HP-16

Computer Aided Universal Measurement System for Balancing Machine

Xuanhua Beilun Balancing Machinery Co Ltd

Catalog

HP-16 hard-supported balancer computer measurement system is suitable for the detection of unbalanced vibration signal of hard-supported balancer.

The electric measuring system is a special measuring instrument for computer-controlled hard-supported balancing machine.

The system has the following functions: automatic sensitivity control, automatic storage of rotor data, direct reading of measurement data (size and angle position of unbalance), keyboard input of rotor data, selection of dynamic balance mode and static-couple balance mode, on-site calibration function, and SD card preservation of balance results. The system also has the function of monitoring whether the two sensor signal lines are normal or not to ensure the normal measurement process.

1. overview:

The electric measuring instrument is suitable for detecting unbalanced vibration signal of hard-supported balancer.

The input of the electric measuring instrument is:

A. The unbalanced vibration signals of the two supporting surfaces of the rotor output by two sensors.

B. A reference signal generator outputs a reference signal (sine wave or pulse) with exactly the same frequency as the rotor rotation.

The output of the electric measuring instrument is as follows:

A. The main display part shows the unbalanced weight and phase or static couple unbalanced weight and phase on the calibration radius of the two correction planes of the rotor respectively.

B. Balanced rotational speed of the rotor.

The electronic measuring instrument adopts novel electric measuring circuit and reasonable structure layout, uses single chip computer circuit for high speed direct sampling calculation, and uses direct input and direct display for “a b c r1 r2” and support mode, which makes the operator see the working state of the balancing machine at a glance.

The conversion accuracy is much higher than the previous hardware conversion. All linear and digital integrated circuits are standard series of international universal packaging and sheet-mounted components, which brings convenience to maintenance and improves reliability significantly.

The core circuit of the electronic measuring instrument is 32 bit industrial single chip computer direct high-speed full-wave sampling, digital software correlation function filtering, using optimized and humanized measurement parameters, filtering and frequency tracking performance. The tracking range is wide, and the speed measurement can cover the existing mechanical rotation. The electric measuring instrument only uses one speed working range, which is convenient for users. Especially, the automatic bandwidth switching circuit is adopted, which reasonably solves the contradiction between the quickness and stability of the response of the electric measuring instrument, and makes the electric measuring instrument have excellent low-speed performance. The speed indication of this electric instrument is 60.9-99990 RPM.

The electronic measurement system is a professional computer device for balancing machine measurement, which is specially embodied in the following aspects:

The measurement data can be automatically memorized at a set speed.

When the power is restarted, the instrument automatically enters the next measurement.

After measuring and memorizing the unbalanced data, the parameters of a, b, c, r1 and r2 can be re-inputted, and the results can be calculated and displayed twice with the re-inputted parameters. You can repeat the above again.

You can press the "Still Couple" button to display the static unbalance immediately.

That is to say, it is allowed to measure memory first, and then set supporting parameters.

2. The electric measuring instrument is suitable for the following working environments

2.1 The temperature of surrounding medium is not higher than + 40 C and not lower than 0 C.

2.2 Air humidity is not more than 85%(+25 C)

2.3 The power supply voltage is ~220V+10%.

2.4 Power supply frequency 50 Hz

3. Main technical parameters

3.1 Maximum error (+5%)

3.2 Maximum phase angle error 5 degrees

3.3 Maximum Error of Planar Operations (+3%)

3.4 Radius Operation Maximum Error (+3%)

3.5 Range Maximum Error (+3%)
3.6 The maximum error of tachometer indication is less than 2%.
3.7 Indicative values of TEST test instrument when different machines leave the factory:
Self-checking speed: 600 rpm
Left Quantity: g Left Phase: Degree
Right Quantity: Gram Right Phase: Degree
Note: (1) The percentage errors of the above parameters are relative errors of full magnitude;
(2) The above technical parameters are assessed according to the steps and methods prescribed by the test card of the electric measuring instrument.
(3) For self-examination, r1 = r2 = b = 100, a = c = 100.
(5) The self-test signal is only used to check whether the electric instrument is working properly, so it can not be used to check the accuracy of the electric instrument.
(5) Fill in the indicating value of the self-checking state instrument after debugging on site.

4. Instructions for Use

Hard-supported balancing machine has the characteristics of a, b, c separation and permanent calibration. It abandons a series of tedious steps such as compensation, separation and calibration of soft-supported balancing machine, and greatly improves work efficiency.

