Setting.....	64
7.1.2 Keyboard Setting.....	64
7.1.3 Auto-shutdown Setting	65
7.1.4 Date and Time Setting.....	65

7.1.5 System Language Setting.....	65
7.1.6 Sensor Sensitivity Setting.....	65
Directly enter the required sensitivity parameters of the vibration sensor through the numeric keys, the unit is: mV/g. And the input data can be modified through the 【C】 key.....	65
The voltage sensitivity parameter is not currently used.....	65
7.2 System Information Interface	65
8. Communication	68
The communication module is used to achieve data interaction with the host computer, and the communication methods are USB and WIFI.	68
8.1 USB Connection	68
8.2 WIFI Connection	68
Appendix: Technical Specification.....	70
Hardware Parameters.....	70
Battery and Environment.....	71
Signal Measurement	72

1. Overview

1.1 Introduction

KMbalancer[®]II+, a dynamic balancing instrument which integrates the advanced embedded technology, measurement & control technology and other professional technologies, is newly developed by KMINSTRUMENT. This product was designed to aid users of rotating equipment, by making balance analysis and manual correction of imbalance fast and easy. Thanks to its multifunction like data acquisition and spectrum analysis, KMbalancer[®]II+ serves as an effective analysis instrument for identifying if unbalancing problems exist. Besides, it also has the function of data storage and display and the data measured can be uploaded to PC application software for professional analysis.

KMbalancer[®]II+ can help you achieving the following tasks:

- To identify if the equipment is in balance by observing and analyzing spectrum.
- To perform balance operation easily and quickly with the help of balance guidance.
- To identify the best position and amount for increasing weights by field calculation with auxiliary instruments .
- To observe amplitude, spectrum, time waveform and phase data.
- To upload the measurement data to PC and generate the balance report automatically.
- To analysis, view all the signals acquired on the instrument.

1.2 Safety Advice

Keep away for water

Even though KMbalancer[®]II+ is designed with IP65 Level of dust & water proof, it still needs to avoid direct contact with water, wet surface or cold & wet areas. Please keep the machine away from wet areas. If KMbalancer[®]II+ must be put on those places, abnormal behaving may occur. We need to ensure that KMbalancer[®]II+ is dry before it put into use.

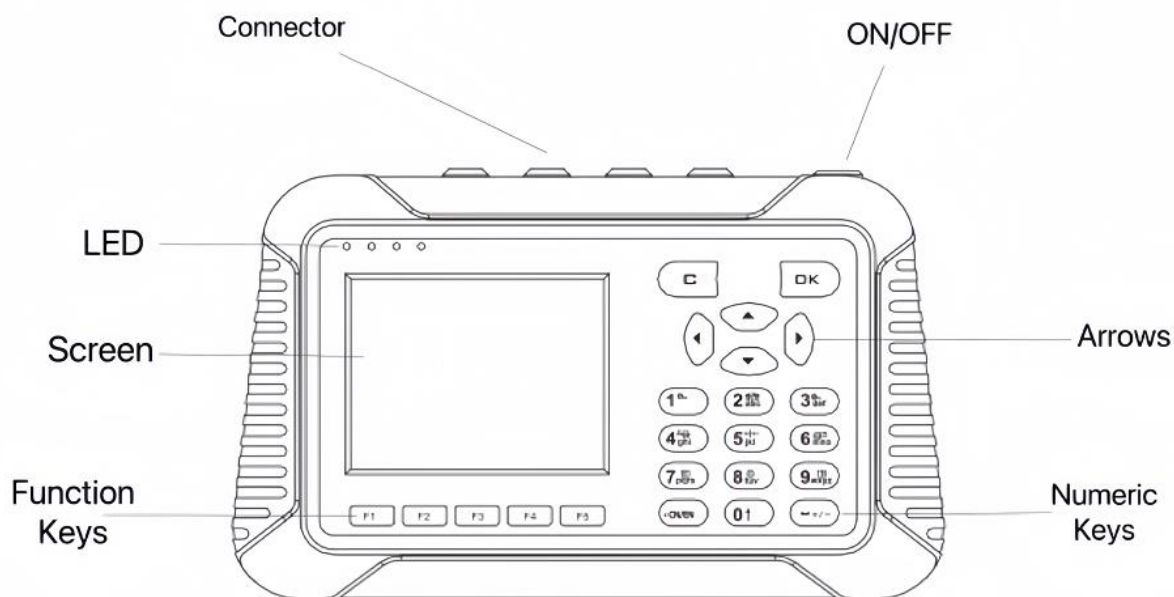
Be careful in handling

To avoid the damage of the instrument, please keep KMbalancer[®]II+ on the stable and dry environment when it is out of service, and no heavy articles should be put on the unit. Please only use the accessories from KM INSTRUMENT. No operation should be taken when liquid or other articles get into KMbalancer[®]II+.

1.3 Summary of Parts

This section introduce the parts of KMbalancer[®]II+, which including the functions of keys, hardware connection and LED display.

1.3.1 Outline of KMBalancer® II+ and Defining of Keys



1.1 Outline of KMBalancer® II+ and its operational Keys

Keys	Functions
Confirm/Ok Key	You can enter the currently selected module by pressing this key, or confirm your current selection
Function Key	These keys marked F1、 F2、 F3、 F4 and F5 called function keys, and above each key direct to corresponding characters to indicate their respective functions. If you fail to see these characters, it is means invalid in current window.
Up Arrow	<ul style="list-style-type: none"> ·Upward selection of menu items ·To the previous measure point
Down Arrow	<ul style="list-style-type: none"> ·Upward selection of menu items ·To the previous measure point
Left Arrow	<ul style="list-style-type: none"> ·Left selection of menu items ·To the next measurement ·Move cursor to left
Right Arrow	<ul style="list-style-type: none"> ·Right selection of menu items ·To the previous measurement ·Move cursor to right
Switch	<p>Power on: Press and hold the power button until the power indicator light turns on</p> <p>Shut down: Press and hold the power button for 2 seconds, a</p>

	shutdown confirmation prompt will pop up. Press and hold the power button for 5 seconds to force shutdown Short press after powering on, standby (screen off, power indicator light always on) or wake up (screen on)
Value	Input value (or connected with other functions)
Backspace/Cancel	Delete a previous character in input area, or back to the previous interface

Table.1 Functions of the Keys

1.3.2 External Connection

The external hardware connections used for commutation and data acquisition are at the front of KMbalancer®II+ as indicated in Fig.1.2

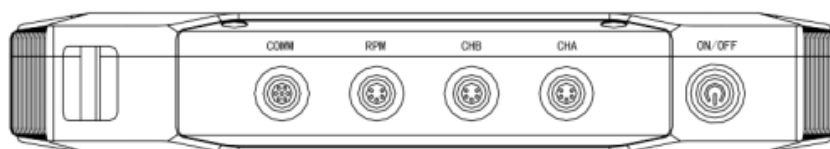


Fig.1.2 External hardware connections

Channel A/B Input-Vibration

Signals are inputted from Lemo connection ports marked CH-A/B on the front of KMbalancer®II+. The minimum full-scale voltage is $\pm 1\text{mV}$ (peak value) and the maximum measurement range is $\pm 25\text{V}$. Inputting is protected by instantaneous high-voltage, and continuous excess voltage must be avoided. Voltage can be DC or AC, when choosing ICP coupled mode, it can be directly connected with piezo electric sensor of internal charge amplifier.

Charge/Tacho signal input

If the speed sensor provided by KM INSTRUMENT is connected to this connection port, the equipment rotational speed and synchronous data get by external rotational speed signals can be acquired. We can also input other trigger signals or rotational speed signals by the special cables. The external power adapter can also be used for the charging of internal battery cells of KMbalancer®II+. The DC output of the external power adapter is connected to the KMbalancer®II+ for battery pack charging via a specific cable.

⚠ Attention: This connection port only accept charging by using the power adapter provided by KM INSTRUMENT, any other power adapters may result in the permanent damage to KM INSTRUMENT.

Communication port

Data communication can be attained when the communication port of KM INSTRUMENT and USB port of computer is connected by the fitting USB cable.

Battery units

The power of Kmbalancer[®]II+ can be supplied by its internal lithium cell, or be supplied by connecting power adapter to Kmbalancer[®]II+. The capacity of battery cells of KM INSTRUMENT is 4300mAH @ 7.4V.

Sheet 1.2 indicates the normal working time under the condition of the full charge of the internal battery cells of Kmbalancer[®]II+.

Mode	State	Working time
Open	Typical data acquisition (dual plane collection)	At least 8 hours
	Idle mode (light screen)	At least 12 hours
	Idle mode (extinction screen)	At least 3 days
Battery Charge Time	100%	6.5 hours

Sheet 1.2 Battery capacity

1.4 Turn On and Off the Kmbalancer[®]II+

1.4.1 Turn On the Kmbalancer[®]II+

Press and hold the power button until the power indicator light turns on.

1.4.2 Turn Off the Kmbalancer[®]II+

In any running interface of Kmbalancer[®]II+, press the [Power Switch] and hold for two seconds.

A shutdown prompt will pop up for confirmation. Select "Yes" to shut down.

⚠ Attention: Normally, please back to application center and then shutdown Kmbalancer[®]II+. Please refer to Section 1.5 of this chapter to see more details on application programme.

1.5 Application

The following introduces the main interface that first appears when starting KMBalancer®II+. Many other interfaces will appear when operating KMBalancer®II+. These interfaces will be introduced along with the operation.

In KMBalancer®II+ application center (main interface), you can switch between different functional modules of KMBalancer®II+, and each option can complete different tasks, such as data acquisition, defining setting options, and viewing data.

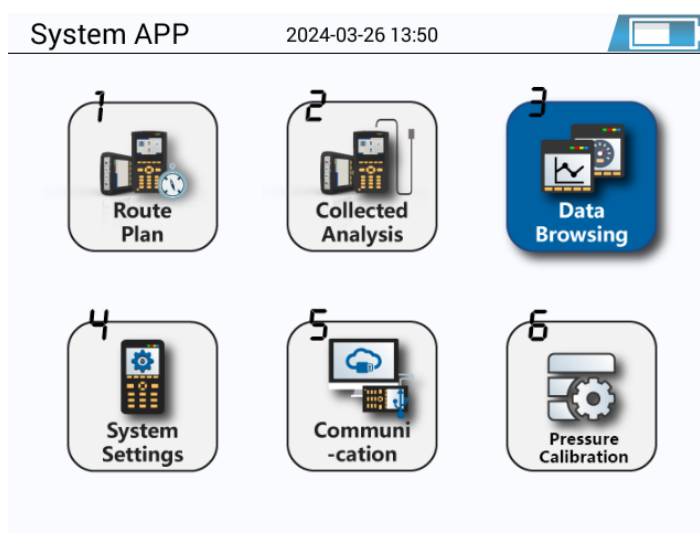


Fig. 1.3 Main Interface (application programme center)

You can highlight the module you need with navigation arrow. Click **【OK】** to enter into module or the corresponding figure of the module to execute operation.

Functional modules of application programs including:

- **Route Inspection:** The inspection plan module is used to collect route (plan) data. Please refer to the relevant contents in Chapter 2 of this manual.
- **Collection and analysis:** The data collection module is used for data collection and analysis and dynamic balance analysis. For more information, please refer to the data collection instructions in Chapter 3 and the Balance Wizard instructions in Chapter 4 of this manual.
- **Data viewing -** This function enables you to view any data stored in instrument. For more information, please refer to the data viewing section in Chapter 5 of this manual.
- **System:** Used to view information such as system power, storage capacity, operating system version, hardware version, etc. For more information, please refer to the system information description in Chapter 7 of this manual.

- **Communication:** Communicates with the host computer software via USB cable for downloading spotting plans, collecting parameter definition groups, recalling data, etc. For more information, please refer to the communication module section in Chapter 8 of this manual.

1.6 Battery Maintenance

When the KMBalancer®II+ is reinstalled after removing the battery, it is necessary to perform a complete cycle of discharging and charging the battery in order to correctly display the power information. The steps are as follows:

1. In the powered-on state (battery power is about 50% at this time), discharge until it automatically shuts down.
2. Plug in the charger and charge in the power-on state until the charging light changes from red to green, indicating that charging is complete, at which time the battery is at 100%.

2. Route

Select by highlighting **【Route】** in main interface, and then click **【OK】** to enter into route module. This chapter introduces to you how to use Kmbalancer[®]II+ to fulfill the task of route.

2.1 Prepare Data Acquisition

Assuming that you have downloaded at least one point check plan sequence for Kmbalancer[®]II+ . Before you begin to collect data, there is something need to do, including:

1. Confirm the battery has been fully charged.
2. Check the date and time of the instrument.
3. Connect the sensor to the instrument.
4. Check the storage space of the instrument.

Connect the sensor to the data collector

Insert the sensor cable plug into the CHA and/or CHB interface of Kmbalancer[®]II+. Red dot on the plug and socket should be consistent with the red dot on the interface .Don't rotate and distort the plug. To disconnect, you can unplug the knurled section. It will be a slight to slip out and then you can pull out the plug.

2.2 Route Acquisition

As mentioned earlier, you can download a route sequence to Kmbalancer[®]II+ to organize your data acquisition, and then collect data according to the measurement definition in sequence (route).

2.2.1 Navigate a Route Manually

Running of the module program of checking is based on a route, which is created and transferred by your upper computer software. The route you created can contain multiple points, which can contain multiple measurement definition. Then you can measure many times.

Select **【Route】** from the applications, and then click **【OK】** to enter into route interface as indicated below.

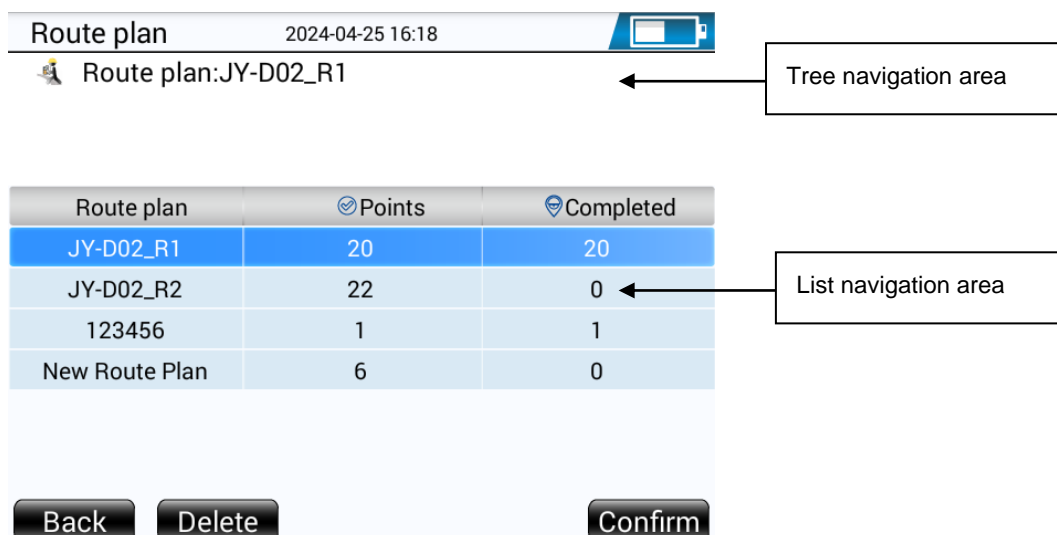


Fig.2.1 Route window

Select the available route list with up or down arrows, and then click **【OK】** or the function keys **【Confirm】** (F5), KMBalancer®II+ will show all the machines or equipments list of your selected plan as indicated below.

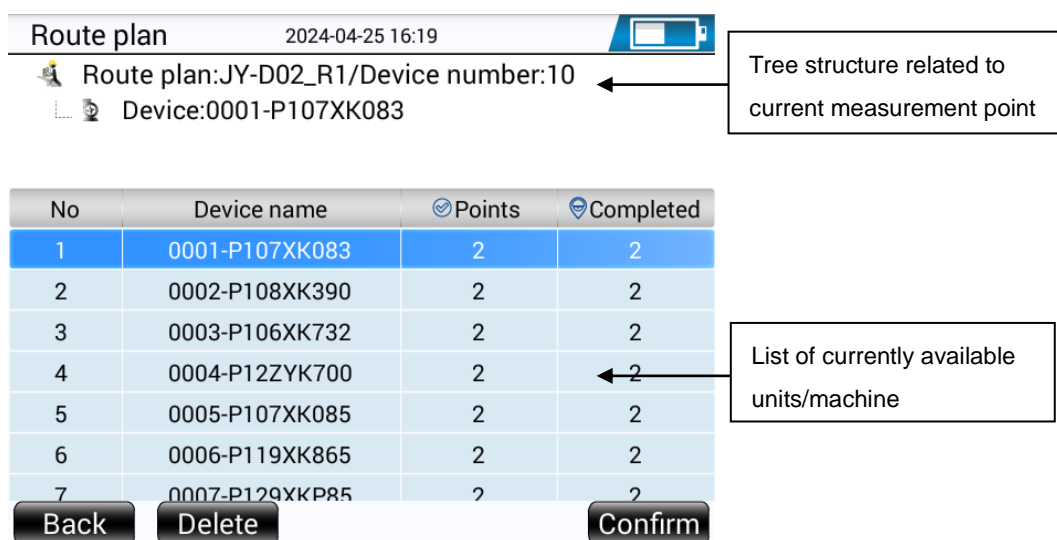


Fig. 2. 2 Equipment list window

Select equipment list in the current route with up or down arrows, and then click **【OK】** or the function keys **【Confirm】** (F5) to show all the measuring points list and the measuring definition list of measuring points as indicated below.

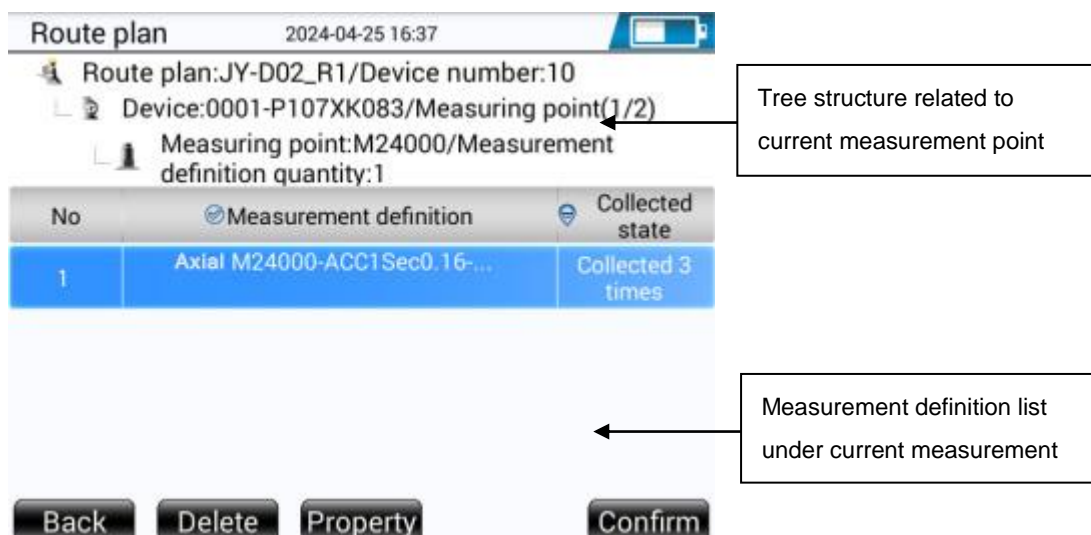


Fig. 2.3 Measuring point's window

Each equipment can contain more than one point. Select different measuring point with left and right arrow keys. When the measuring point is the first or the last point of equipment, if you press the left or right direction key again, it will prompt "It is already the first measuring point" or "It is already the last measuring point".

2.2.2 Start Data Collection

You can start data collection after having selected measuring points of the route. You can stop the collection at any time during the collection by clicking the function key **【Stop Collection】** (F5) or **【OK】**. As Fig. 2.4 indicated, you can collect current selected measurement definitions by the function key **【Collection】** (F5). After collection, it will show as below.

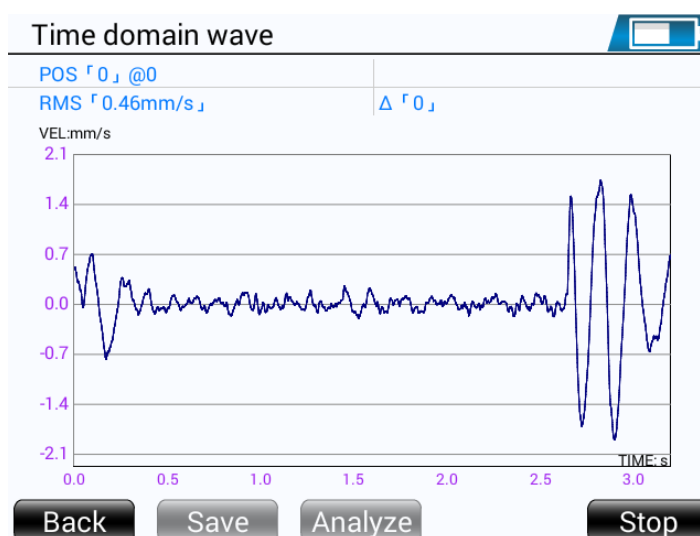


Fig. 2.4 Collection Window

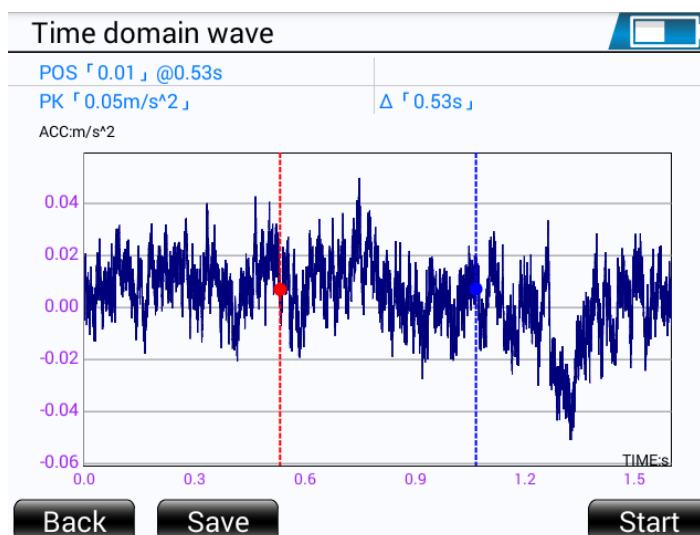


Fig. 2. 5 Stop Collection Window

After collection, you can select save by the function keys **【Save】** (F2). Press **【OK】** to save the data.

Start collection again by the function keys **【Collect Again】** (F5).

2.2.3 Query Progress of Collection

Users can know the completion of the acquisition task by viewing the number of measuring points and completing in Fig. 2. 1(route) and Fig. 2. 2(equipment list). Assuming that the number of measuring point is m , the number of completing is n , their specific meaning is as follows:

(1) M and n showed on the list of route. N shows the number of measuring points that has completed acquisition task. M shows the number of the whole measuring points of the route. For example m is 40 and n is 1, it means that the number of measuring points that has completed is 1. There are 39 points that are unfinished.

(2) M and n showed on the list of equipment. N shows the number of measuring points that has completed acquisition task. M shows the number of the whole measuring points of equipment.

As shown in Fig. 2.5 "Route 1", the number of measuring point is not equal to the number of completed, which means that the route has not yet completed.

When finishing the last measuring point, KMinstrument[®] II+ will prompt the user of the completion of this check plan.

After saving data, you can view the data collected by the **【Data Collection】** module easily through selecting the **【Data Browsing】** in the main interface. Please refer to Chapter 6 for the method of data browsing.

3. Analysis

This chapter introduces to you how to use KMBalancer®II+ to fulfill single/dual channel analysis, overall evaluation, and rotational speed measurement to help determine whether the equipment is balanced.

Select by highlighting **【Analysis】** in main interface, and then click **【OK】** to enter into analysis module as indicated in Fig.3.1.

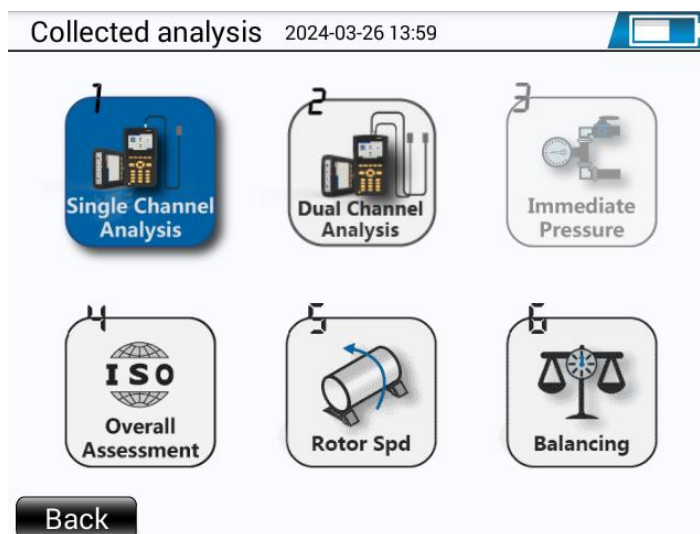


Fig 3.1 Analysis module window

3.1 Single Channel Analysis

【Single Channel Analysis】 can be used for single channel vibration analysis, and be used for judging if the equipment have balancing problems by the data acquired.

The types of data that users can collect include time waveform and total value.

Select **【Single Channel Analysis】** in **【Analysis】** main window, and click **【Yes】** to enter into the interface as indicated in Fig.3.2.

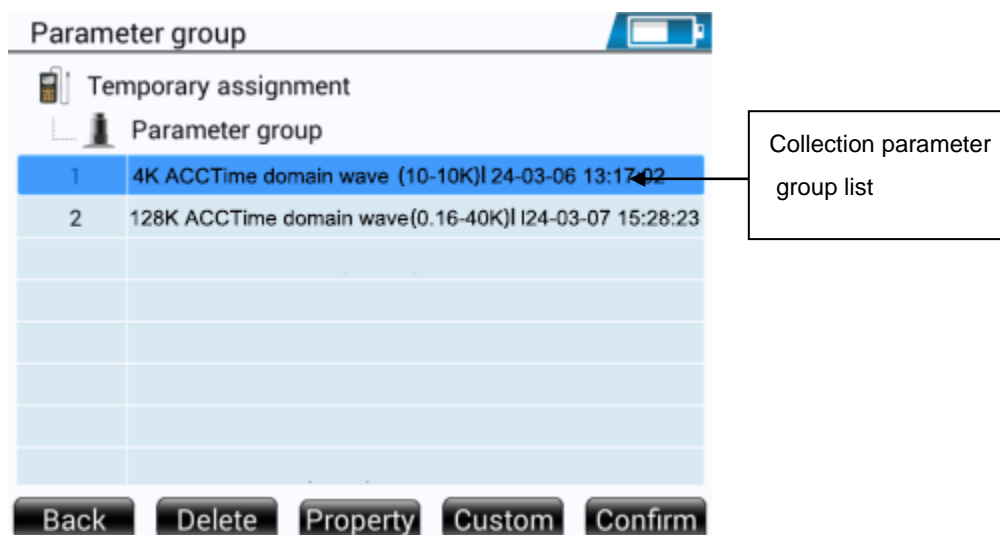


Fig.3.2 Single channel acquisition parameter population

3.1.1 Single Channel Acquisition Parameter Setting

User-defined acquisition parameters

In the window as indicated in Fig.3.2, you can click **【User-define】** (F4) to set acquisition parameters as indicated in Fig.3.3

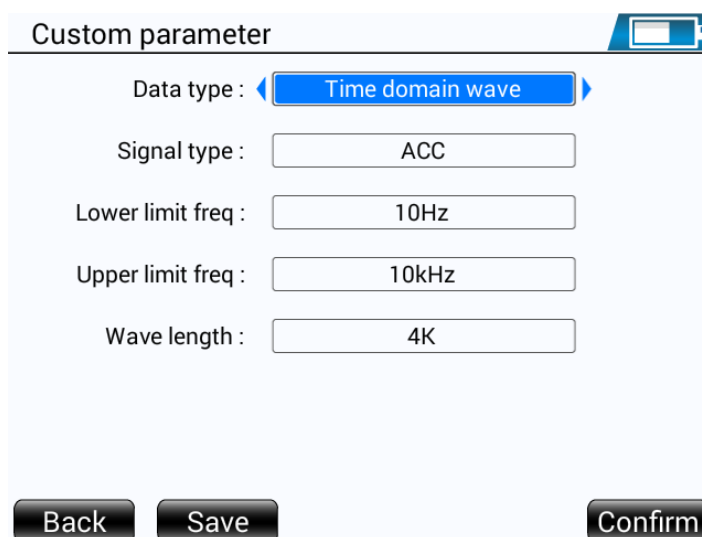


Fig.3.3 Self-defined acquisition parameter

In this window, you can select the items you want to set with up and down navigation arrows. Left and right navigation arrows can be used for changing values of the items. Setting items differ as the differ of **【Data Type】** settings.

- **Data type: time-domain waveform**

You should select this item if you want to acquire the temporal series of a magnitude, namely,

the time-domain measurement value of a magnitude. The window of the item selected is indicated as Fig.3.3. Setting parameters including:

- 1) Signal type: Select the value units for data analysis in signal type item selection. Options including: acceleration, velocity, displacement.
- 2) Minimum of frequency: Set the minimum acquisition frequency for data acquisition in this item. Optional values for this item including: 0.16Hz、1Hz、2Hz、5Hz、10Hz、20Hz、50Hz、100Hz.
- 3) Maximum of frequency: You can set the maximum acquisition frequency for data acquisition in this item. Optional values for this item including: 500Hz、1KHz、2KHz、5KHz、10KHz、20KHz、40KHz.
- 4) Wave length: You can set the length of acquisition temporal series, namely the number of data acquired. Optional values including: 1K、2K、4K、8K、16K、32K、64K、128K.

- **Data type: total value trend**

Total value trend aims to observe the total value volatility curve of varying duty. When 【Data Type】 is set as 【Total Value Trend】 , the setting window is indicated as Fig.3.4

The screenshot shows a 'Custom parameter' window with the following settings:

- Data type: Total value trend (selected in a dropdown menu)
- Signal type: ACC
- Lower limit freq: 10Hz
- Upper limit freq: 10kHz
- Wave length: 4K
- Total value type: Valid value

At the bottom of the window are three buttons: 'Back', 'Save', and 'Confirm'.

Fig.3.4 Total value trend acquisition parameter setting

The settings of 【Data Type】 【Signal Type】 , 【Minimum of frequency】 , 【Higher Frequency Limit】 , and 【Waveform Length】 are exactly the same as the above setting method for 【Data Type】 to 【Time Waveform】 . The settings of other items are as below:

Total value type: This type offers the types for setting total values. You can conduct cyclical selection between the options of 【 Virtual Value】 , 【Peak Value】 and 【Peak-to-peak Value】 .

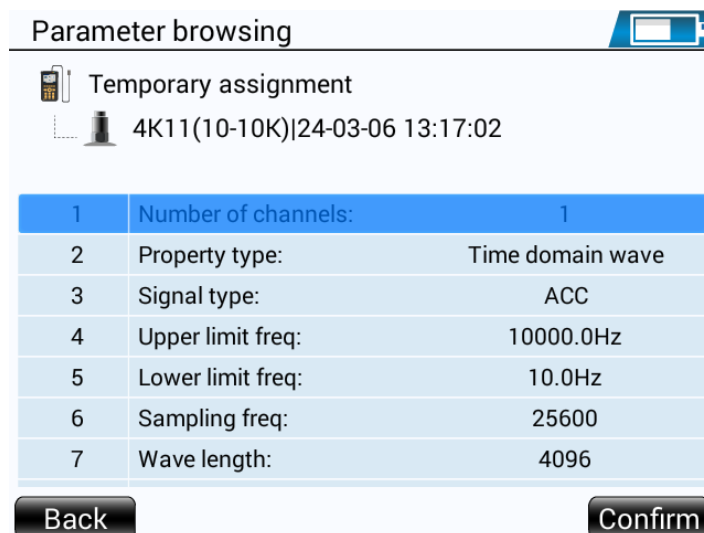
- **Save/delete self-defining value**

Save your setting by pressing **【 Save Property 】, all parameter definitions saved will be displayed in the interface of 【Acquisition Population of Parameter】** as indicated in Fig.3.2.

User-defined parameter columns are displayed in the list group.

User-defined collection parameters can be operated by **【Delete】** and **【Property Preview】** .

The attribute preview is shown in Figure 3.5



Parameter browsing		
Temporary assignment		
4K11(10-10K) 24-03-06 13:17:02		
1	Number of channels:	1
2	Property type:	Time domain wave
3	Signal type:	ACC
4	Upper limit freq:	10000.0Hz
5	Lower limit freq:	10.0Hz
6	Sampling freq:	25600
7	Wave length:	4096

Back Confirm

Figure 3.5 Property preview

When the user-defined acquisition parameters are selected and the function key **【Delete】** is highlighted, press the **【Delete】** key (F2) at this time, and the system will delete this piece of data.

3.1.2 Collecting Single Channel Data

This section introduces the process of collecting single channel data.

After you set the single channel acquisition parameter, click **【OK】** to enter into scratch data naming interface, the system will generate a default temporary collection name, as shown in Figure 3.6:

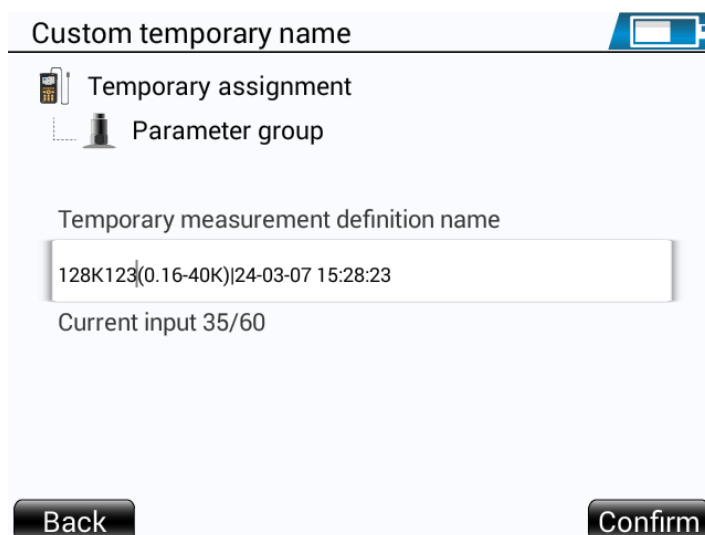


Fig 3.6 Interim measuring point name setting

Collecting time-domain waveform

Click **【OK】** /F5 in provisional measurement point naming interface to enter into time waveform acquisition window as indicated in Fig.3.7

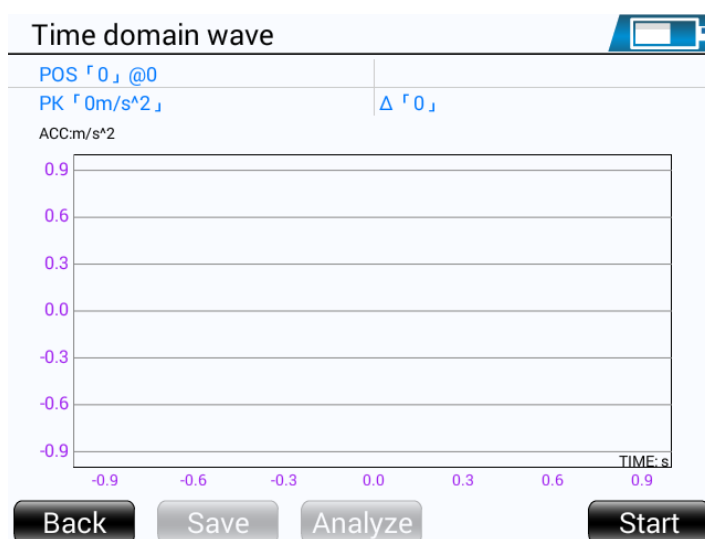


Fig.3.7 Time waveform collecting

Start data acquisition through the function key **【Start Acquisition】** (F5), and the acquisition time domain waveform will be continuously refreshed. In the course of data acquisition, function keys like **【Back】** , **【Save】** and **【Analysis Method】** will be deactivated and only **【Stop Acquisition】** will remain activate. After data collecting stopped, acquisition finished interface will be displayed as in Fig.3.8

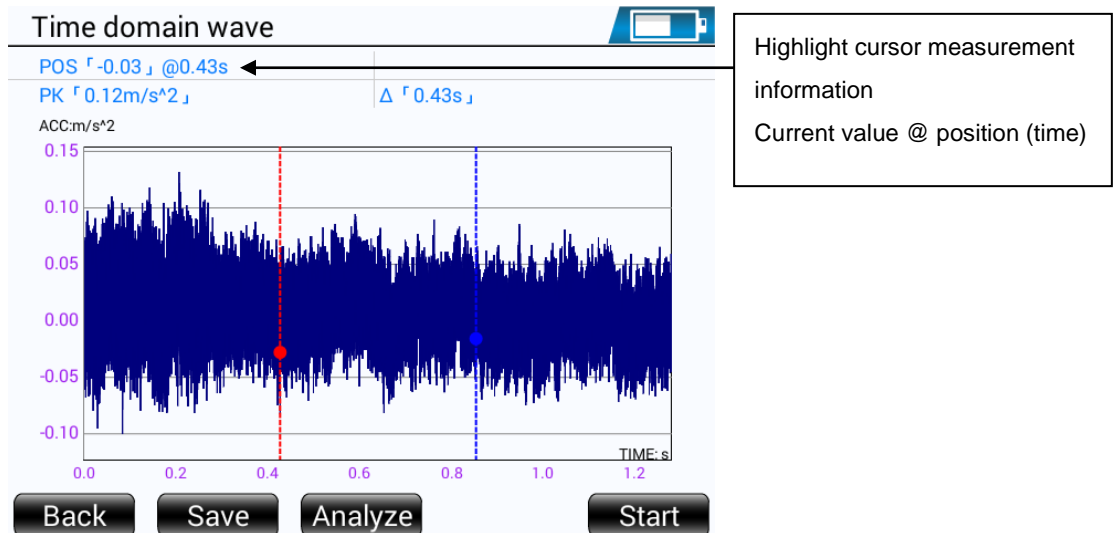


Fig.3.8 Time-domain waveform collecting finished

After the collection is stopped, you can perform the following operations:

- To switch the cursor with **【Number 2】**, and the selected cursor will be highlighted (red).
- To reduce waveform with **【Number 1】**, to amplify waveform with **【Number 3】**
- Pan the waveform to the right with **【Number 6】**, pan the waveform to the left with **【Number 4】**
- Navigate with the left and right keys to move the highlighted cursor, click to move a data point, and long press to move quickly.
- Navigate up and down keys to move the highlighted cursor, click to move a segment of data points
- Save the data acquired by **【Save】** (F2)
- Re-collecting with the same acquisition parameter by **【Collecting】** (F5).
- Conduct current data analysis by **【Analysis Method】**.

After zooming in, the original waveform in the left half of the screen will be enlarged to full screen display. The initial position of the double cursors is also located at one-third and two-thirds of the total length of the waveform. After the waveform is enlarged, use **【Number 1】** to zoom out to the screen situation before this enlargement (original waveform). Figure 3.9 shows the window in Figure 3.8 after continuously using **【Zoom】**.

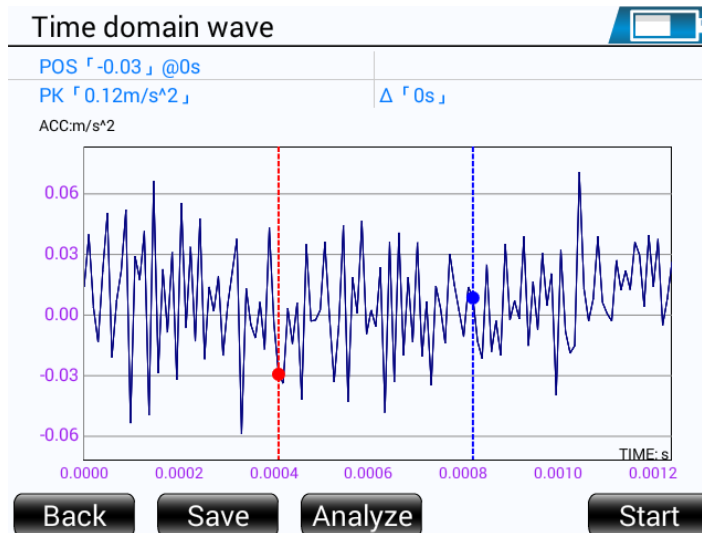


Fig.3.9 Amplified waveform

When moving the current cursor with navigation arrows, the cursor measurement information on the top of the window also change consequently.

Information following Δ means the time or frequency difference between the two cursors.

Use the function key **【Analysis Method】** to select the analysis algorithm to calculate the currently collected data. If the acquisition data type is **【Time-domain Waveform】**, analysis method menu will pop up by pressing **【Analysis Method】**. You can select analysis method like frequency spectrum, time-domain waveform, and eigenvalue with up and down navigation arrows.

Fig. 3.10 indicates the result of choosing **【Frequency Spectrum】**. Fig.3.11 is the analysis window of **【Eigenvalue】**.

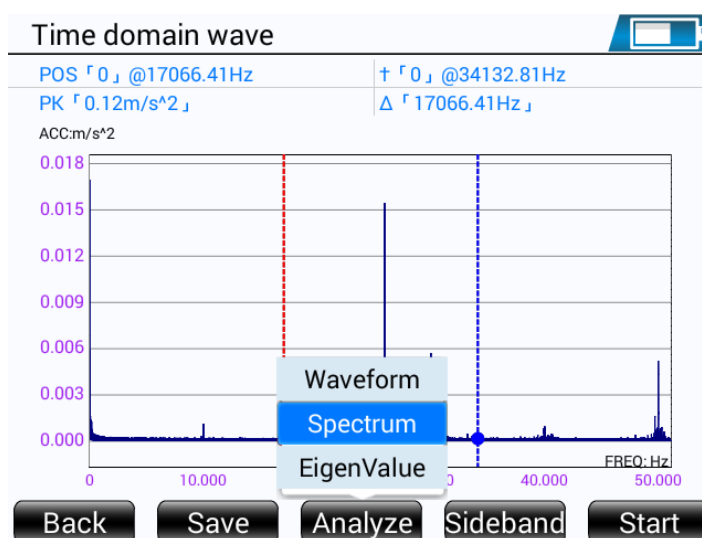


Fig. 0.1 Spectrum

Time domain wave	
EigenValue name	Numerical value
PK :	0.1155
PP :	0.2309
RMS :	0.0237
MAX :	0.1308
MIN :	-0.1002
MEAN :	0.0084
SKEW :	0.1510
MSR :	0.0006
CF :	5.2030
MST :	0.1665

Back

Fig. 0.11 Eigenvalue

In the spectrum mode, you can switch between the octave frequency cursor (Figure 3.12) and the side frequency cursor (Figure 3.13, Figure 3.14) through the F4 function key.