Because the main technical index of the whole machine is the minimum remaining unbalance Umar, the reduction rate URR of unbalance is guaranteed by the coordinated

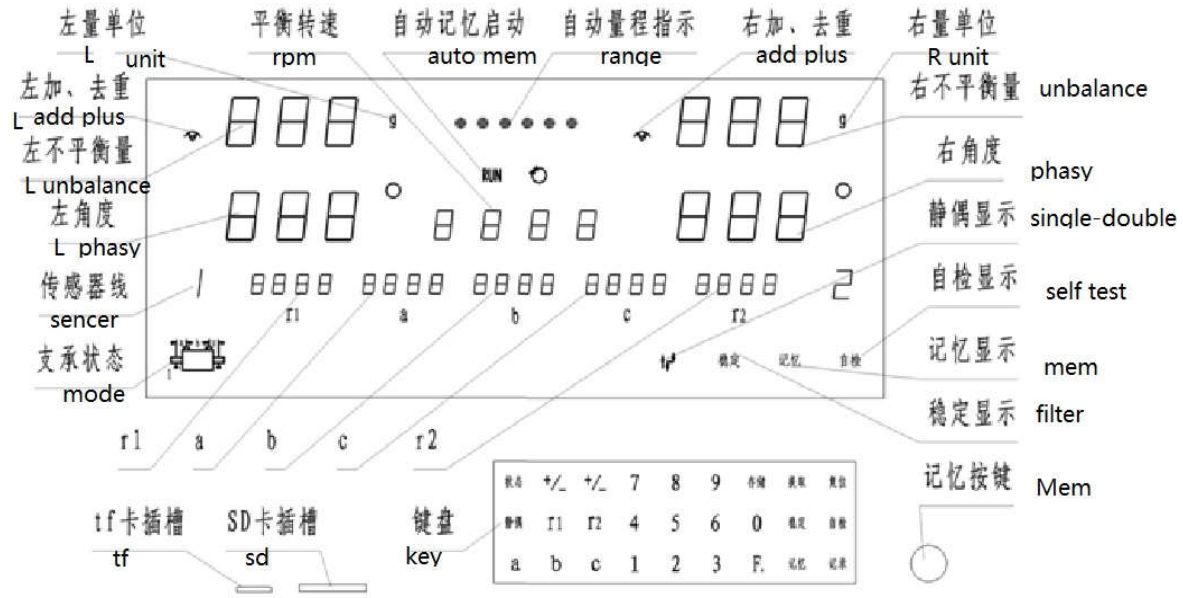
adjustment of sensors and electrical measurement system. The failure and replacement of any link will affect the accuracy of the whole machine to varying degrees, so it should be avoided that the whole machine can be adjusted casually without knowing the principle of the whole machine. Man-made faults caused by adjustable elements in the electric measuring instrument.

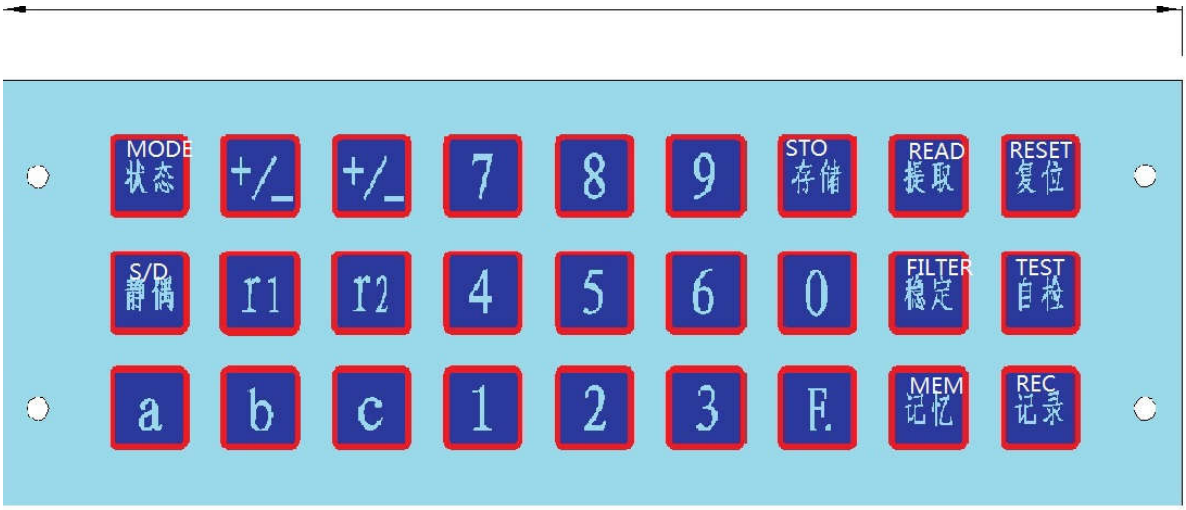
In the input settings of r1, r2 and b in the operation parameters, the electric measuring instrument automatically avoids the position of 0000. Otherwise, the three sets of data flicker bit by bit and the electrical measurement system does not work.