In octave cursor mode:

- To reduce the waveform with **【Number 1】**, to enlarge the waveform **【Number 3】**
- To pan the waveform to the right with **【Number 6】**, to pan the waveform to the left with **【Number 4】**
- Quickly switch the position of the sub-cursor (blue line) (at what multiplier it is located) with **【Number 5】**
- Panning cursor position and octave spacing with left and right arrow keys

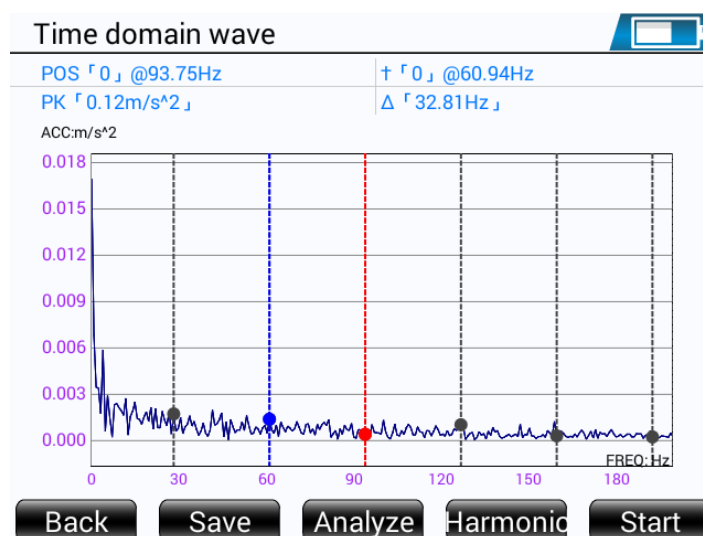


Fig. 0.2 octave frequency cursor

Side frequency cursor mode:

- To reduce the waveform with **【Number 1】** , to enlarge the waveform with **【Number 3】**
- To pan the waveform to the right with **【Number 6】** , to pan the waveform to the left with **【Number 4】**
- To switch the position of the sub-cursor (blue line) with **【Number 5】**
- To exchange the main and sub-cursor positions with **【Number 2】** and set the reference line (gray line) spacing mode to fixed or variable. The default is fixed spacing.
- To pan the position of the cursor and reference line with Left and Right direction keys. When the spacing is fixed, the spacing of the translation cursor remains unchanged (Figure 3.13); when the spacing is variable, the spacing of left movement is reduced and the spacing of right movement becomes larger (Figure 3.14)

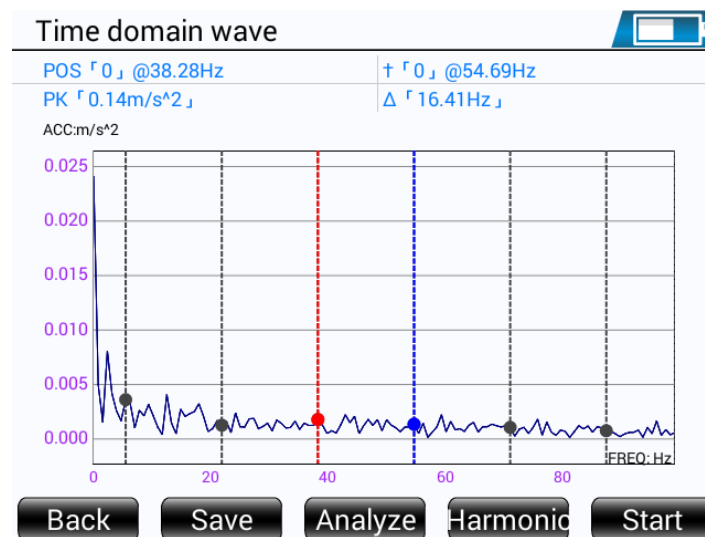


Fig 0.3 Side Frequency Cursor - Equal Spacing

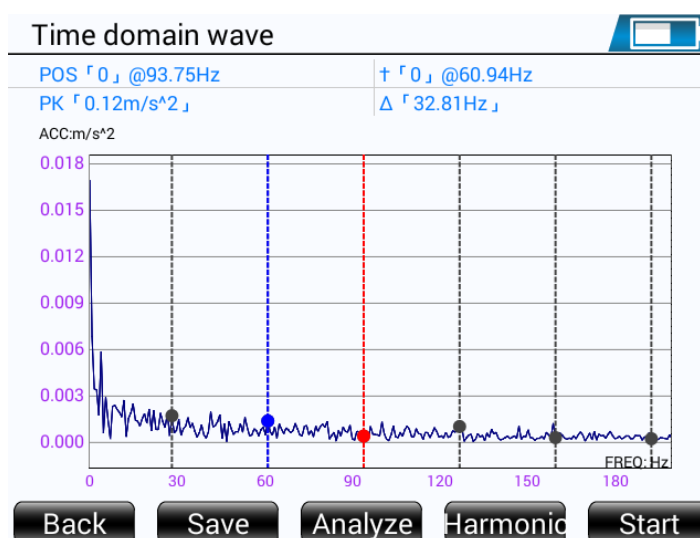


Fig 0.4 Side Frequency Cursor - Variable Spacing

Acquiring total value trend

You can start to acquire total value trend after selecting **【Total Value Trend】** of **【Data Type】** and establish a temporary measuring point. Start the acquisition with the function key **【Start Acquisition】** (F5) or **【OK】**.

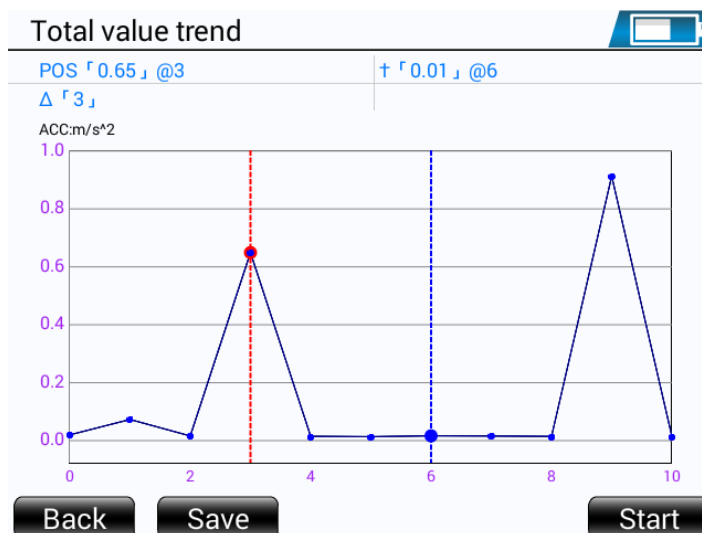


Fig. 3.15 Total value trend acquisition

While the acquisition is in progress, you can observe the waveform of each acquisition, or terminate the acquisition by using the function key **【Stop Acquisition】**. After stopping acquisition, the window will display the last acquired waveform and enter the waveform cursor navigation state. After stopping the acquisition, the method of zooming in and out of the waveform as well as the cursor navigation is exactly similar to that of the time domain waveform, please refer to the operation method of the time domain waveform.

The function key **【Save】** (F2) only saves the last collected data.

3.2 Dual Channel Analysis

An effective predictive maintenance process is mostly based on the collection and analysis of route vibration data, supplemented by other technologies, such as oil analysis, temperature recording and motor current analysis. The detection of most common machine faults and the location of faulty components can be accomplished using vibration measurements with a single-channel data collector and a trend analysis software. But in many cases, if a specific fault must be pinpointed, dual-channel capabilities are required for a more thorough analysis.

Dual-channel analyzers are distinct from a single-channel instrument. The ability to measure two parameters or two positions simultaneously, to measure cause and effect in a system, to measure the relative amplitude and phase between two signals sampled at different positions or directions on a single machine makes dual-channel analysis suitable for analyzing the root cause of a fault.

KMbalancer®II+ offers dual channel analysis function, which enables users to conduct the Synchronization of two measurement points. It can also perform special analysis functions such as total value trend and spectrum, so as to analyze the relevant characteristics of the two measuring points and diagnose machine faults.

Select by highlighting **【 Dual Channel Analysis 】** in **【 Collection Analysis 】** window, and then press **【 OK 】** to enter into the window as indicated in Fig.3.16.

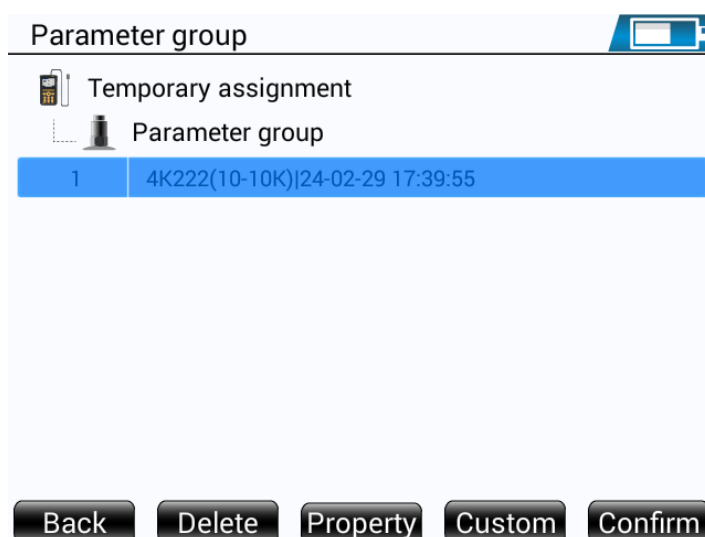


Fig.3.16 Dual channel analysis acquisition parameter array

3.2.1 Dual Channel Acquisition Parameter Setting

Self-definition Acquisition parameter

【 Dual Channel Analysis 】 also allows you to self-define acquisition parameter population. As indicated in Fig.3.16, you can open the self-define acquisition parameter window with **【 Self-definition 】** (F4) in the window as indicated in Fig.3.17.

Custom parameter

Data type : Time domain wave

Signal type : ACC

Lower limit freq : 10Hz

Upper limit freq : 10kHz

Wave length : 4K

Back Save Confirm

Fig.3.17 Self-define dual channel acquisition parameter

When **【Data Type】** is **【Time Domain Waveform】** and **【Aggregate Trend】**, parameter setting items are quite similar with that of **【Single Channel Analysis】**, and please refer to **【Single Channel Analysis】** for detailed settings.

3.2.2 Dual Channel Data Acquisition

Press **【Confirm】** (F5) or **【OK】** after setting the collection parameters, KMBalancer[®] will remind you to enter a new name to establish the temporary measurement point. You can start to acquire data after temporary measurement point was established.

Custom temporary name

Temporary assignment

Parameter group

Temporary measurement definition name

4K222(10-10K)|24-02-29 17:39:55

Current input 31/60

Back Confirm

Fig.3.18 Setting of temporary measurement point name

Under acquisition state, you can observe the waveform acquired each time, or stop acquisition with **【Stop Acquisition】** key. The window will indicate the waveform of the last time acquired

after acquisition stopped and enter into the state of waveform cursor navigation.

Waveform indication of dual channel can be divided into up and down parts, which used to indicate the waveforms of Channel 1 and Channel 2 respectively.

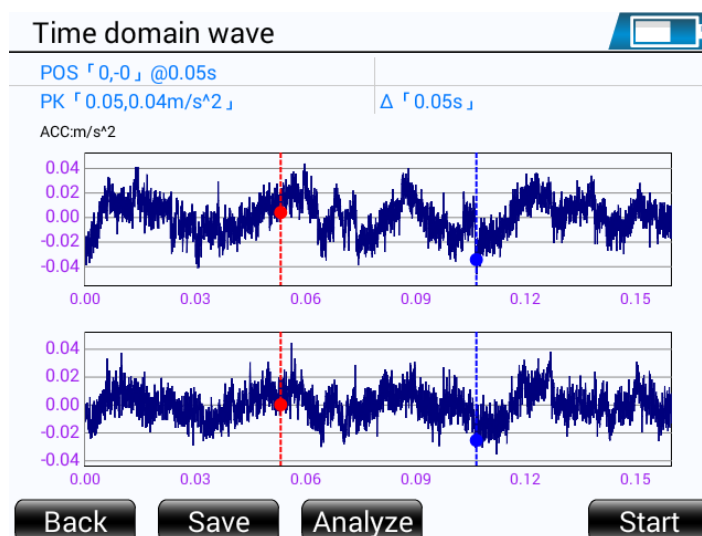


Fig 0.5 Dual-channel time domain waveform acquisition

The methods of the amplification/reduction of waveform, cursor navigation method are the same as introductions above. The measurement information structure of highlighted cursor is CHA:

(Y value of Channel A) | CHB: (Y value of Channel B) @the position of X axis.

【Save】 (F2) only saves the data acquired the last time.

The data you acquired and saved in **【Dual Channel Analysis】** can also be viewed in the data viewing module. Please refer to data viewing section in Chapter Five for specific method.

3.3 Pressure Acquisition and Analysis

This version does not include pressure data collection and analysis functions.

3.4 Overall Assessment

Through the parameter configuration need to collect the power range of the equipment, there will be matched with the national standard vibration level reference table, and then press the evaluation button **【F5】** to start the evaluation will be shown after the results. It is divided into four levels: A, B, C, and D. A and B are normal ranges, C is warning level, and D is severe level. Return operations are not allowed during the evaluation process.

Overall assessment 2024-03-26 14:47

Overall assessment

Please set the operating parameters of the device

Power

Rotating vel

Support

Channel ID

Fig 0.6 Level evaluation parameter configuration operation

Overall assessment 2024-04-29 15:07

Overall assessment

Large machines with nominal power greater than 15KW and less than 300KW; Motor with shaft height greater than or equal to 160mm and less than 315mm (rigid support)

Regional Boundary	Vel RMS mm/s
A	
B	
C	
D	4.5~+∞

Speed effective value: mm/s

Evaluation level:

Fig 0.7 Level evaluation in progress

Overall assessment 2024-03-26 14:50

Overall assessment

ISO10816-1 general guideline (Small machines with power less than 15KW)

Regional Boundary	Vel RMS mm/s
A	0~0.71
B	0.71~1.8
C	1.8~4.5
D	4.5~+∞

Speed effective value: 0.05 mm/s

Evaluation level: **A**

Fig 0.8 Evaluation results display

Note: The rating assessment is an equipment vibration data collection, so please make sure that the sensor is connected correctly before operation.

3.5 Rotational Speed Measurement

Select by highlighting **【 Rotational Speed Measurement 】** in **【 Collection Analysis 】** window, and then click **【OK】** to enter into rotational speed measurement window, where you can activate rotational speed measurement with **【 Start Acquisition 】** F5, and rotational speed will be timely updated. The below vibration gram is used for indicating the trend of all rotational values acquired this time.

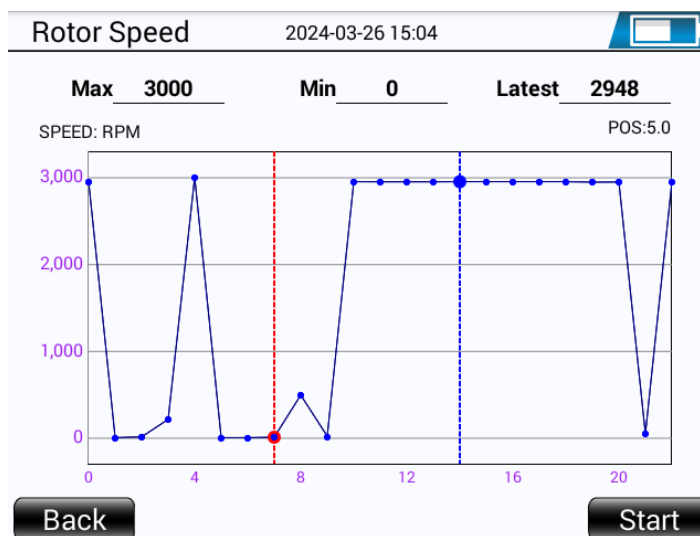


Fig.3.23 Rotor speed is being measured

You can click **【Stop Acquisition】** to stop acquisition at any time.

4. Balance Guide

Dynamic balancing is a technology which used for measuring the centre-of-gravity shift of rotator, the mass, size and position of rotor. By this technology, you can balance the equipment by adding weight or remove the same weight to the opposite direction. Relevant operations include equipment starting/stopping, weight-adding and weight-moving.

There are three measurement types in dynamic balancing:

1) Initial vibration measurement

The measurement is conducted before the weight-adding of equipment, and the measurement acquires vibration values of each side. This vibration value is just the one which needs to be corrected by weight-adding of dynamic balancing.

2) Trial weight Measurement

Trial measurement is taken after one plane of the equipment is being weight-added. Trial weight measurement aims at measuring the effect of the equipment of being weight-added.

The ideal trial weight should have 30% amplitude change or 30 degree phase change.

3) Unbalance Measurement after Correction

Vibration data measured is from the equipment which counterweight has been added or weight has been corrected. Measurement of residual unbalance measures the residual unbalance, counterweight reduces initial unbalance and correct weight removes the vibration measured in residual unbalance measurement.

The user has the option to decide if dynamic balance has reached the required accuracy and thus to finish balancing.

4.1 Dynamic Balance Data List

This section introduces the function and usage of dynamic balance data list.

Select **【Balance Guidance】** in **【Collection Analysis】** , and then click **【OK】** to enter into dynamic balance data list as indicated in Fig.4.1.

A title bar located at the top of the form that describes the current stage of dynamic balancing.

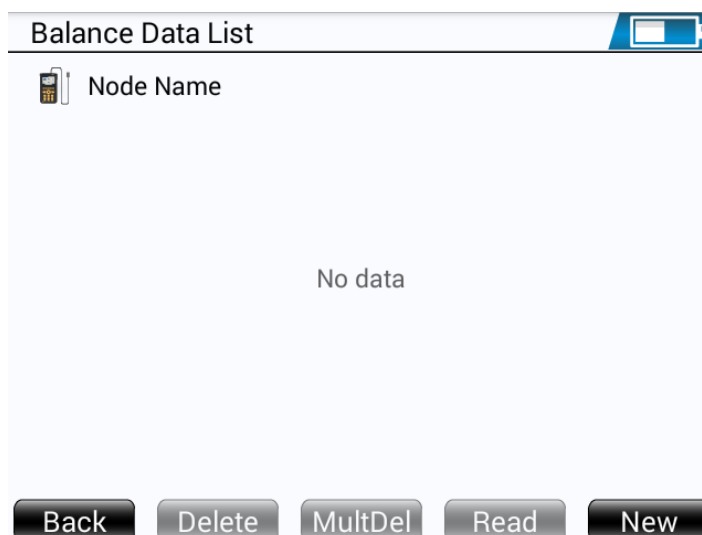


Fig.4.1 Dynamic balance data list

The initial state of list is blank if there is no data, and data will be indicated in data list after you saving the record as can be seen in Fig.4.2.

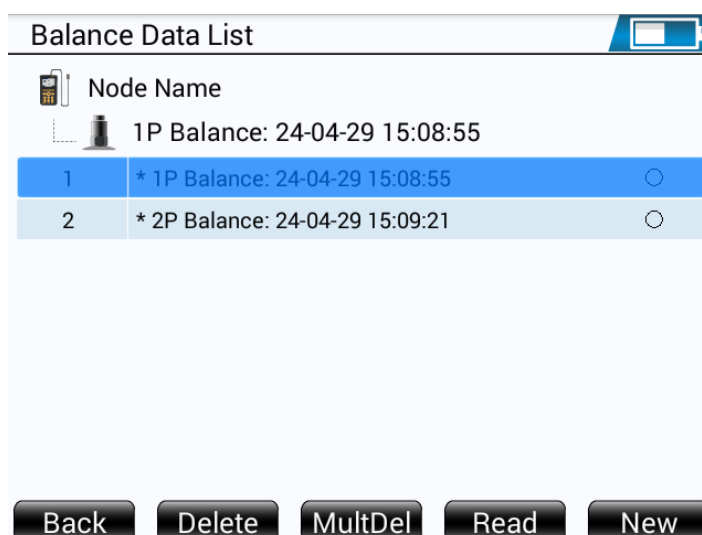


Fig.4.2 Dynamic balance data list window

Dynamic balancing is finished. Please finish dynamic balancing and save the data, and you will find another record in data list has been added as indicated in the first record of Fig.4.2. If the dynamic balancing is terminated and then record saved, it be will indicated as the second record in Fig.4.2. The symbol (*) before record means unfinished balancing (Please refer to the subsequent introduction for " termination and exit")

In dynamic balance data list , the selected record will be indicated in the window, and Fig.4.2 is the interface of the first record selected. In this interface, you can select one record (press left key to cancel selection) with the right navigation key, and click **【Delete Selected】** to delete all you selected as indicated in Fig.4.3. You can also delete the records one by one with **【Delete】** .

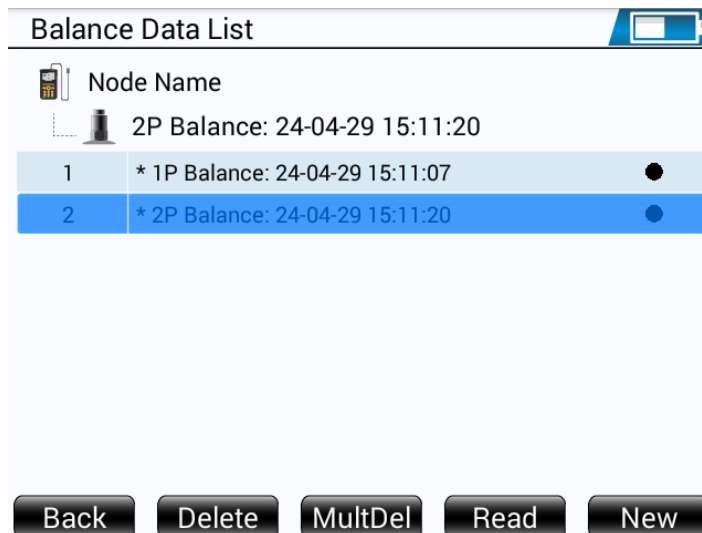


Fig.4.3 Navigation key select record

You can continue the unfinished dynamic balancing with **【Read】** (F3) in Fig.4.3. For instance, you can click **【Read】** to enter into dynamic balancing vibration interface.