The electric measuring instrument is a precise measuring instrument. It should be operated by special personnel and checked regularly. Operators should be trained professionally.

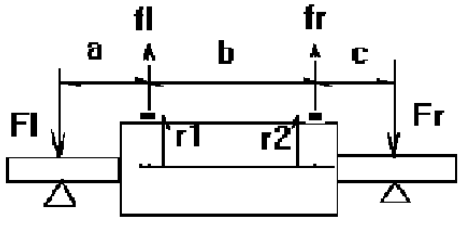
5. Operational functions and instructions

5.1 Functions and instructions of the operation panel (see figure below, in order of keyboard operation)





(1) state " mode": the "supporting state" of the rotor, the key to select the relative position of the supporting surface and the correcting surface of the rotor.

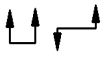


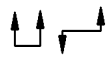
There are six kinds of dynamic balance correction

modes of two-plane separation and six other static couple balance correction modes of 1, 2, 3, 4, 5 and 6 static couple separation combined with static couple function. Press" mode" key in turn and observe the display panel until the display figure conforms to the actual load form of the rotor.

Detailed illustrations of 12 correction methods are shown on the following page.

(2) Static couple: the key to choose the correct way of static couple imbalance.

"Static couple" press “S/D” key  "bright", static unbalance and couple unbalance correction mode.

The "static couple" “S/D”key is pressed again and  "extinguished" enters the dynamic equilibrium state of two planes separation.

Any dynamic unbalance can be corrected either by two-sided decomposition or by static couple decomposition. For the dynamic balance correction of some special rotors, the method of static couple decomposition is very convenient and reasonable.

In the static couple decomposition, the machine can set a.b.c parameters according to the graph. a .c is the distance from left and right support to unbalanced correction plane, a+c equals the distance between two support planes, b is the distance between even unbalanced correction planes, r1 is the static unbalance correction radius, press "static couple" vigorously to make the "static couple" light on, and the "state" selection key press actual

uneven. Selection of the relationship between the balance correction surface and the support (general even imbalance correction is inside the support, at this time the "state" selection key can be selected to "1"), the indication value of the left table is static imbalance, and the indication value of the right table is right even imbalance. At this time, on the corresponding static imbalance correction surface, the correction of the left table finger can be made on the determined radius. On the right even imbalance correction plane, the even imbalance indicated by the right table is corrected on the determined radius, and the even imbalance indicated by the right table is corrected on the same correction radius on the left even imbalance correction plane, but the correction direction is opposite.

(3) Number of separation positions a, b and c.

"a" The number of locations of the distance from the correcting surface to the supporting surface or the distance from the static imbalance correcting surface to the supporting surface is _____.

"b" is the distance between the correction plane and the correction plane or the distance between the dual imbalance correction plane. Be careful! No location of 0000 is allowed. The electric measuring instrument will be flickering because the number is zero - automatically corresponding to the character change, waiting for input parameters.

"c" the number of locations from the correcting surface to the supporting surface or from the even unbalanced correcting surface to the supporting surface.

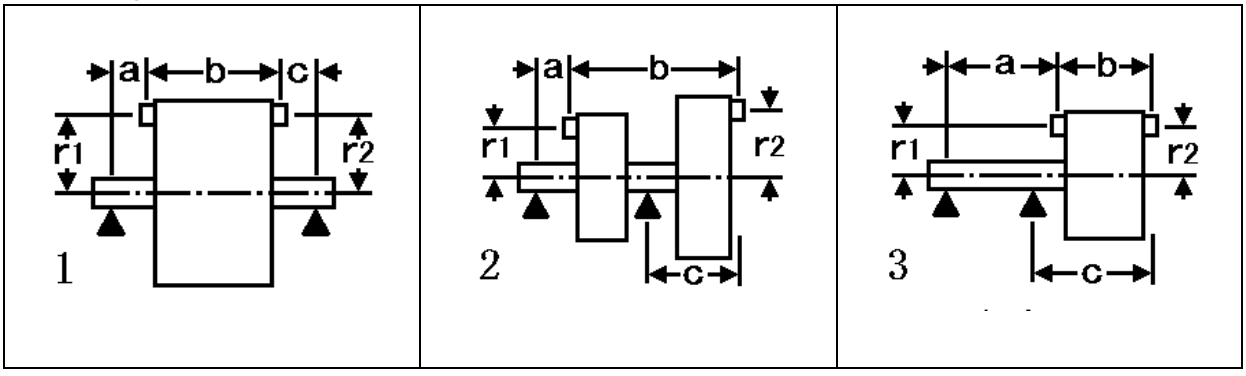
(4) r1 and r2 are about (1) the number of correction radius of correction surface. Be careful! No location of 0000 is allowed. The electric measuring instrument will be flickering because the number is zero - automatically corresponding to the character change, waiting for input parameters.

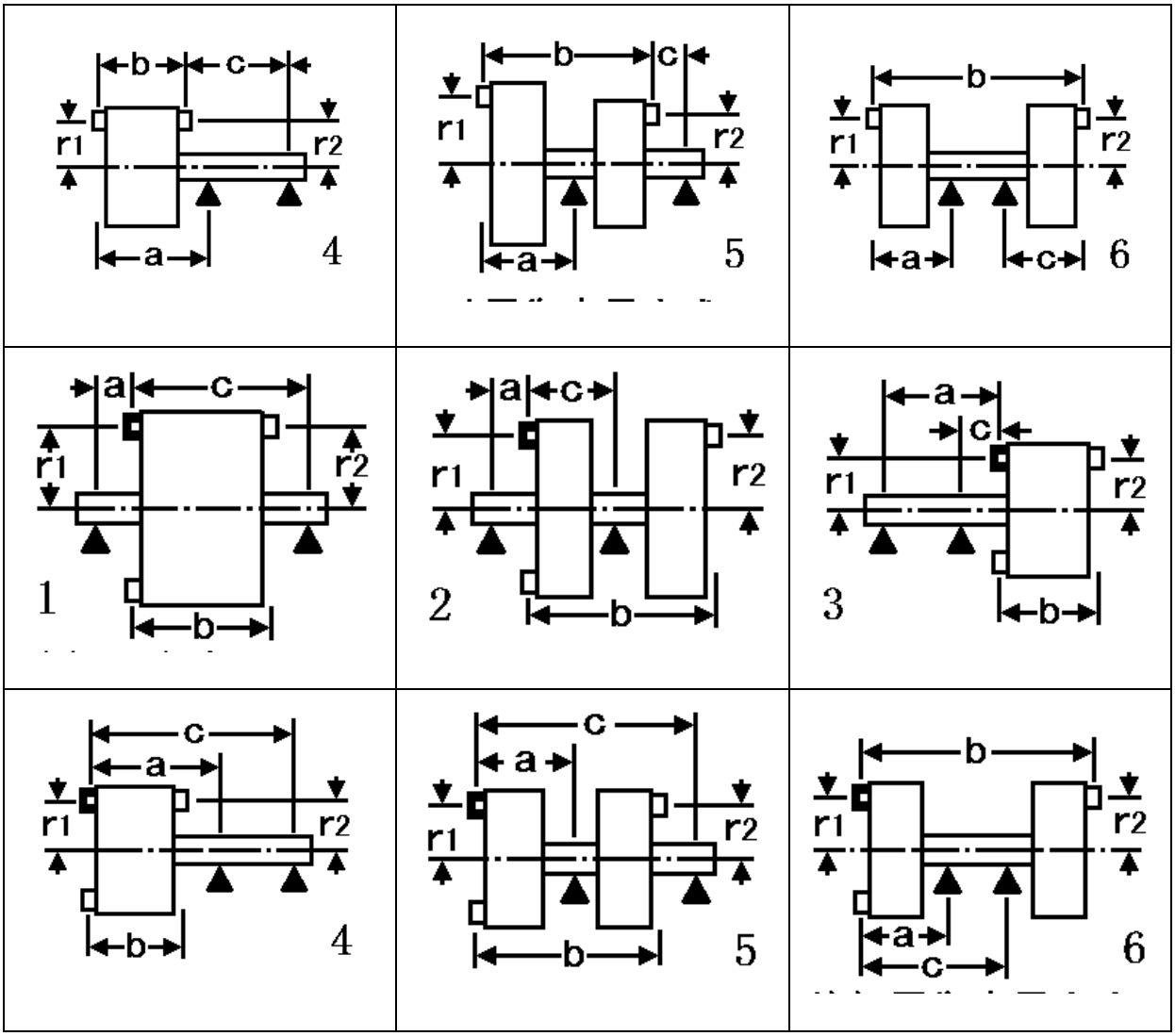
When setting the values of r1, r2, a, b and c by keyboard, press any key of r1, r2, a, b and c, and flicker the corresponding characters. After inputting the numeric value by pressing the numeric key, it delays a few seconds and automatically saves in memory. No data will be lost when power failure or shutdown occurs.