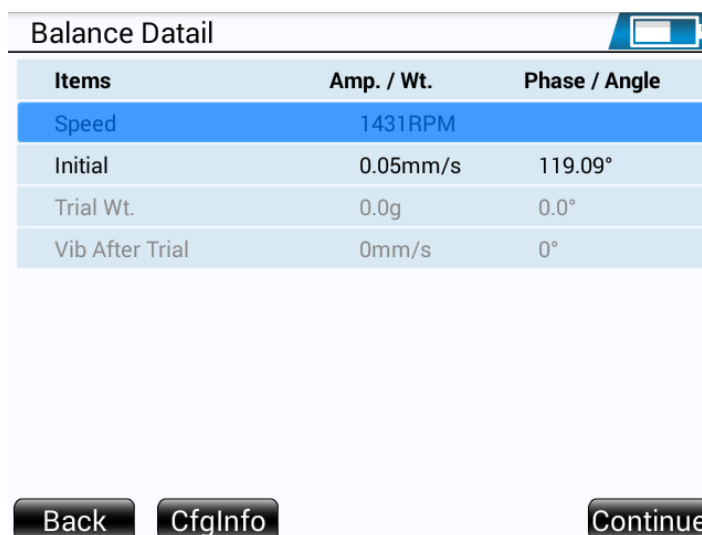


Fig 4.1 Dynamic Balancing Vibration Information

As in Fig.4.4, you can click **【Continue Balance】** to the position where you exited dynamic balancing to continue the unfinished balancing.

4.2 Dynamic Balance Parameter Setting

This section introduces the dynamic balance parameter setting.

Click **【New Establish】** F5 in dynamic balance data list interface to enter into the setting interface of dynamic balance, where you can choose different number of balance planes, scale direction and method of balancing as Fig.4.5 indicated.

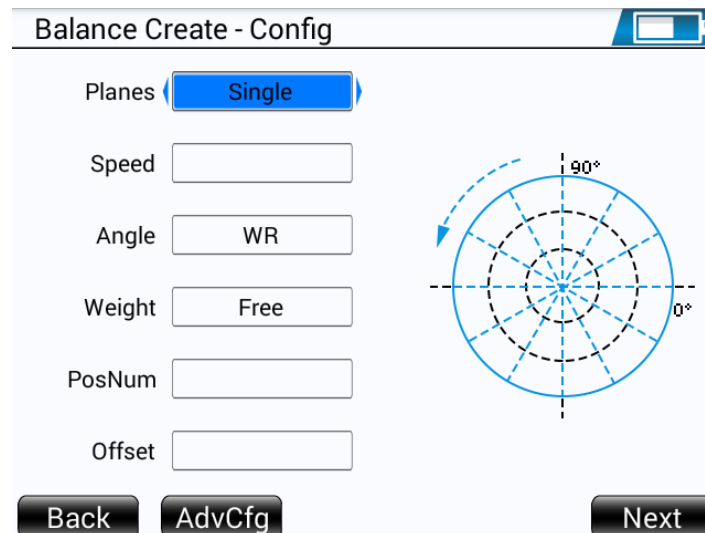


Fig.4.5 Dynamic balance setting interface

1) Number of balancing plane

An effective way to decide if single-plane dynamic balance or two-plane dynamic balance should be adopted is to refer to the width-diameter of rotor. Width-diameter ratio is the width of rotor (axis is not included) divided by its diameter. Sheet 4.1 will help you to decide if single-plane dynamic balance or two-plane dynamic balance to be adopted.

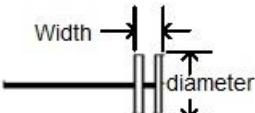
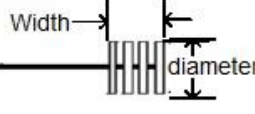
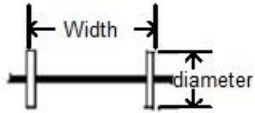
	Width diameter ratio	Single-plane	Two-plane
	<0.5	0 - 1000RPM	>1000RPM
	>0.5 And <2	0 - 150RPM	150 – 2000RPM or >70% of first-order rotational speed
	>2	0 - 100RPM	100RPM to 70% of first order rotational speed

Table 4.1 Parameter comparison of single-plane/two-plane balance

When balancing the equipment, we should assure the weight-adding point relative to the position or angle of reference slot and tag point. (Position quantity is usually the quantity of blades or balancing holes). You must choose if the direction of angle tag and rotational direction of rotor are the same or the opposite.

2) Scale direction

With **【Rotation】** and **【Against Rotation】** means calculation angle and rotor rotational direction relations. Scale direction parameter affects each measurement angle, if the parameter is set as With **【Rotation】** , angle will be marked from reference point and with the rotational direction of the equipment, and if the parameter is set as **【Against Rotation】** , angle will be marked from reference point and with the opposite rotational direction of the equipment.

3) Mode of counterweight

【Fixed Position】 and **【Arbitrary Position】** means the positions where weight can be added or removed on the rotor are fixed or continuous. If you choose **【Fixed Position】** , which means there has been fixed position on the rotor for adding /removing weight during balancing, and we should also input fixed position for adding / removing weight and zero-drift.

After selecting **【Fixed Position】** , you should also input the corresponding numbers in **【 Number】** and **【Zero-drift】** . The number must within 3-360. Zero-drift should smaller than angle difference between two fixed positions as indicated in Fig.4.6.

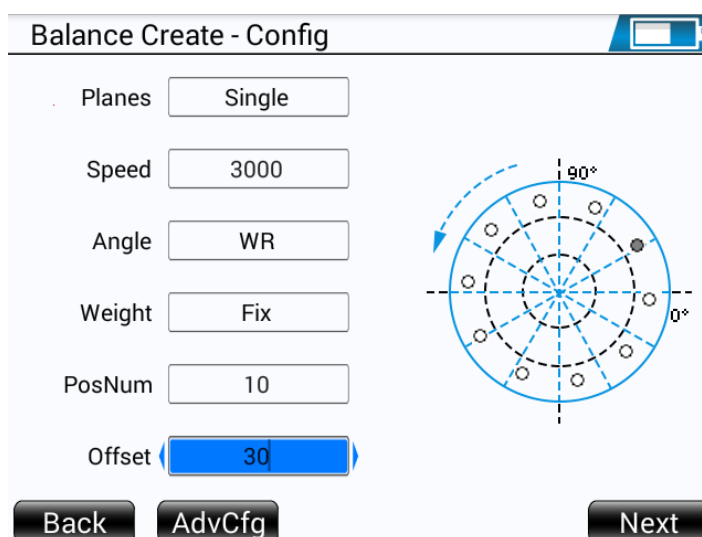


Fig.4.6 Mode of counterweight is fixed position

If the basic setting cannot meet you requirement, you can also enter into the advanced dynamic balancing setting.

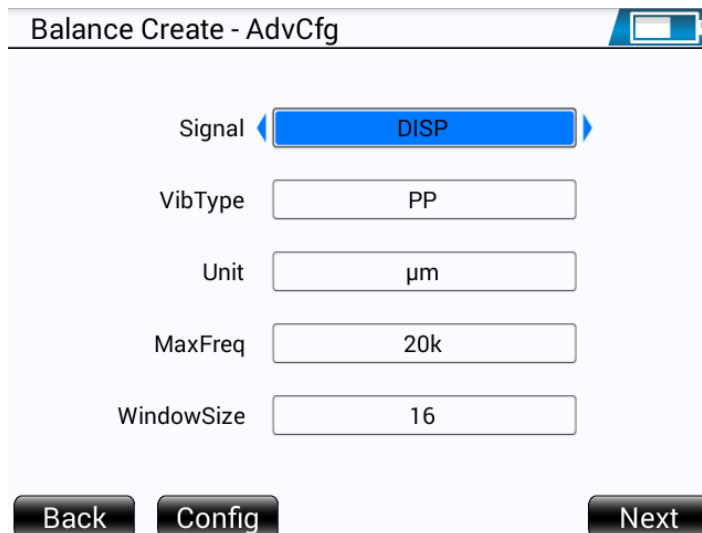


Fig. 4.7 Dynamic balancing advanced setting

1) Signal type

Signal type selection item enable you select the value unit of data analysis, and options are acceleration, displacement and velocity.

2) Amplitude type

By selecting the type of amplitude, we can choose the way of viewing the data acquired, and options are peak value, peak-to-peak value and effective value.

3) Unit option

By selecting different units to observe the data acquired. Different signal types have corresponding units, such as acceleration: m/s², g, velocity: mm/s, in/s and displacement: µm, mm, mil.

4) Maximum of frequency

This item enables you to set the maximum collectable frequency value of data acquisition, and options of this item including: 500、1K、2K、5K、10K、20K、40K. This parameter has nothing to do with the dynamic balance calculation results.

5) Window size: Set the window size for calculating vibration characteristic values, optional 16 or 64 (smoother).

4.3 Create Dynamic Balance Node

After setting parameter in Fig.4.7, click **【Next Step】** to enter into dynamic balancing node creating interface.

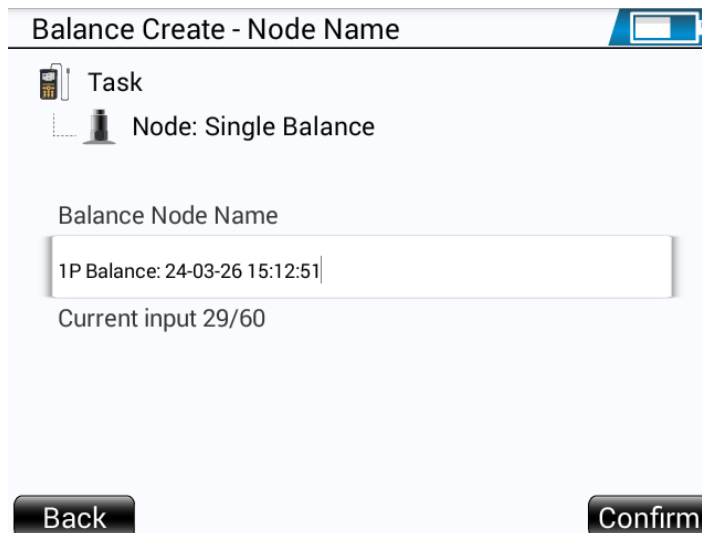


Fig.4.8 Node Creation window

Note: The data acquired in the following interfaces have no special meanings but just used for the function introduction of the unit.

4.4 Single-plane Dynamic Balance

This section introduces the steps for single-plane dynamic balancing. To finish a dynamic balancing, we have to conduct:

- Initial measurement
- Trial weight measurement
- Unbalance measurement after correction

The above steps are to be conducted with system guidance, in which more than 6 times of trim balancing can meet the vibration grade you need.

4.4.1 Initial Vibration Measurement

After creating node name, you can click **【Confirm】** F5 to enter into single-plane dynamic balancing initial vibration interface (Here single-plane is set).

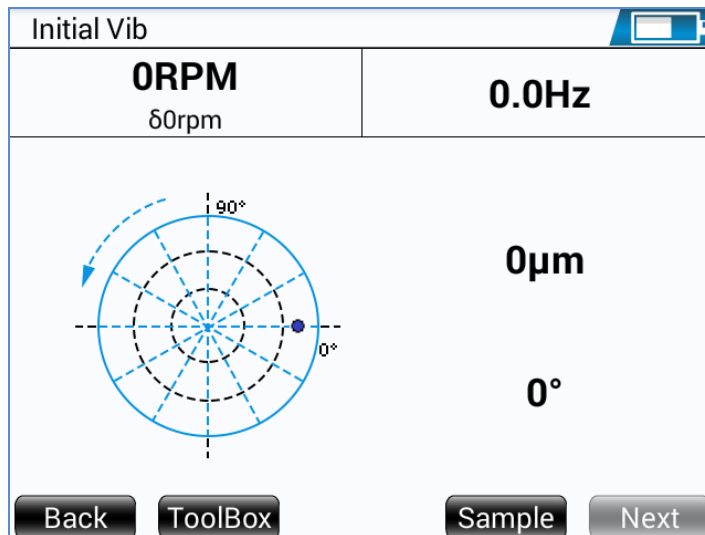


Fig.4.9 Initial vibration measurement window

You can activate acquisition with **【Acquisition】 F4** in this interface, then KMBalancer[®]II+ starts to detect trigger conditions (The trigger condition for dynamic balancing is rotational channel triggering) and KMBalancer[®]II will automatically acquire data once the triggering condition is met. If there is no rotational speed trigger within (approximately) 7 seconds after starting the acquisition, it will prompt "No rotational speed data" and automatically stop the acquisition, as shown in Figure 4.10.

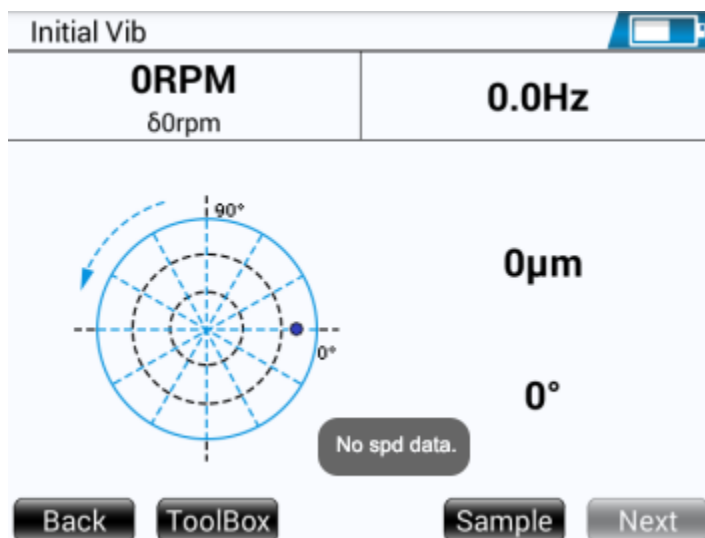


Fig 4.10 "No speed data" prompt

Attention: You should install rotational speed sensor and connect it to KMBalancer[®]II r before conducting acquisition.

The data in the screen display the rotational speed, vibration amplitude and phase of rotor. We can see that rotor has reached a stable state when the data is approaching to stable (can be judged by the value of δ below the rpm), and we can stop acquisition with **【Stop Acquisition】**.

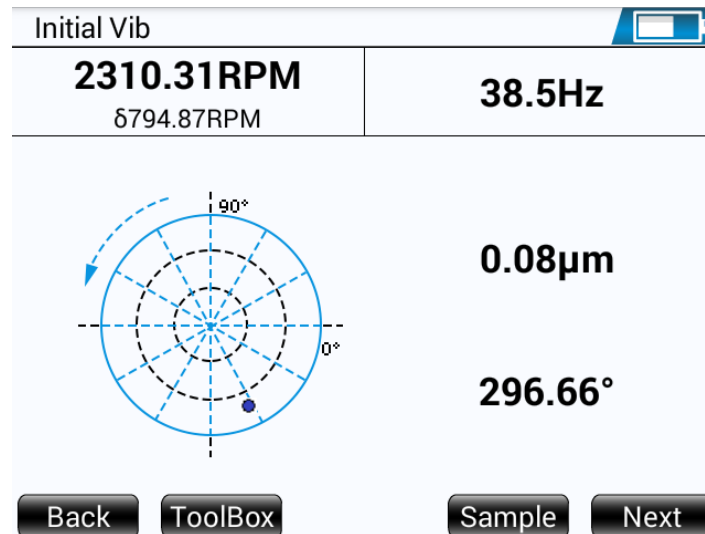


Fig.4.11 Initial vibration data acquisition window

Menu will pop up after pressing **【Toolbox】** F2 and the menu has five function: Input, cache viewing, data review and termination & exit as indicated in Fig.4.12.

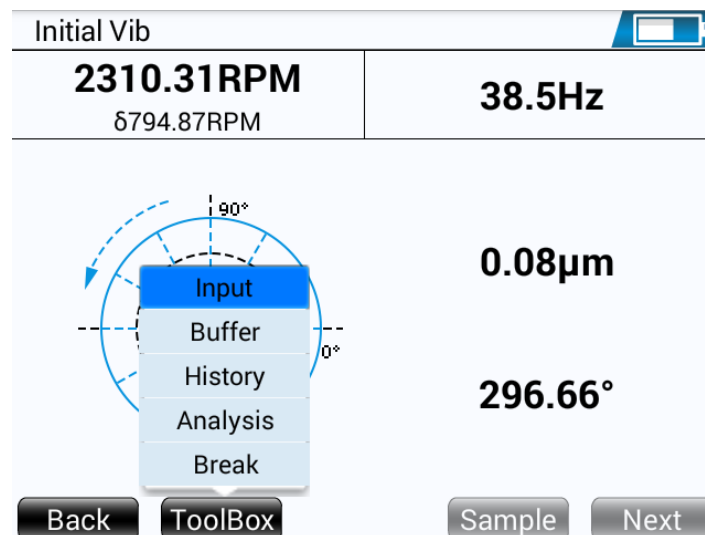


Fig. 4.12 Menu pops up after pressing **【Toolbox】**

1) Input

When actual acquired data is not needed during acquisition measurement, we can input data to programme manually to serve as the data acquired. The specific operation is: Select **【Input】** and click **【OK】** to enter into manual input interface.

Initial Vib

2310.31RPM
6794.87RPM

38.5Hz

0.08µm

Input

Rotor speed 2310 RPM

Vib Amplitude 0.08 µm

Vib Phase 60 °

Cancel OK

Fig.4.13 Manual input interface

When inputting data manually, you can click **【Confirm】** (F5) to confirm and the data have been inputted will be saved in initial vibration acquisition interface, which serves as the initial date for the next operation.

2) Cache viewing

KMbalancer[®]// will save the data acquired in each acquisition measurement interface. When abnormality occurs in the system or the data previous acquired should serve for dynamic balancing calculation, we can use this function to search the ideal measurement value.

Select **【Cache Viewing】** and click **【OK】** to enter into cache viewing interface.

No.	RPM	Amp.	Phase
4	2948.98	0.01µm	114.93°
5	2949.69	0.02µm	166.55°
6	2949.84	0.02µm	140.15°
7	2950.14	0.01µm	85.13°
8	2950.39	0.01µm	321.29°
9	2950.74	0.01µm	341.03°
10	2950.29	0.01µm	354.94°
11	2950.66	0.01µm	355.63°
12	2950.88	0.01µm	8.8°
13	2950	0.01µm	31.92°

Back Clear Select

Fig.4.14 Cache viewing window

By **【Cache Viewing】** , you can select a population of proper values to conduct dynamic balancing. You can click **【Select】** to take the value as the current data. Fig 4.15 shows the process of loading the data into the current vibration data after selecting the 1st data.

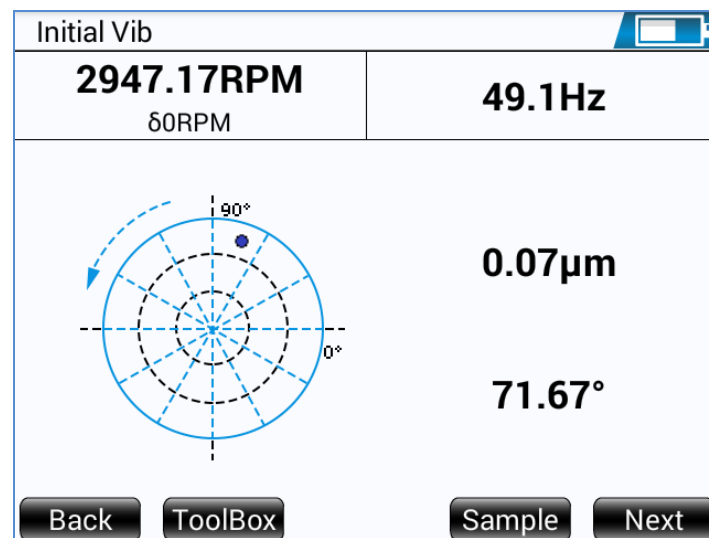


Fig.4.15 Selecting the first data

You can clear cached data with **【Clear Cache】** , as indicated in Fig 4.16

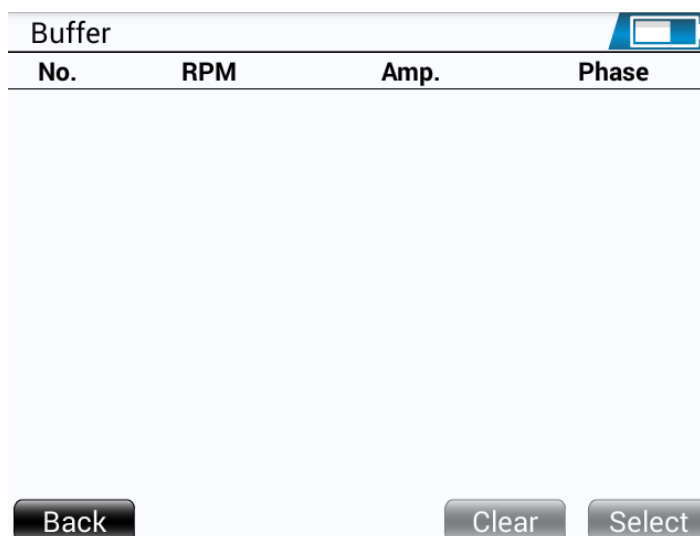


Fig.4.16 【Clear Cache】 window

3) Data review

Data review is the reviewing of the data of the all process. The processes which have been conducted are highlighted, and these un-proceeded remain gray.