The units of a, b, c, r1 and r2 are millimetres.

Note: When input setting, if one of the parameters r1, r2 and b is set to 0000, the corresponding position data bits will always flicker and the electrical measurement system will not work.

Twelve correction methods (support state) and legends for setting a, b, c, r1 and r2:





(5) "+/-" is about (1) the accentuation and de-selection keys of the correction surface. （①②

"Weighting" means that the correction plane is light and needs to be corrected by weighting (welding, riveting, bonding, etc.).

"De-weighting" means correcting the plane weight, which needs to be corrected by de-weighting (drilling, grinding, milling, etc.).

(6) 1, 2,... 9, 0, and. Digital input keys.

When input a, b, c, r1, r2, read and save rotor data, etc. need digital input operation, it should be used together.

(7) "Storage": Keep rotor data; "Extraction": Read the stored rotor data.

Keyboard saves the rotor data as a rotor number 1 - 99. Press the save key, the display speed of the digital tube began to flicker, you can enter the rotor number to be saved, input, and then press the save key to save.

Rotor data of rotor numbers 1 - 99 are read by keyboard. Press the read key, the start of the display speed flickers, you can enter the number of the rotor to read, the input is completed, and then press the read key to read.

The "Storage" button is a multi-function key. For other functions, see the relevant chapters.

(8) Stability function selection key "stability".

When the accuracy of checking unbalance is very high, this function is activated. The display part indicates slower and the fluctuation of digital change is reduced to facilitate reading.

When the measuring time of the electric measuring instrument exceeds 30 seconds, it will automatically enter a stable state. After shutdown, it will automatically exit the

stable state.

Manually press the "stability" button "stability" to show bright, indicating that the stability function works. The stabilization time is displayed at the "r2" indicating position for 8 seconds. (Stabilization time can be modified by digital keys. The allowable range is 3-75 seconds. The recommended setting is 10-20 seconds, which will affect the correct display speed of the measured data. Press the "Storage" key after the modification is completed to store, or wait for 8 seconds to store automatically.

Press the "stability" button again to "stability" to show that the stability function does not work.

Note: When this key is pressed, it will not work until the stable time is up. This function is not used in general measurement.

(9) Memory, memory function keys. "Memory" lights up, representing the state of memory.

On the right side of the panel, there is a single memory button, which has the same function as the memory button on the keyboard.

When the balance machine is used normally, you can wait for the reading to be stable, press this key, and the unbalanced data will be memorized on the display digital table, and the measurement will stop working. Then stop and correct the unbalance. The electric measuring instrument

can automatically memorize at a set speed and drive the control system to shut down.

Automatic memory at set speed:

When the rotor works to the normal measuring speed, the electronic measuring instrument can automatically memorize the measuring data at this speed by clicking the "storage" key, including the speed itself at this time. When the power is restarted, the automatic memory function of the electric measuring instrument has been activated at this speed without affecting any other operation. As long as the speed of balancing measurement is not changed, when the balancing machine is turned on again, the electronic measuring instrument will start the automatic memory function without manual operation of the "memory" button.

Whether manual memory or automatic memory, the unbalanced data measured and memorized can be re-inputted into the parameters of a, b, c, r1, r2 weighting and de-duplication mode of the rotor, and then calculated and displayed with the re-inputted parameters.

That is to say, in the state of memory, it is allowed to measure and memorize first, and then set the supporting parameters.

(10) "Reset": The restart button of the computer software part is usually not used for normal operation.