Select **【Data Review】** and click **【OK】** to enter into data view interface.

Balance Detail		
Items	Amp. / Wt.	Phase / Angle
Speed	2947.17RPM	
Initial	0.07 μ m	71.67°
Trial Wt.	0.0g	0.0°
Vib After Trial	0 μ m	0°

Back CfgInfo

Fig.4.17 Data view window

In the interface of 【data review】 , you can click 【Setting Information】 F2 to view the parameter you set in parameter setting interface as indicated in Fig.4.18. Pressing the 【Vibration Information】 key in the 【Setting Information】 window returns you to the 【Data Review】 interface.

Balance Detail	
Items	Content
Planes	Single
Angle	WR
Remove Trial Weight	No
Weight	Fix
PosNum	10
Offset	30.0
Signal	DISP
VibType	PP
Unit	μ m
Misc	0.015

Back VibInfo

Fig 4.18 Select the 【Setting Information】

4) Data analysis

Data analysis is the time-domain observation and spectrum analysis of the original waveform data which acquired the last time.

Select 【Data Analysis】 and click 【OK】 to enter into data analysis interface as indicated in Fig.4.19.

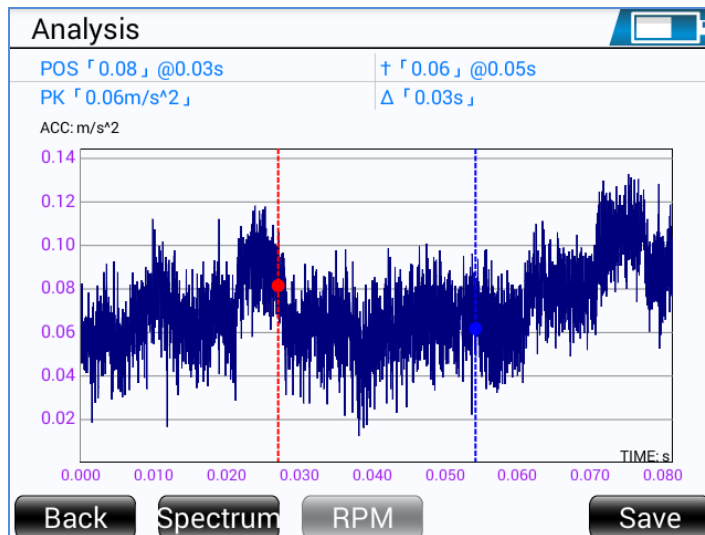
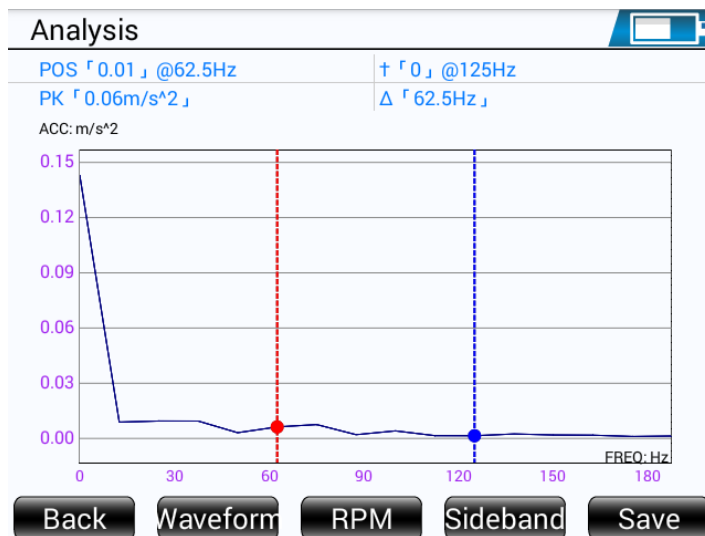


Fig. 4.19 After selecting **【Data Analysis】**

Please refer to Chapter 4 for operation method of cursor and navigation keys.

In the interface as indicated in Fig.4.19, you can click **【Spectrum】** to observe spectrum. Function keys **【Unit RPM】** can be used for unit conversion. Spectrum analysis interface is indicated as Fig.4.20.



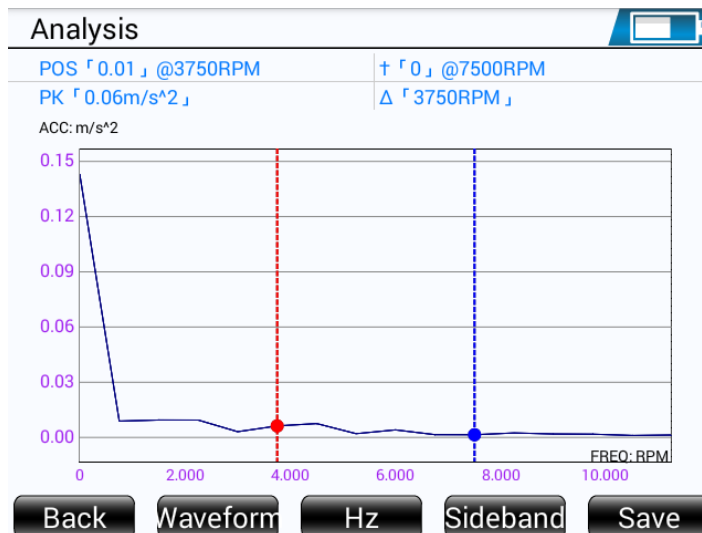


Fig 4.20 After clicking the 【Spectrum】 and 【Unit RPM】

5) Termination & Exit

User can stop dynamic balancing and exit at any time, and system will save current data, the next balancing will start from the terminating point to finish to remained process.

【Termination & Exit】 from the menu which pops up by pressing 【Toolbox】 and click 【OK】 to save as indicated in Fig 4.21. After completion, you will see a record with a “*” before it, which means the process is unfinished.

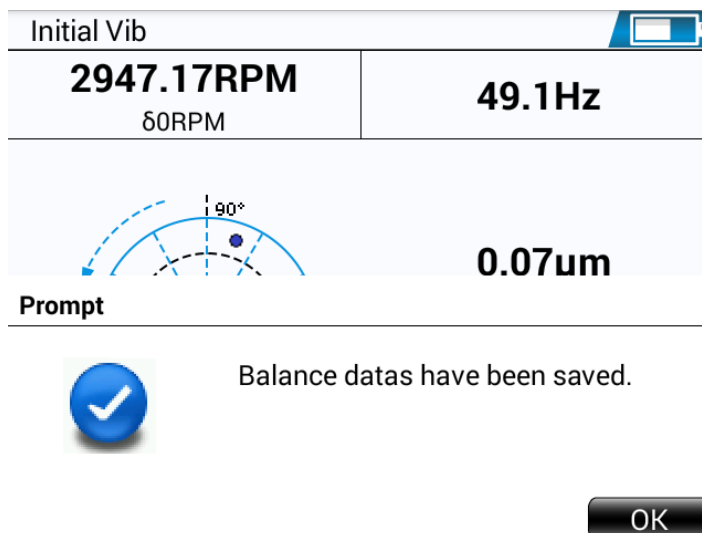


Fig 4.21 Process after selecting 【Termination & Exit】

Attention: The exit of dynamic balancing before Vibration after Correction will all be marked with “*”. Dynamic balancing finished after Vibration after Correction is proceeded, and there will be no “*” for choosing 【Termination & Exit】 now.

Cursor switching, moving, and cursor measurement information in the time-domain and spectral interface are as described above, so they will not be repeated.

4.4.2 Trial Weight Measurement

After the acquisition of initial vibration, enter into add trial weight process.

In the initial vibration form in Figure 4.11, click the function key 【Next step】 (F5) to enter into trial weight interface.

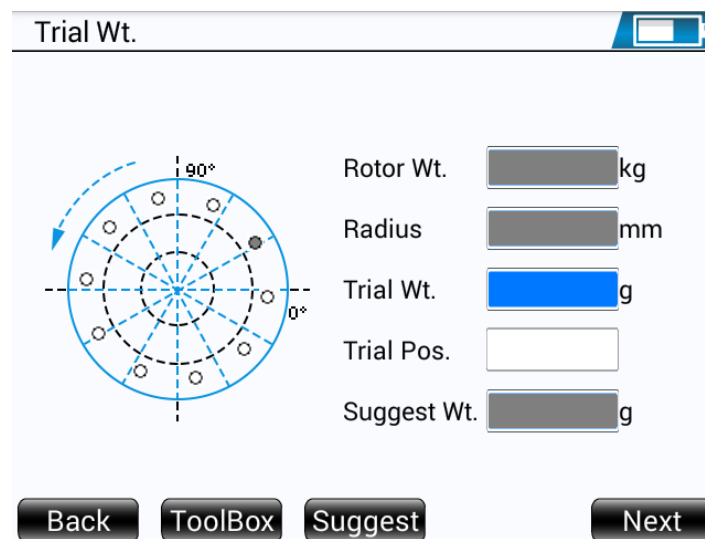


Fig.4.22 Trial weight adding interface

In this interface, you can directly input the mass and degree to weight-adding and weight-adding position respectively.

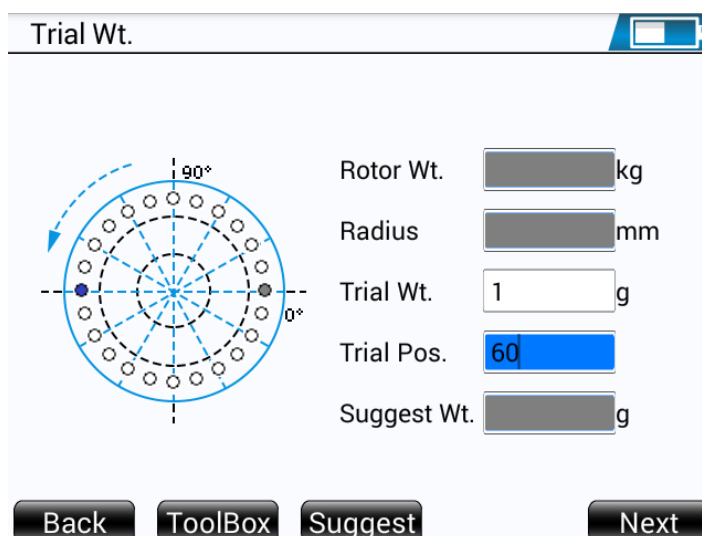


Fig.4.23 Trial weight adding interface after inputting the mass

If you are not sure how much and where you should add weight, this unit offers additional calculative function. As long as you input the weight of rotor and counterweight radius, you can soon get how much weight should be added. Click **【 Estimate Trail Weight 】** , and **【 Estimate Trail Weight 】** will change into **【 Calculation 】** .

The screenshot shows the 'Trial Wt.' interface. On the left is a circular diagram with a dashed blue circle representing the rotor and a solid blue circle representing the counterweight. The diagram is divided into 12 radial segments, with 0° and 90° marked. A blue arrow indicates the direction of rotation. On the right, there are five input fields: 'Rotor Wt.' (empty), 'Radius' (empty), 'Trial Wt.' (1), 'Trial Pos.' (60), and 'Suggest Wt.' (empty). Below the fields are four buttons: 'Back', 'ToolBox', 'Calculate', and 'Next'. The 'Calculate' button is highlighted in blue.

Fig.4.24 Trial weight estimation

In Fig. 4.24, input the mass and the radius of the rotor and click the **【 Calculation 】** F3 as shown in Figure. You can input proposal quality directly in the column.

The screenshot shows the 'Trial Wt.' interface after some inputs. The circular diagram is the same as in Fig. 4.24. The input fields now contain: 'Rotor Wt.' (10), 'Radius' (200), 'Trial Wt.' (1), 'Trial Pos.' (60), and 'Suggest Wt.' (0.84). The 'Calculate' button is highlighted in blue.

Fig.4.25 Trial weight estimation

In the interface of get the suggested trial weight **【 Toolbox 】** includes **【 Data Review 】** and **【 Termination & Exit 】** The operations of the two items are the same as that of **【 Initial Vibration Measurement 】** .

After adding the proper trial weight as inputted, click **【 Next Step 】** to enter into trial weight vibration interface. The operation of this window is totally the same as that of initial vibration measurement interface, please refer to the operation of **【 Initial Vibration Measurement 】** .

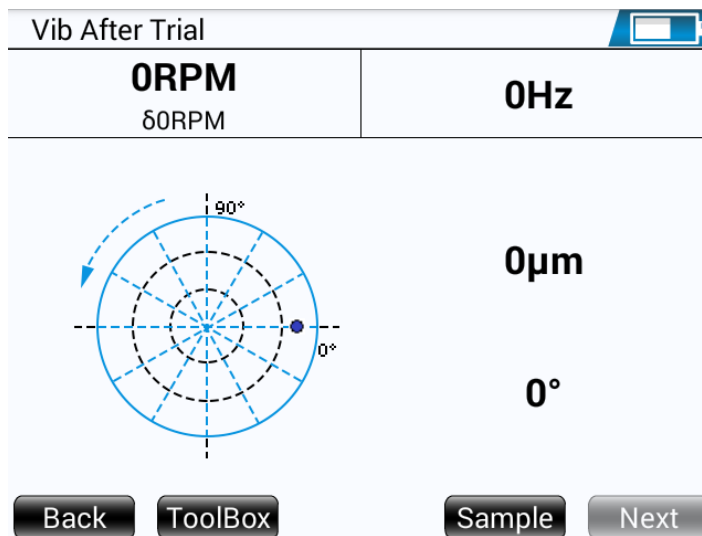


Fig.4.26 Dynamic balance 【 Trial Weight Vibration 】

After collecting the data, click [Next Step]. If the vibration change caused by the test weight is less than 20%, a prompt will appear as shown in Fig 4.27:

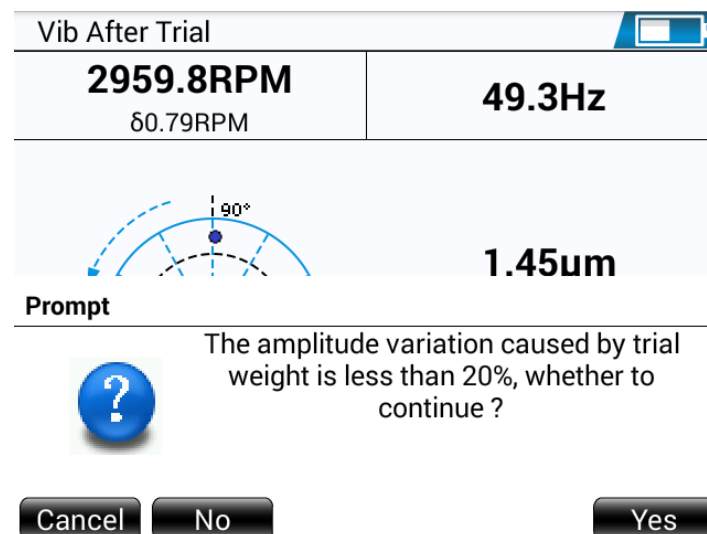


Fig 4.27 Vibration change caused by the test weight is less than 20%

In Fig. 4.27, if you select **【Cancel】** or **【No】**, it will return to Fig. 4.26 Test Weight Vibration interface. If you click **【Next step】** (F5) without collecting data, it will return to Fig. 4.25 Add Test Weight interface to add test weight and measure the vibration of test weight again.

In Fig 4.27, if you select **【Yes】**; or the vibration change caused by the trial weight is greater than 20%, a dialog box will pop up asking: Do you want to remove the trial weight? After selecting to remove the trial weight, the instrument will remove the previously aggravated mass

when calculating the added calibration weight; after selecting **【No】**, the instrument will also include the aggravated mass when calculating the added calibration weight.



Fig.4.28 【Remove Trial Weight or Not】 option

Continuous counterweight type:

As indicated in Fig.4.28, select **【Cancel】** to back to trial weight vibration interface and you can also select **【Yes】** or **【No】** to enter into Weight adding or correction interface as indicated in Fig.4.29. The reminding form of weight correction and angle is “weight @ angle”. The colored dot in the interface means the place to add counterweight.

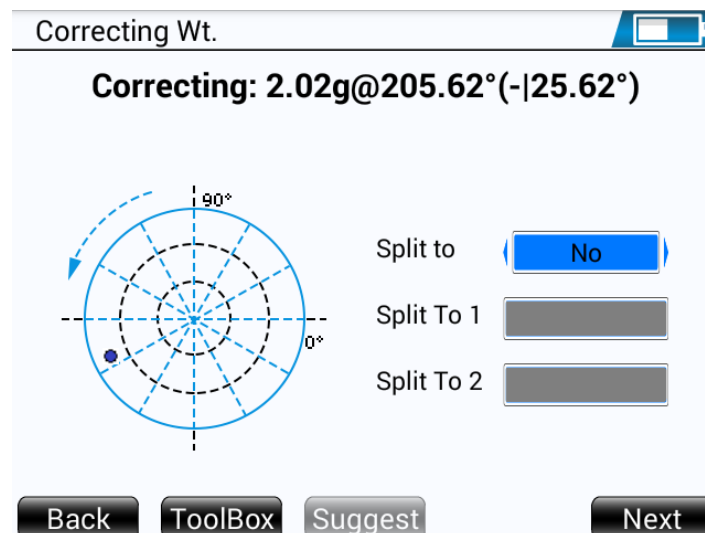


Fig. 4.29 Add trial mass window

Choose **【NO】** of **【Decomposition method】** in the interface, add 0.85g on 24.7° directly
 In some cases like overweight in correction information or cannot add correcting weight in designated angle, we can change the **【Decomposition Method】** parameter to “the fixed angle” with **【Right】** navigation key and distribute the weight calculated to the two fixed angles. Input

decomposition angle in **【Decompose To】** and click **【Distribution】** (F3) to get the weight form after distribution: Weight @ angle.

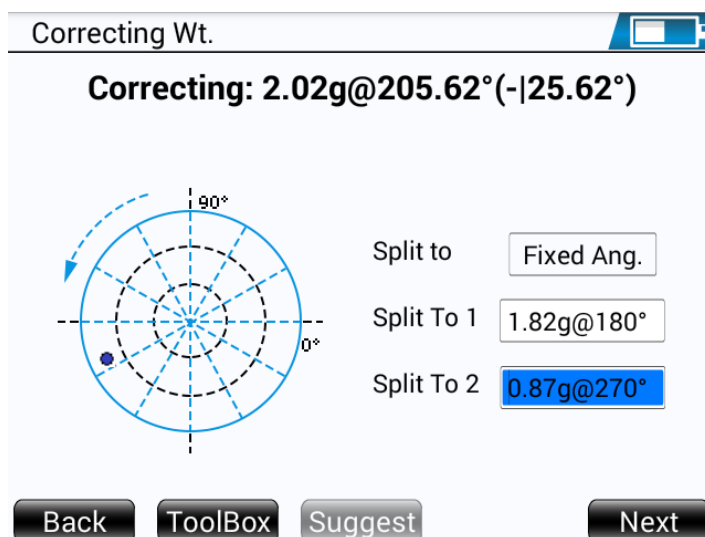


Figure 4.30 Decomposition according to angle

In some cases like correct weight has been fixed, we can change **【Decomposition Method】** parameter to “the fixed weight” and input weight in **【Decompose To】** and click **【Distribution】** (F3) to get result.

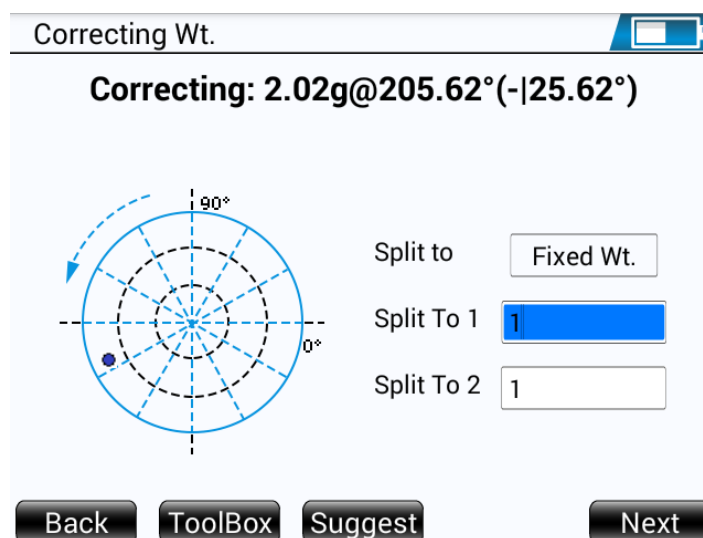


Fig. 4.31 Decomposition according to weight

The type of fixed position:

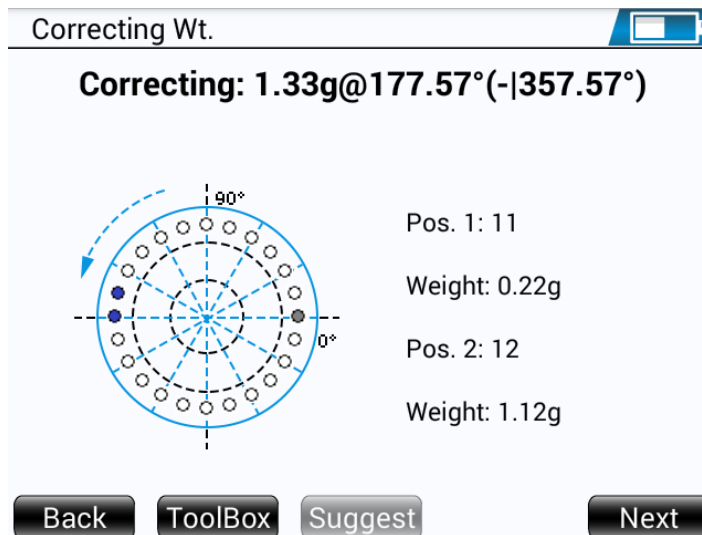


Fig.4.32 Weight adding or correcting interface in fixed position mode

The color dot means that the mass should be added in this position.

In the interface of 【Adding & Correcting Weight】, 【Toolbox】 offers dynamic balance auxiliary calculative tool, allowing users to calculate the most suitable weighting position on site without using other tools.

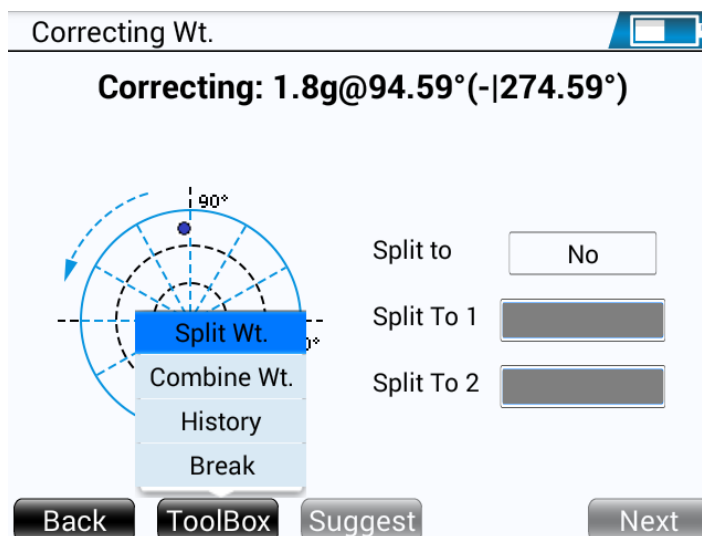


Fig.4.33 Adding and correct weight toolbox

4.4.3 Unbalance Measurement after Correction

This section introduces the process and operation of unbalance measurement after correction.

After correction-mass was added, start the equipment(rotational machineries) and click 【Next Step】 (F5) in the interface as indicted in Fig.4.29. And then skip to 【 Residual Vibration】 interface.

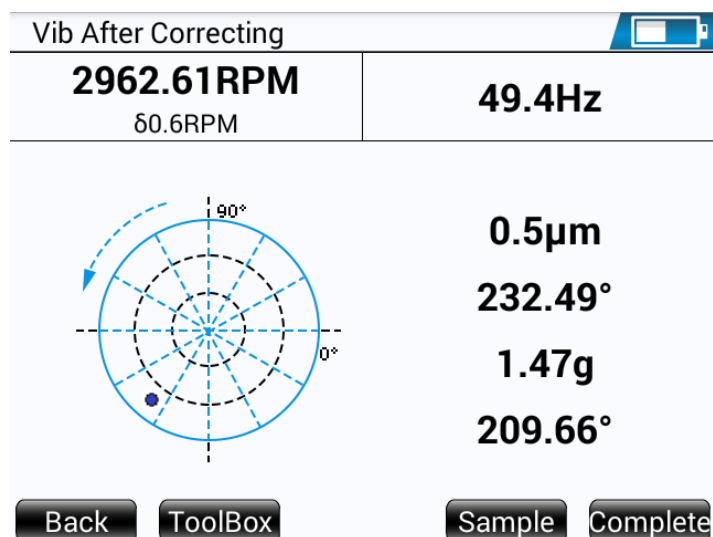


Fig. 4.34 Residual vibration interface

In this interface, you can judge if balancing effect has been achieved by acquiring data with **【Acquisition】** key, click **【Finish】** (F5) to finish it. You can continue to conduct trim balancing if you are not satisfied with the balancing effect.

4.4.4 Fine Balance

Fine balancing indicates that after measuring the operating condition of the rotor after calibration, according to the user's accuracy requirements, if the requirements are not met, the user can choose fine balancing to continue the dynamic balancing. And this time no longer use the method of test weight to calculate the influence coefficient, but directly evaluate and calculate the remaining vibration amount to get the mass of calibration. Fine balancing can only be done 6 times at most.

In Fig. 4.2, select the record of completed dynamic balancing (without *), click **【Read】** (F4) to enter Fig. 4.4 Dynamic balancing details, and click **【Continue balancing】** (F5), it will enter the stage of fine balancing.

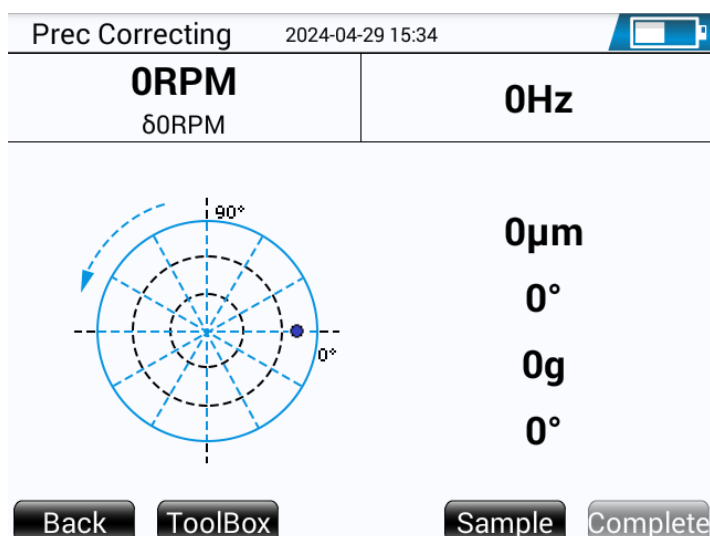
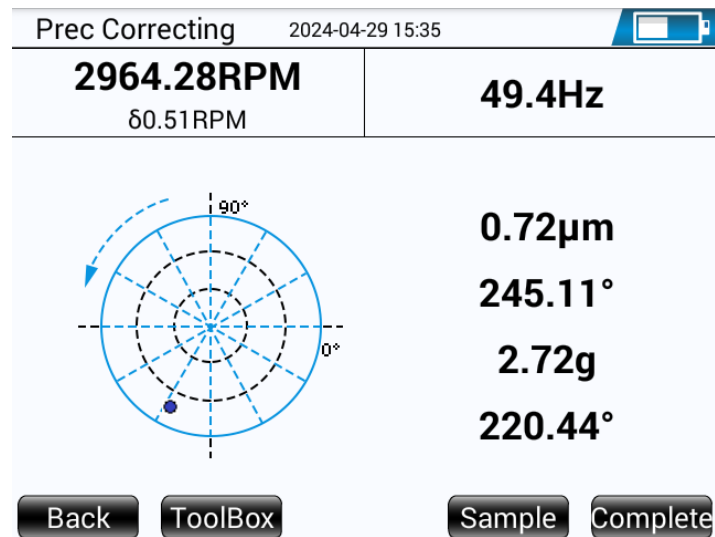


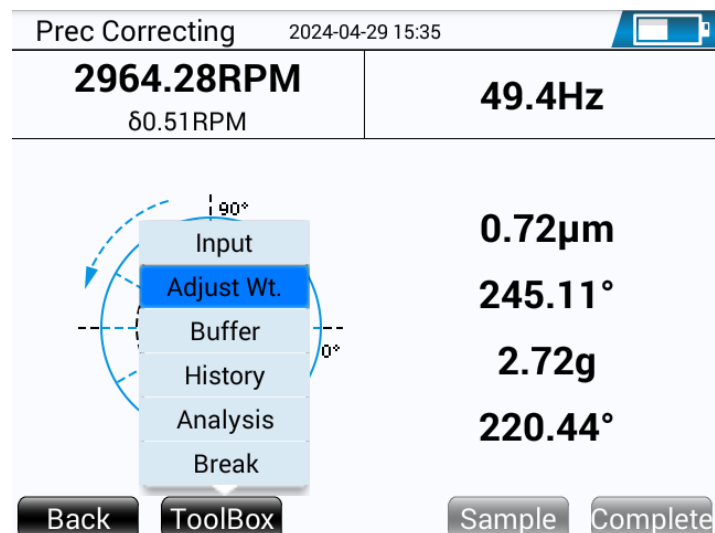
Fig 4.2 Fine Balance Stage

In Fig. 4.35, the current vibration value is collected, and when the collection is completed, it will also give the information that the counterweight needs to be added, as shown in Fig. 4.36.

**Fig 4.3 Fine Balance Vibration Acquisition**

Continuous counterweight types:

Similar to the dynamic balancing "Adjusting weight" stage, the counterweight of "Fine balancing" can be broken down to a fixed angle or a fixed mass. In Fig. 4.36, click on **【Toolbox】** (F2) and select "Adjust Counterweight".

**Fig 4.4 Fine Balance Toolbox**

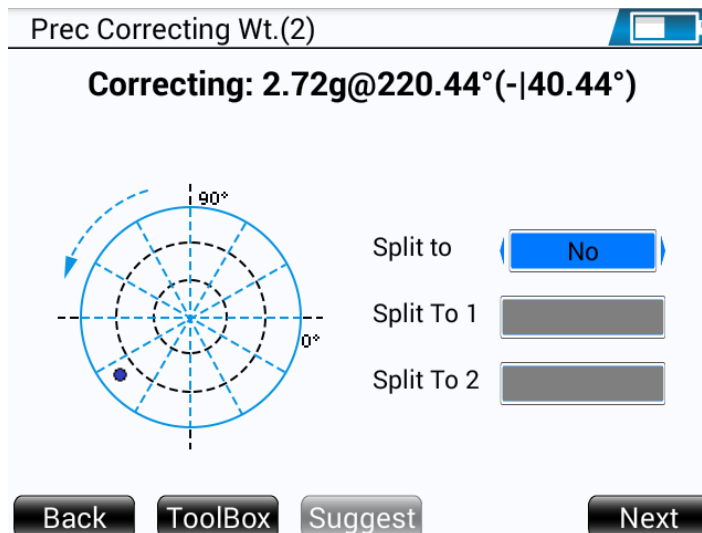


Fig 4.38 Finely balanced adjustable counterweights

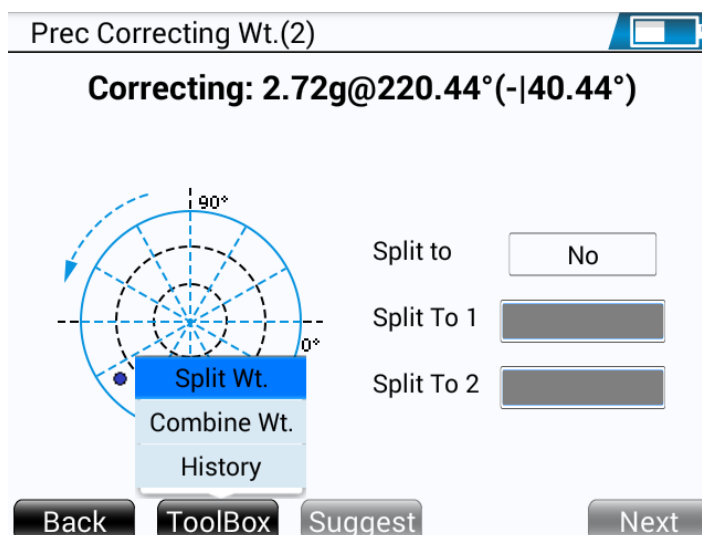


Fig 4.39 Finely balanced adjustable counterweights toolbox

In the fine balancing interface, **【Toolbox】** includes **【Breakdown Calculation】**, **【Synthesis Calculation】**, and **【Data Review】**. Because the entire process of dynamic balancing has been completed when dynamic balancing reaches the fine balancing counterweight interface, there is no interruption in the interface to exit at this time.

For fine balancing, first stop the machine (rotating machinery) and configure the corrected weight on the rotor according to the interface prompts for the weighted mass, switch on the machine, click **【Next】** (F5) and enter the fine balancing vibration acquisition again. This process can be cycled until satisfied (maximum of 6 times). If the collected vibration value meets the requirements, click **【Finish】** (F5) to complete the fine balancing.

Balance Detail		
Items	Amp. / Wt.	Phase / Angle
Speed	2962.89RPM	
Initial	0.47 μ m	119.25°
Trial Wt.	1.0g	0.0°
Vib After Trial	0.56 μ m	147.2°
Correcting Wt.	1.8g	94.59°
Vib After Correcting	0.91 μ m	104.35°
Prec Corr Wt.(1)	3.45g	79.69°
Vib After Prec Corr(1)	0.72 μ m	245.11°
Prec Corr Wt.(2)	2.72g	220.44°

Back CfgInfo

Fig 4.40 Data Review Interface after Several Fine Balances

Fixed position type:

The adjustable counterweight for the fixed position type is assigned to the fixed position and the rest of the steps are the same as for the continuous position type.

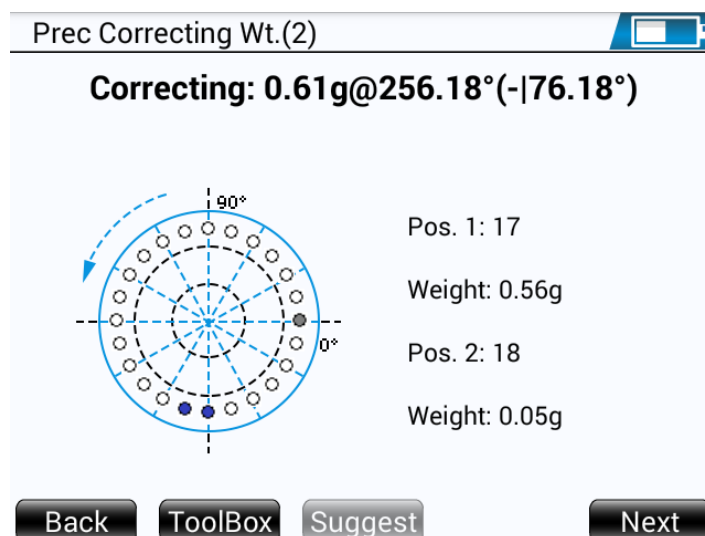


Fig 4.41 Fixed position fine balance counterweight

⚠Attention:

If the rotor is still unbalanced, repeat fine balancing until the rotor is accurately balanced.

If the dynamic balancing never improves (more than 6 fine balances), check that you are entering the correct correction weight, size and position, or check for other factors such as misalignment, bearing failure, etc.

4.5 Two-plane Dynamic Balancing

In dynamic balance parameter setting, if the balancing quantity item is set as two-plane, you should conduct two-plane dynamic balancing as introduced in this section.

4.5.1 Initial Vibration Measurement

Entering two-plane dynamic balancing starts with an initial vibration measurement (the signal type set for this time is displacement).



Fig.4.42 Initial vibration measurement

Start the acquisition with **【Acquisition】** (F4). Then KMBalancer®II+ will start to keep testing the trigger condition (the trigger condition of dynamic balancing is speed channel). Once the trigger is start, KMBalancer®II+ will start to collect data automatically. If no RPM trigger occurs within (approximately) 7 seconds of starting the acquisition, the message "No RPM data" will be displayed and the acquisition will stop automatically.

KMBalancer®II+ can refresh and display the collected data in real time, so we can observe the status of rotor speed, amplitude and phase. When the data trends to be stable, the rotor has reached steady state. (This can be judged by the δ -value below the RPM). Through the function key **【Stop collecting】** to stop collection.

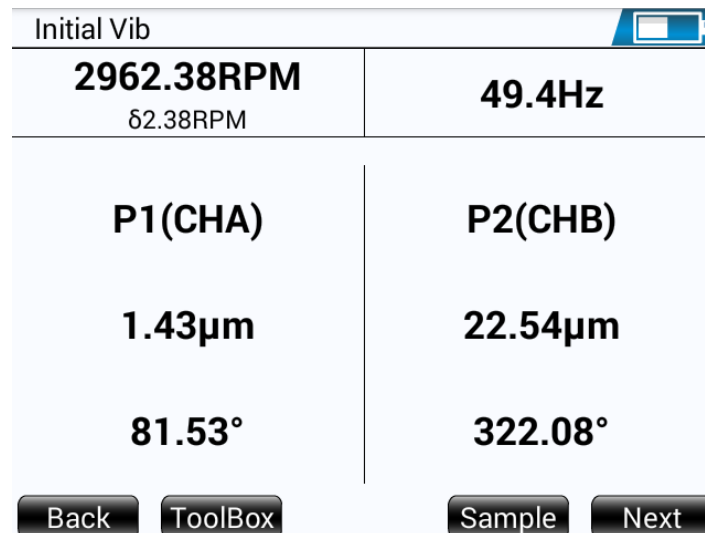


Fig.4.43 Initial vibration measurement after stopping collecting

Click **【Toolbox】** (F2) for cache browsing of data, data review; data analysis for time domain/spectrum analysis; interrupt to exit the program. Please refer to single dynamic balancing instructions.

4.5.2 Trial Weight Measurement

In the initial vibration interface, click **【Next Step】** (F5) to enter into 1 plane trial weight interface.

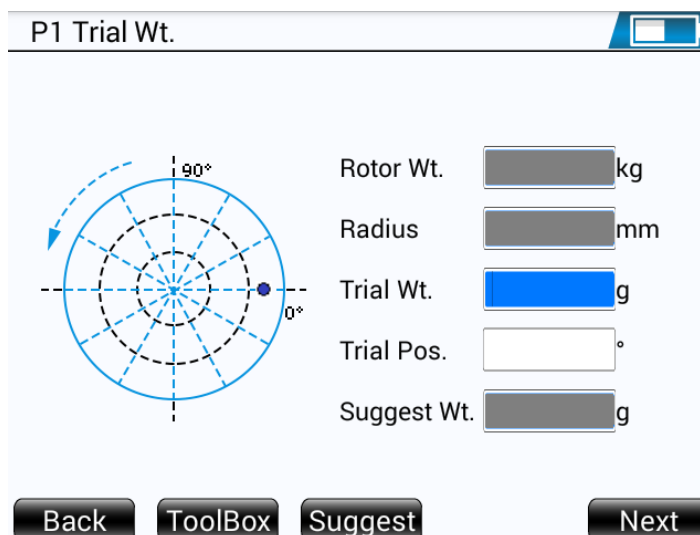


Fig.4.44 1 Plane Trial Weight Interface

After adding the proper weight in Fig. 4.44, click **【Next】** to enter into the interface after 1 plane trial weight.

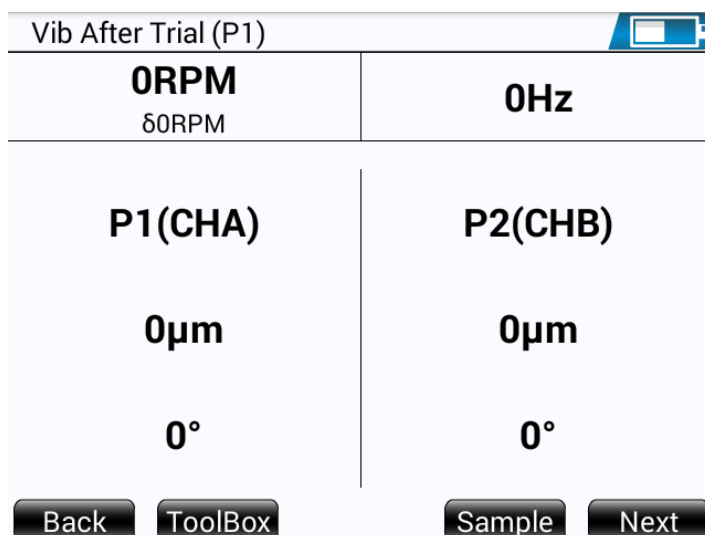


Fig.4.45 After 1 Plane Trial Weight of dynamic balance interface

After collect the data in Fig4.45, click **【Next step】**, a dialogue box will pop up asking: whether to remove the test weight? If you choose to remove the test weight, the instrument will remove the previously weighted mass in the calculation of adding and calibrating weights, and if you choose no, the weighted mass will also be counted in the calculation of adding and calibrating weights.

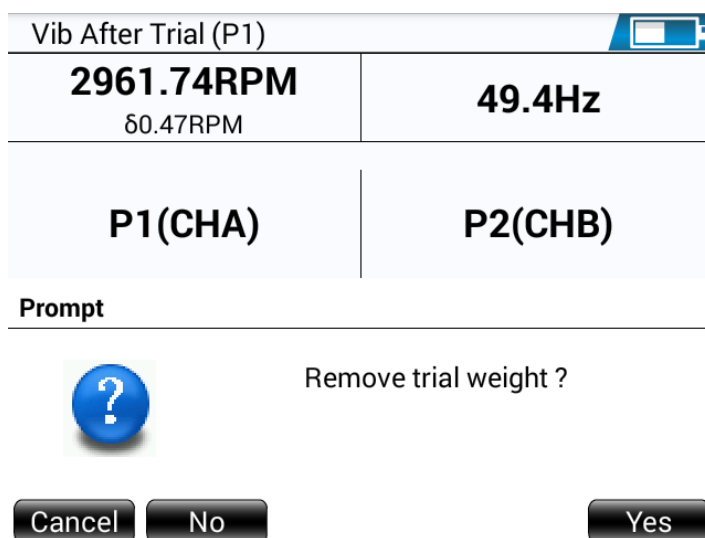


Fig 4.46 "Whether to remove the test weight" interface

错误!未找到引用源。 , choose **【Cancel】** to return to the trial weight Vibration interface, or you can select **【Yes】** or **【No】** to go to 2 plane trial weight.

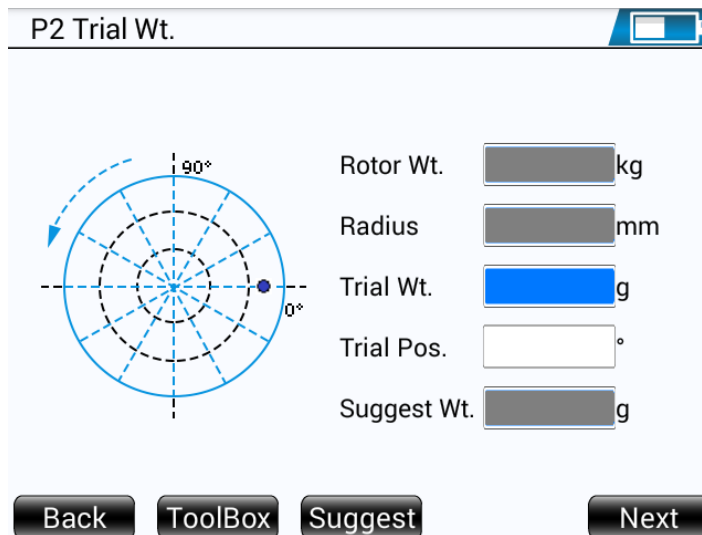


Fig 4.5 2 plane trial weight interface

In fig. 4.47, after adding the weight, click **【Next step】** to enter the interface after the 2 plane trial weight.

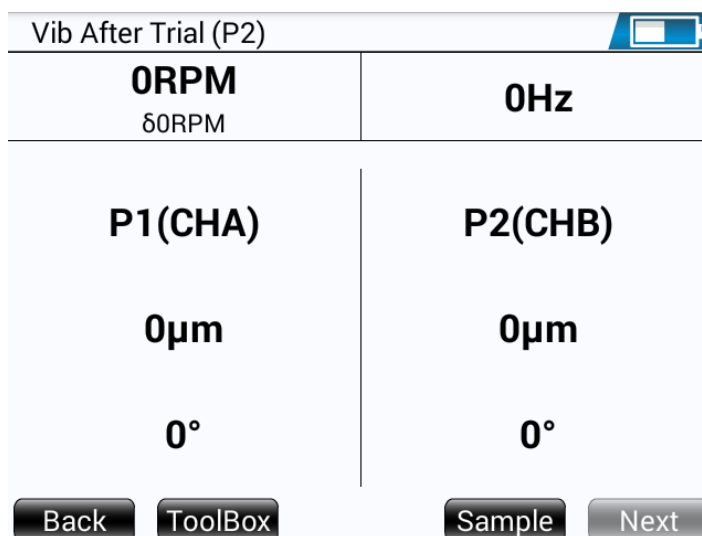


Fig4.48 after the 2 plane trial weight interface

The interface operation of 1-plane, 2-plane trail weight and post trail weight for two-plane dynamic balancing is the same as that of the trail weight interface for one-plane dynamic balancing, please refer to section 4.4.2 Trail Weight Measurement

错误!未找到引用源。 , after collect the data, click **【Next step】** to enter into the add trail weight interface. The coloured dot indicates that the counterweight should be added at this position.

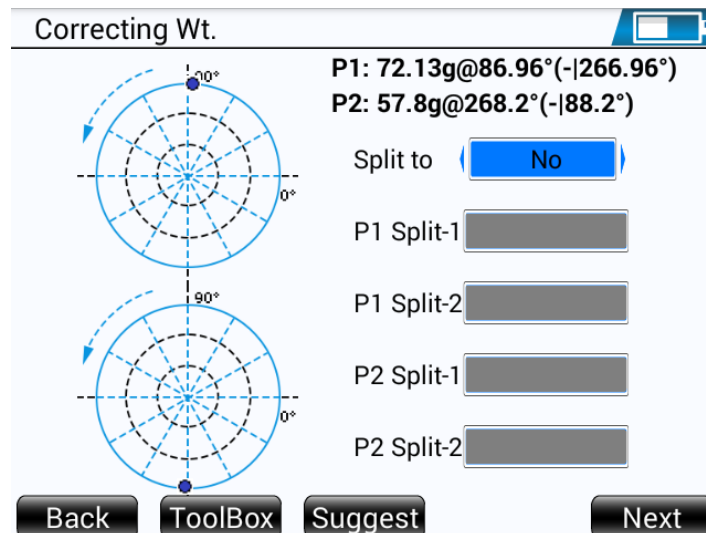


Fig 4.49 "Add Weight" Interface

You can choose **【no】** to decompose the weight in this interface, and directly add a counterweight with 16.7g at 200° and a counterweight with 12.6g at 69°.

In many cases, it is not possible to correct the imbalance at the specified angle if there is too much mass in the correction information. Use the navigation keys left and right to change the decomposition method parameter to "to a fixed angle", thereby distributing the calculated mass to two accessible positions. Enter the angle to be decomposed into in the Decompose to ** edit box, and click **【Assign】** (F3) to get the distributed mass in the form of "mass @angle".

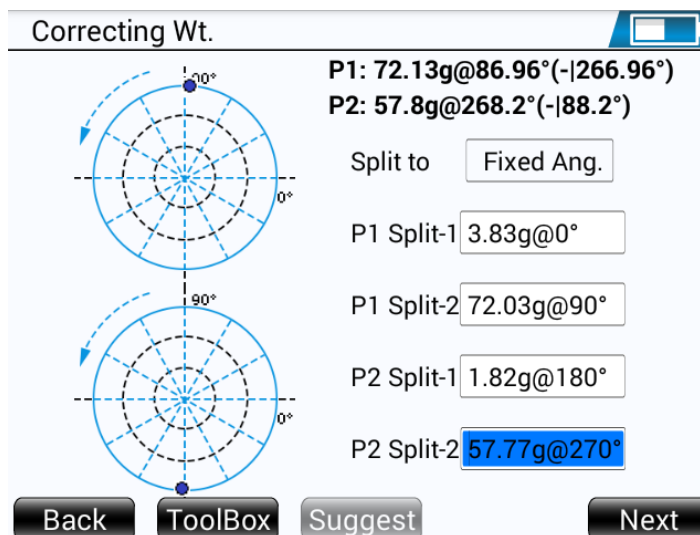


Fig.4.50 Decomposition of correction weight according to angle in dynamic balancing

In many cases where the existing mass is already fixed, it is possible to change the distribution method parameter to "to fixed mass", thus calculating the distribution of the existing mass to the two accessible positions, by entering the mass (the sum of the two mass must be greater than the calibrated mass) in the "Decompose to ***" edit box.

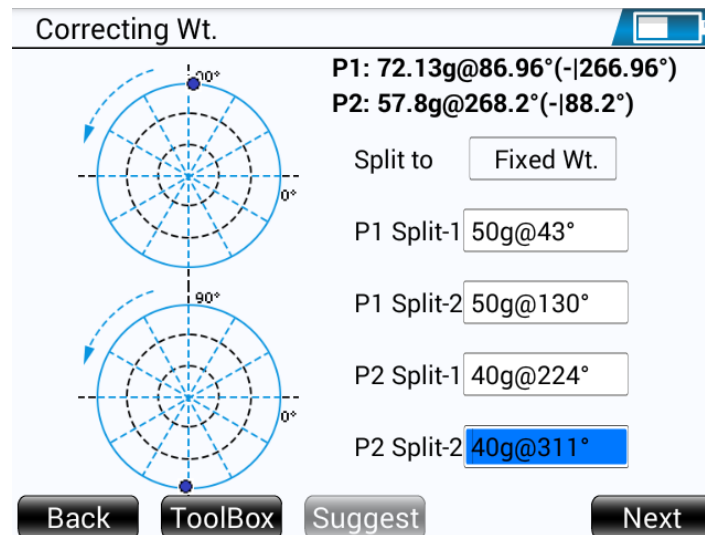


Fig.4.51 Decomposition of correction weight according to mass in dynamic balancing

The calibration counterweight for the fixed position type is in a fixed position and the rest of the steps are the same as for the continuous position type.

In the weighting interface, the **【Toolbox】** contains a dynamic balance auxiliary calculation tool, which enables users to calculate the most suitable weighting position on site without the use of other tools.

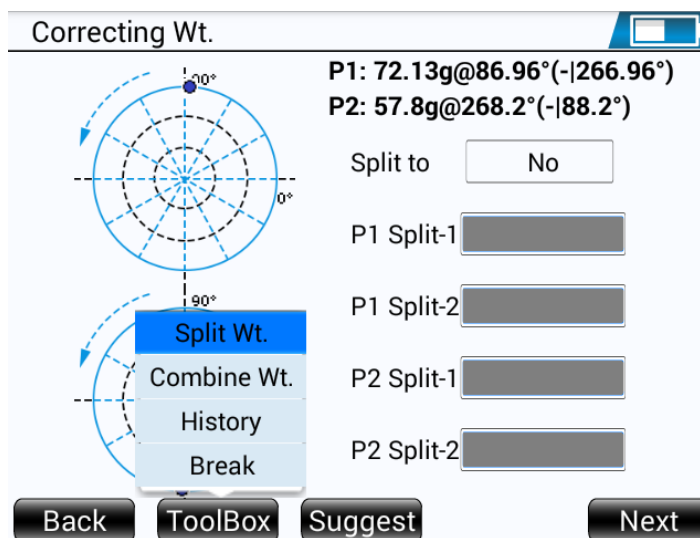


Fig 4.52 Interface after selecting **【Toolbox】**

4.5.3 Unbalancing Measurement After Correction

This section introduces the unbalance measurement after correction.

After adding the correct mass, start the equipment(rotary machinery) and click **【 Next Step 】**

(F5) to skip to **【Residual Vibration】** interface.

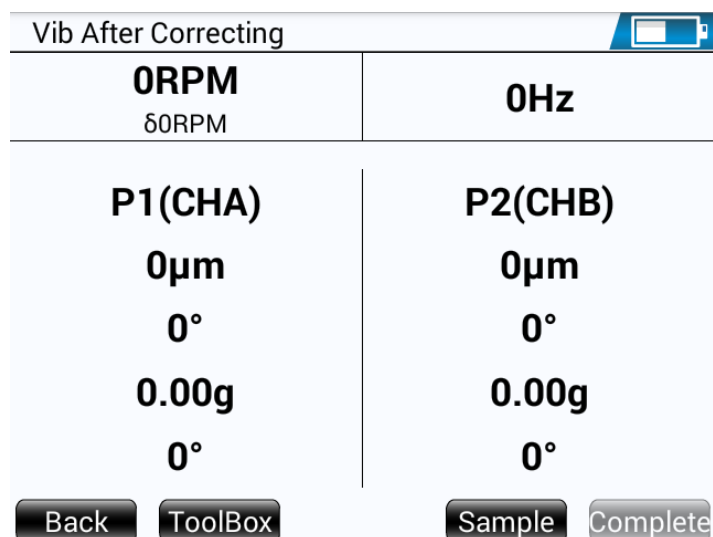


Fig. 4.53 Residual vibration interface

In this interface, collect data through the **【Collect】** function key and check whether the balancing effect has been achieved, if you are not satisfied with the balancing effect you can perform fine balancing.

4.5.4 Fine Balance

Fine balancing indicates that after measuring the operating condition of the rotor after calibration, according to the user's accuracy requirements, if the requirements are not met, the user can choose fine balancing to continue the dynamic balancing. And this time no longer use the method of trial weight to calculate the influence coefficient, but directly evaluate and calculate the remaining vibration amount to get the mass of calibration. Fine balancing can only be done 6 times at most.

For the fine balancing operation of two-plane dynamic balancing, please refer to the fine balancing instruction of single-plane dynamic balancing.

If the rotor is still unbalanced, repeat fine balancing until the rotor is accurately balanced. If more than one correction weight has been added, their weight values can be combined to form a permanent correction weight.

5. Pressure Zero

The zero calibration test of the sensor can calibrate the sensor regularly to assist in pressure collection. The zero mark acquisition result is the reference voltage value of the current environment.

This version does not include the pressure zero function.

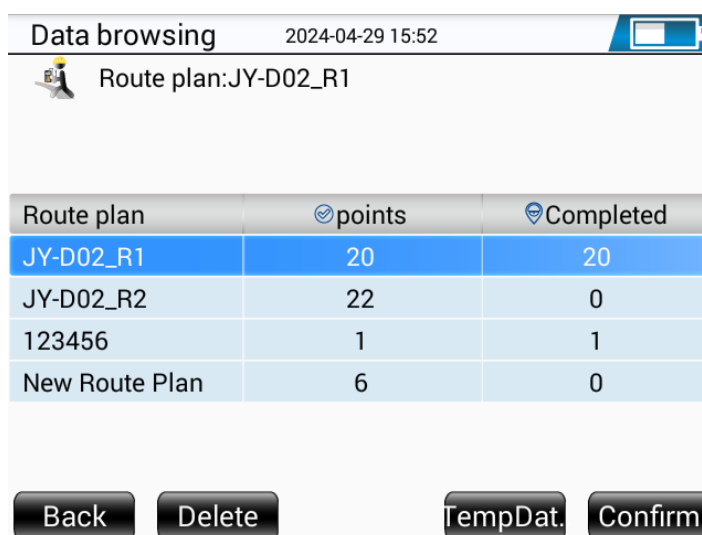
6. Data Viewing

KMbalancer®II+ provides data viewing function which facilitates users to view and analyze the saved data of the route or the temporary acquisition, to ensure the validity of the data collection or to carry out on-site equipment diagnostic work.

Select by highlighting **【Data Viewing】** in main interface and click **【OK】** to enter into data viewing module. This section will introduce how to use KMbalancer®II+ to view the measuring point data saved in the **【Inspection Plan】** module and the temporary measuring point data saved in the **【Collection Analysis】** module.

6.1 Viewing Measurement Points of Route

Enter into **【Data Viewing】** window and you will see the saved route data list.

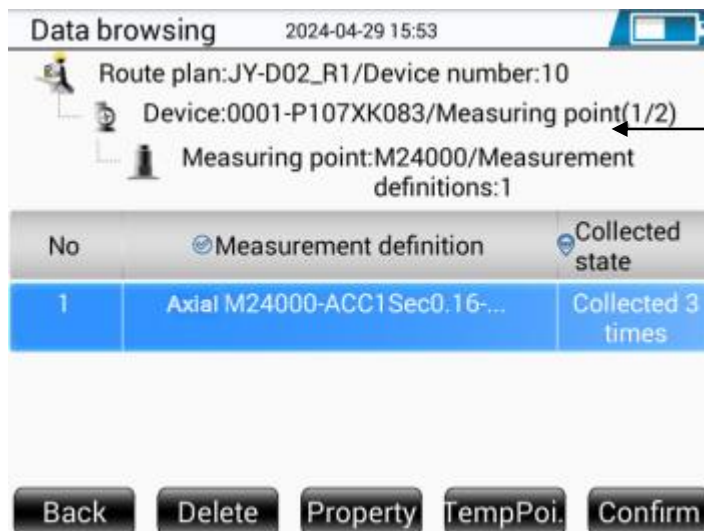
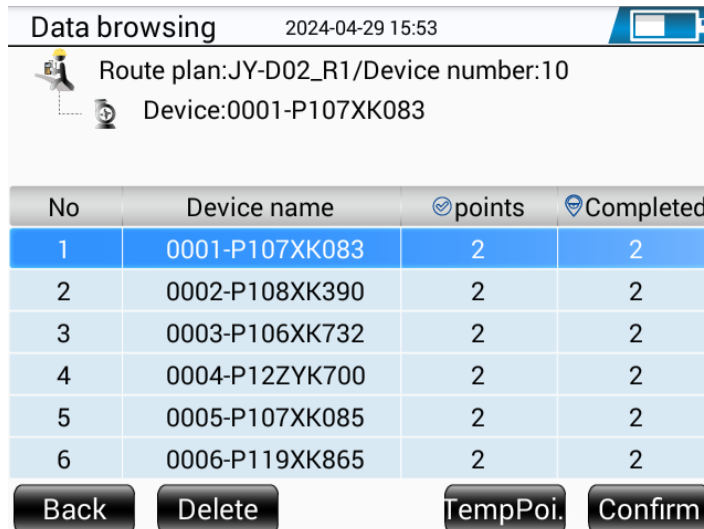


Route plan	points	Completed
JY-D02_R1	20	20
JY-D02_R2	22	0
123456	1	1
New Route Plan	6	0

Fig.6.1 Route data list

Select a route with up and down navigation keys, and use **【Confirm】** (F5) to view the machines of this route. Then select a machine with up and down navigation keys, and use **【Confirm】** (F5) to view the measurement points and definitions as indicated in Fig. 6.2.

Choose the corresponding measurement definition, and view the settings attribute of the measurement definition with the function keys **【Attribute】** (F3), and **【Confirm】** (F5) to return as indicated in Fig. 6.3.



Navigate left and right keys to select measuring points

Fig.6.2 Machines, measurement points and definitions

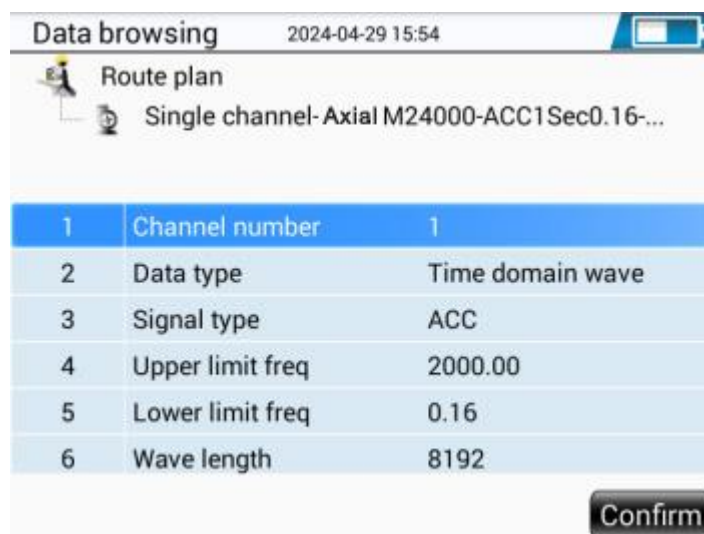


Fig.6.3 Attribute viewing

In the second figure of Fig.5.2, select **【Confirm】** (F5) to view the saved data.

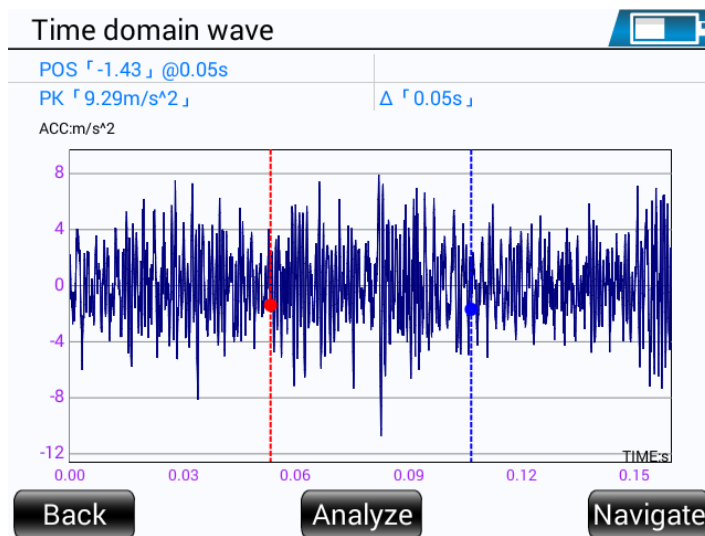


Fig.6.4 The saved measurement points of route

In data viewing interface, you can change between data acquired at different time points with left and right navigation keys under this measurement definition.

Use **【Navigation】** / **【Cursor】** (F5) to change cursor/navigation, and you can conduct amplification/reducing of waveform, moving of cursor as introduced in Section 3.1.2.

In time-domain waveform data viewing window, you can conduct various analysis with **【Analysis Method】** F3.

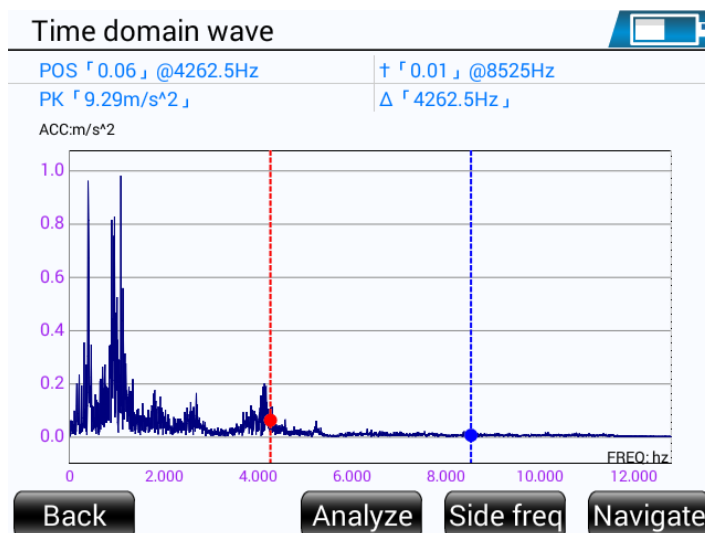


Fig.6.5 Data viewing-spectrum

Eigenvalue

Time domain wave	
Eigenvalues name	Numerical value
PK :	9.2903
PP :	18.5807
RMS :	2.5557
MAX :	7.8391
MIN :	-10.7416
MEAN :	0.0011
SKEW :	-0.0285
MSR :	6.5318
CF :	3.0672
WST :	0.0000

Back

Fig.6.6 Data viewing- eigenvalue

6.2 Viewing Provisional Measurement Points

In the route list interface of Fig 6.1 【Data Browse】 , you can enter into provisional measurement lists by pressing F4 【Provisional Data】 .

Data browsing		2024-04-29 15:59
Temporary assignment		
Dual channel4KVELTime domain wave 24-04-29 14:48:51		
1	Dual channel4KVELTime domain wave 24-04-29 14:48:51	
2	Single channel4KACCTime domain wave 24-04-29 15:55:55	

Back Delete Property Confirm

Fig 6.7 Provisional Data List

In the equipment and measuring point list interface of Fig 6.2 【Data Browse】 ,enter the provisional measuring point list by pressing 【Provisional Measuring Point】 (F4) .

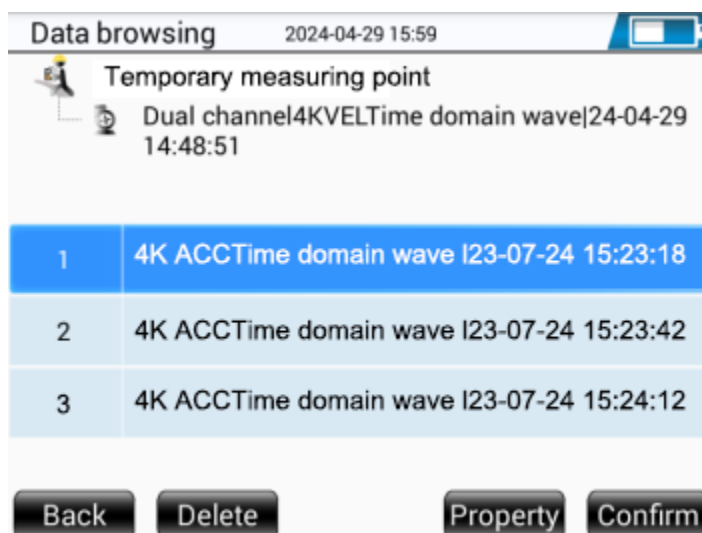


Fig.6.8 Provisional measurement points list

You can use the navigation keys **【Up】** and **【Down】** to switch and select a provisional measuring point, and use the function key **[OK]** (F5) to view the data of the measuring point. Use the function keys **【Navigation】** or **【Cursor】** (F5) to switch the cursor/navigation status. In the "cursor" state, you can perform operations such as zooming in and out of the waveform and moving the cursor. The operation method is as described in Section 3.1.2.

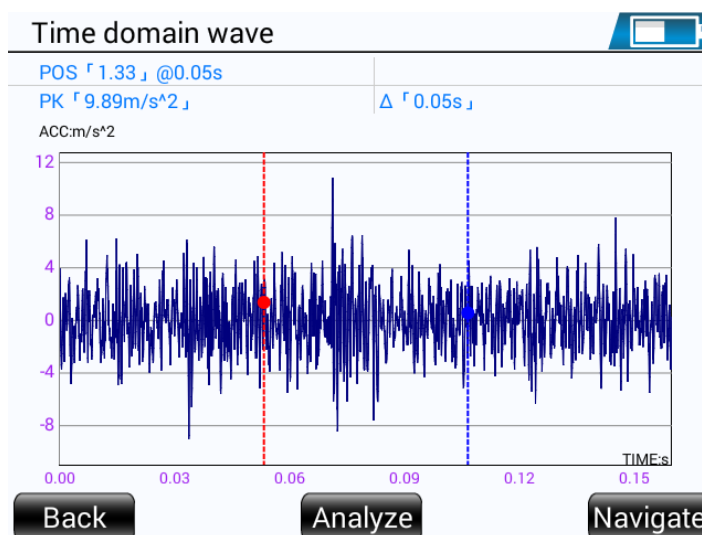


Fig 6.1 Provisional time domain waveform data "cursor" browsing

In the "Navigation" state, use the keys **【Left】** and **【Right】** to switch between multiple data acquisitions (different time points) under this measurement definition.

In the time domain waveform browsing window, use **【Analysis Method】** (F3) to observe different analysis methods.

Spectrum display: For the use of the Spectrogram Cursor, please refer to 3.1.2 Cursor Description in Acquiring Single-Channel Data.

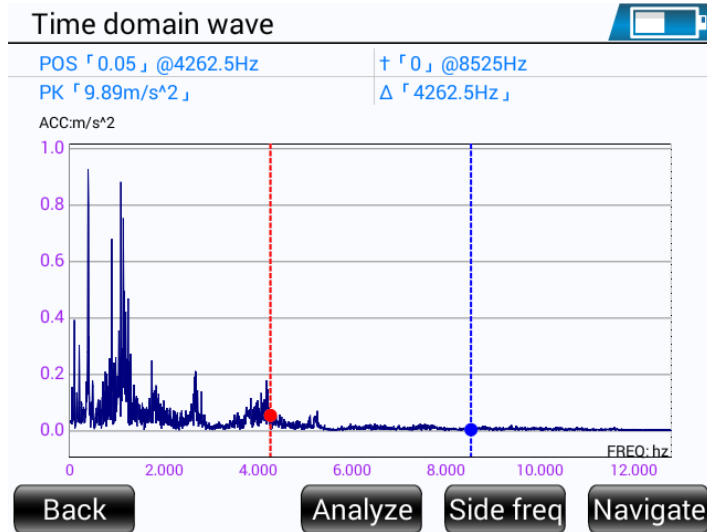


Fig.6.10 Data viewing-spectrum

Eigenvalue:

Eigenvalues name	Numerical value
PK :	9.8930
PP :	19.7860
RMS :	2.1760
MAX :	10.7607
MIN :	-9.0253
MEAN :	-0.0143
SKEW :	0.0476
MSR :	4.7352
CF :	4.9450
KURT :	2.5607

Fig.6.11 Data viewing- eigenvalue

7. System

This chapter gives a detailed introduction to **【System Setting】** and **【System Information】**. Select by highlighting **【System】** and click **【OK】** to enter into system setting interface.

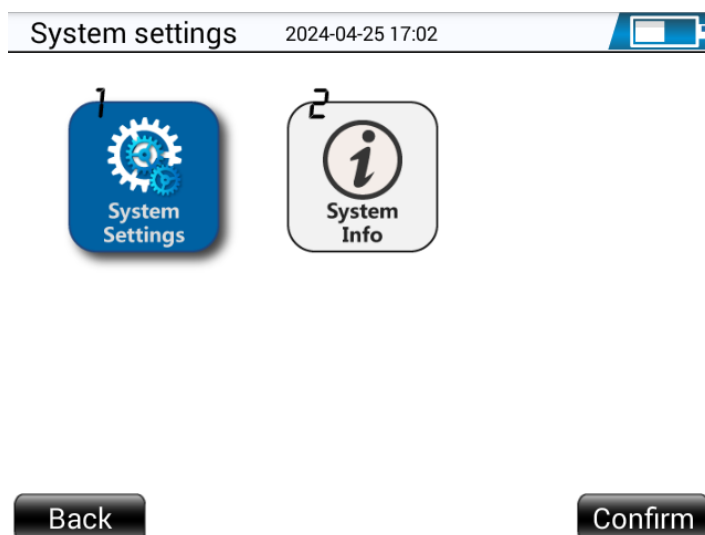


Fig. 7.1 System module window

7.1 System Setting Interface

Select **【System Setting】** and click **【OK】** to enter into setting window. The title shows the name of the current operation and the name of the pending operation, and the current operation is highlighted and the next operation is grey. In this interface, you can set the general items for KMbalancer[®] II+ like date and time.

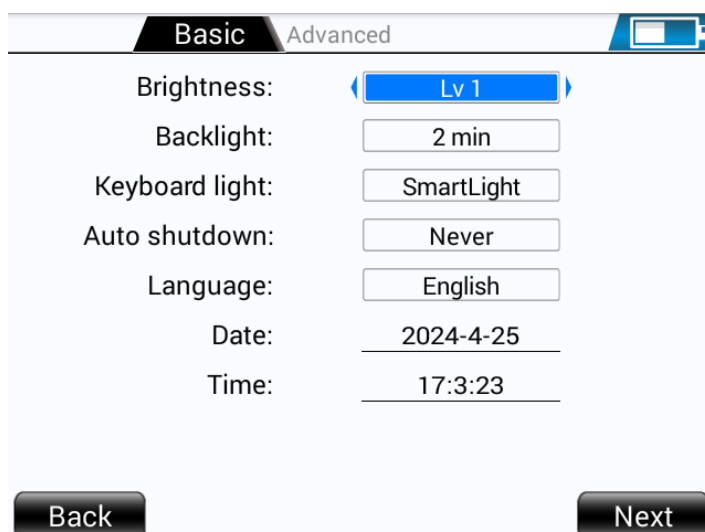


Fig. 7.2 System basic setting interface

In the basic settings interface, use the navigation up and down arrows to highlight the setting option, and use the navigation left and right arrows to set the value of the option. During the setting process, you can click **【Back】** (F1) to cancel and exit the setting interface. After the setting is completed, press **【Next Step】** (F5) to enter the advanced setting interface and then click **【OK】** (F5) to save the system settings and exit the setting interface.

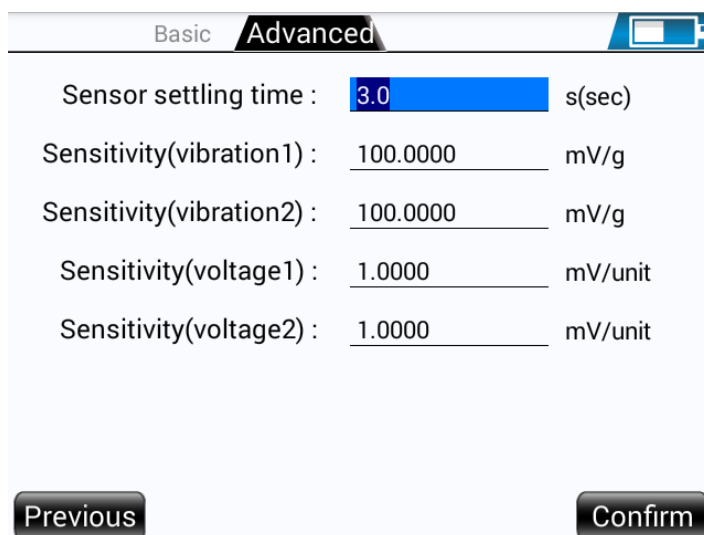


Fig.7.3 System advanced setting interface

7.1.1 LCD Display Setting

Screen brightness

Used for the setting of LCD screen brightness, and Band 1 to Band 6 is for options. When changing the value of the selected item with left and right navigation arrows, the screen brightness is also changed consequently.

Closing the backlighting

Used for setting how long auto-backlighting proceed and options including “30 seconds later”, “one minute later”, “two minutes later” and “never”. If you choose “never”, the screen backlighting shall never be turned off. Tap the power button to wake up the screen when it is resting.

7.1.2 Keyboard Setting

Sound

Used for whether to have sound when pressing the key. Options for choosing are On/Close.

Keyboard backlighting

Used for setting the rule for turning on keyboard backlighting and the options are “intelligent photosensitivity”, “always turning on” and “always turning off”. If you choose “intelligent

photosensitivity”, it will automatically adjust keyboard backlighting according to the nature light.

7.1.3 Auto-shutdown Setting

Auto-shutdown

This item enables the auto-shutdown of KMBalancer®// when it reaches the stted time to save power. Standby time can be selected by left and right navigation arrows from options including “one minute later”, “three minutes later”, “five minutes later”, “ten minutes later” and “never”. KMBalancer®// will not automatically shutdown if you select “never”.

7.1.4 Date and Time Setting

Date

Used to set time. After highlighting this item, year input area is selected, you can input the year you want directly. Direct input will replace the original corresponding value. You can also delete the previous value first and then re-enter it. Right and left arrows can be used to select Month input area or Day input area to set month and day respectively.

Time

Used to set time, the setting method is same as date setting.

7.1.5 System Language Setting

Used to set system language, can be set to "Chinese" or "English".

7.1.6 Sensor Sensitivity Setting

Vibration sensor sensitivity

Directly enter the required sensitivity parameters of the vibration sensor through the numeric keys, the unit is: mV/g. And the input data can be modified through the **【C】** key. The voltage sensitivity parameter is not currently used.

7.2 System Information Interface

In system setting interface, after selecting **【System Information】** through the navigation arrows, click the [OK] (F5) key to enter the system information interface. You can view the basic information of the current system, operating system version and hardware version.

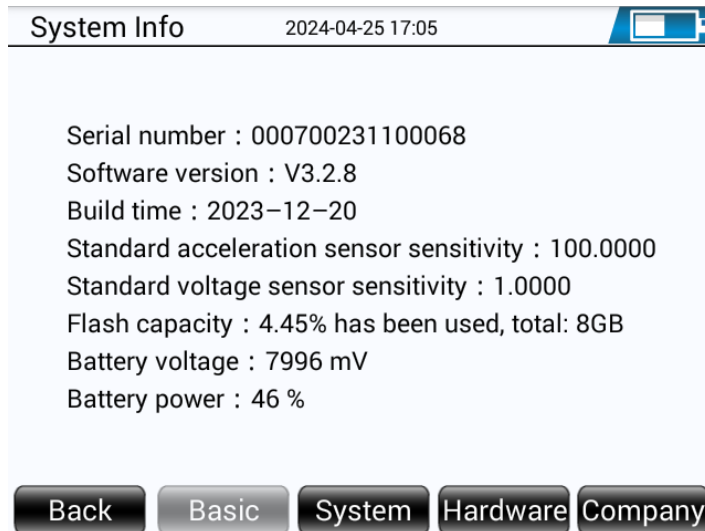


Fig 7.1 System Basic Information

You can view the version information of the operating system through **【Operating System】** (F3).

You can view the hardware version information through **【Hardware】** (F4).

You can view company information through **【Company Information】** (F5).

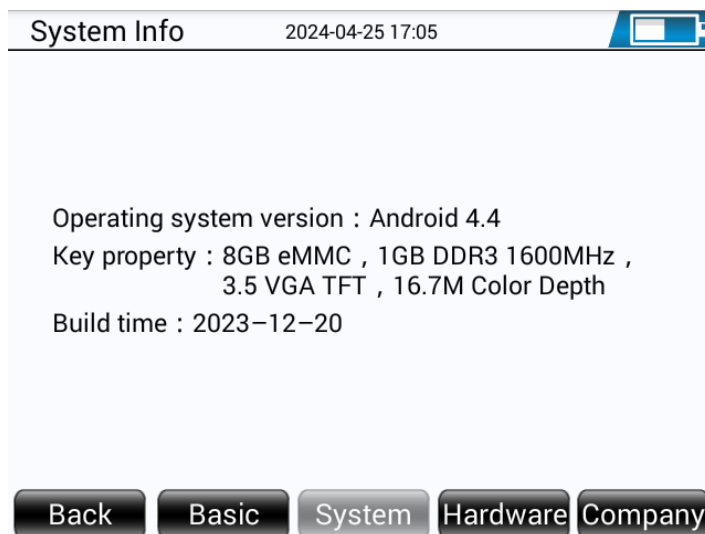


Fig 7.5 Operating system information

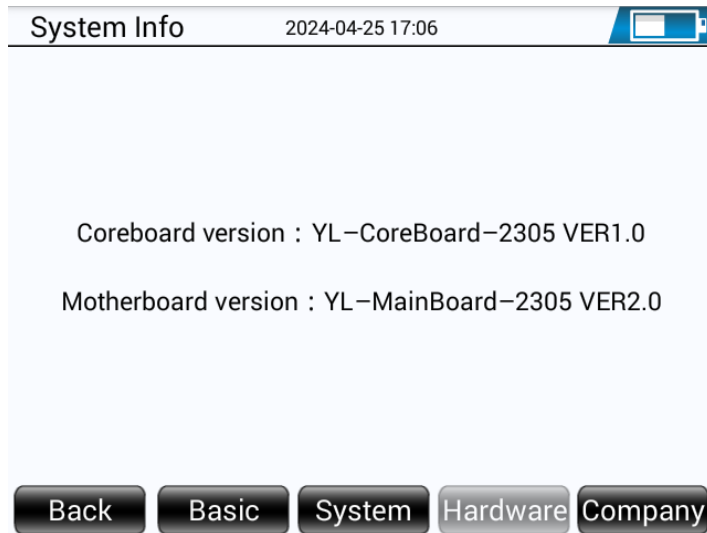


Fig 7.6 System hardware information

8. Communication

The communication module is used to achieve data interaction with the host computer, and the communication methods are USB and WIFI.

8.1 USB Connection

After plugging in the USB data cable and opening the communication, it enters the USB communication mode to communicate with the host computer. Unplug the USB data cable to exit the communication application.

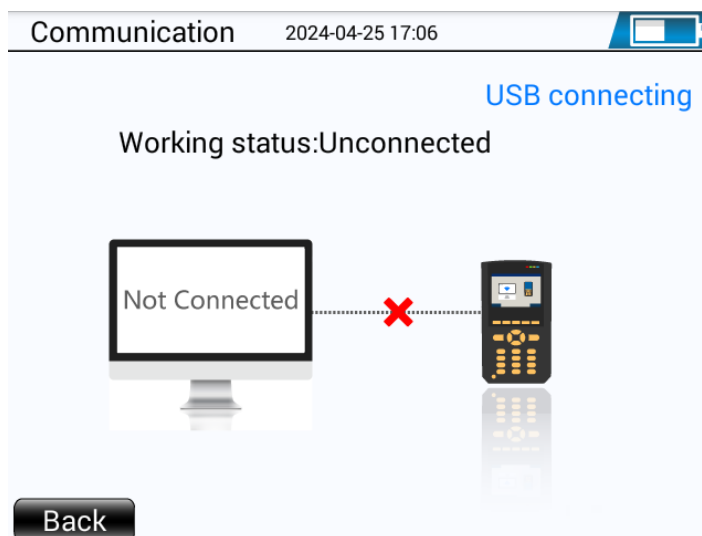


Fig 8.1 USB Communication

8.2 WIFI Connection

When the USB data cable is not plugged in, in the main application window, use the navigation arrows to select the **【Communication】** module and click **【OK】** to enter the communication module.



Fig 8.2 WIFI Communication

When entering the communication interface, a passwordless WIFI hotspot will first be created. After the host computer is connected to the hotspot, relevant operations can be performed. The WIFI hotspot name will be saved, and a hotspot with this name will still be created when opened later.

Click Advanced Setting to modify the WIFI hotspot name.

Plug in the USB data cable and switch directly to USB communication mode.

For data communication with the host computer, please refer to the data acquisition and analysis software instructions.

Appendix: Technical Specification

Hardware Parameters

Product Attribute	Specification
Accessories	
Size	200mm x 121.5mm x 34mm
Weight	840g
Display	Color LCD, 480 x 640, 16.7M color, with backlight
Connector	USB
PC Comms	RS232 serial port
Signal input	Channel A: 5-pin LEMO ICP/AC/DC Channel B: 5-pin LEMO ICP/AC/DC
Other I/O	RPM/ trigger input, power input RPM
System	
Operational system	Android 4.4.2
Processor	I.MX6Q, quad-core Cortex-A9, single core 1GHz
DDR	1G DDR3 1600MHz
Flash	8G e.MMC
MMC/SD card	Support SD card expansion (optional)
LED indicator	Red, green, yellow
24 bit AD	24-bit high-precision ADC

Battery and Environment

Product Attribute	Specification
Battery Type Capacity Working time Specification Rechargeable	Rechargeable Lithium-ion battery cell 4300mAH@7.4V >8hours, under working Battery capacity indication With marching charger
Environment Packaging Falling test Operational temperature Storage temperature Humidity	IP65 (dust & water proof) 1.2m (to Mil-Std 810) -10°C to +50°C (14°F to 122°F) -20°C to +60°C (-4°F to +140°F) 0% to 80 relative humidity (RH)

Signal Measurement

Product Attribute	Specification
Input signal type	Acceleration sensor
Channel number	Channel A: ICP/AC/DC Channel B: ICP/AC/DC Channel RPM: Speed signal
Channel A input	ICP™ (24V @ 2.4 mA) AC signal DC signal
Channel B input	ICP™ (24V @ 2.4 mA) AC signal DC signal
Measurement definition	Acceleration / speed / displacement
Measurement type	Time waveform/ eigenvalue / total value trend/ spectrum
Signal input range	± 25V
Signal	RMS, Peak Peak to Peak True Peak True Peak to Peak

Product Attribute	Specification
Dynamic range	> 110 dB (typical)
Frequency range	High (Fmax) all inputs = 40 kHz Low (Fmin) DC input = DC AC/ICP input
Wave filter: high-pass	0.16Hz / 1Hz / 2Hz / 5Hz / 10Hz / 20Hz / 50Hz / 100Hz
Wave filter: low-pass	500Hz / 1kHz / 2kHz / 5kHz / 10kHz / 20kHz / 40kHz
Refresh rate	40 kHz (single channel)
Sampling length	1 k ~ 128 k lines
Window function type	Hanning

KM Instrument

No.399,QianJin East Road
KunShan , JiangSu 215334
China

Tel: 0512-50333915

Email:kim@kmpdm.com

©2023, KM Instrument all rights reserved. KM and the KMinstrument logo are trademarks and service marks of KM Instrument Corporation. All other marks are the property of their respective owners. The content of this publication is for informational purposes only, and while every effort has been made to ensure accuracy, the content should not be construed as a warranty or guarantee, express or implied, regarding the products or services described herein or their use or suitability. All sales are subject to our terms and conditions, which are available on request. We reserve the right to modify or improve product designs or specifications at any time without prior notice



KM Instrument