(11) Self-check button

In order to check whether the electric measuring instrument is normal when parking, press this key. At this time, the

文件号(FILE No.)：45

动平衡测试报告
DYNAMIC BALANCE TEST REPORT

测试结果（RESULT）：

左残余量 U1：+0.100g	左角度 PH1：213
右残余量 U2：+0.350g	右角度 PH2：35

测试条件（CONDITION）：

平衡转速 (SPEED（RPM）)：1147
支承方式 (MODE)：1
转子参数 (ROTER)：a=50 b=80 c=60 r1=70 r2=70

操作者签字（OPERATER）：

测试单位（章）（DEPARTMENT）：

日期（DATE）：

electric measuring instrument cuts off the external measuring signal and the reference signal, and generates an unbalanced signal from the inside of the electric measuring instrument into the reference and measurement channel, showing a pair of unbalanced quantities from the digital meter. The self-test signal of each balancer is the determined value. See the parameter table in Section 3.7.

The self-test signal is only used to check whether the

electric instrument is working properly. It can not be used to check the accuracy of the electric instrument.

(12) Record button. If the user needs to record the test results in written form, after pressing the "Record" button, the test instrument records the measurement data at this time to the SD card (or TF card), so as to record or print the test report permanently. The printed example is shown in the right figure. The light next to the card holder lights up for 2 seconds when writing data.

(13) Display part of the tachometer. The middle four-digit table indicates the working speed of the workpiece on the balancing machine in units of rotation/minute.

On the premise that the tachometer has normal and stable indication, the circuit starts to work normally (the tachometer is 600rpm when self-checking).

(14) The central top of the display part is indicated by the output level meter, which does not involve the operation process.

(15) Imbalance Display Digital Table

Two digital tables on the left show (1) plane unbalance and its phase (angle).

Two digital tables on the right show (2) plane unbalance and its phase (angle).

(16) Sensor Connection Monitoring Function

Ten seconds after power-on (or press the reset key), there are digital "1" and "2" display on the left and right sides of the display section. When the left and right sensor

connection is short-circuit or open, the corresponding number "1" or "2" will be short of strokes, and accompanied by the buzzer alarm sound.

When the signal line is broken, the lower stroke is extinguished.

When the signal line is short-circuited, the upper stroke is extinguished.

(17) Brief description of keyboard definition:

State: Select the support state corresponding to the actual rotor.

Static couple: Choose static couple balance or dynamic balance mode.

r1, r2, a, b, c: support parameter setting key.

+/- Selection keys for weighting and de-weighting.

0-9: Digital input key.

Storage: Preserve current rotor data or other operational data.

Extraction: Read the saved rotor data to the current operating interface.

Stable: Stable reading.

Memory: Memory reading, easy to parking weight.

Reset: Software reset or hardware reset.

Self-inspection: Internal inspection of electric measuring instrument.

Record: Record the measurement results to SD card (or TF card).

5.2 Functions and instructions for operating the rear panel (sketch)

1 Power switch of electric measuring instrument.

2 FU1: 50Hz, 220V AC power fuse wire, core 0.75A.

3 50Hz, 220V AC power supply access socket.

4 Reference signal input socket (reference signal with exactly the same frequency as rotor rotation)

5 Automatic parking memory function selection switch (some models do not have this function).

6 “①”、“②”side sensors.

6. Calibration of the electric measuring instrument

The electric measuring instrument has calibration function. In special cases, operators can calibrate themselves according to the content of this chapter.

The electric measuring instrument has been permanently calibrated when the whole machine is qualified for commissioning and delivery to users. If the user considers it necessary to use this function to calibrate the balancer, please consult the manufacturer.

Prior to the start of the host, key "F", "1", "2", "3" in turn can enter the calibration state. Press this button after the host starts and cannot enter the calibration state.

The rotor before calibration does not need very high balancing accuracy, but under the conditions, it is better to carry out a rough balancing weight before calibration. It is easier to ensure the calibration accuracy.

Before calibration, appropriate calibration mass blocks should be prepared according to rotor size and host specifications. If the

calibration mass is too small, the calibration accuracy will be affected, and if the calibration mass is too large, the unsafe factors will be produced.

The weight of the calibrated mass block should be greater than the residual unbalance of the rotor, so as to ensure adequate calibration accuracy.

By default, a calibration mass block of 100g plus 0 degrees is required for calibration. If the 100g calibration block is not used for calibration, the weight and installation angle of the calibrated mass block need to be input manually in the calibration process.

6.1.1 Before entering the calibration state, set the sub-parameters according to the following requirements:

The rotor for calibration is specified as:

Supporting state: 1
Input a, b, c, r1, r2 according to the actual state of the rotor
Weighting mode

Double-sided Dynamic Balance

The allowable weights of calibrated mass blocks are: 1g to 99000g

6.1.2 Calibration method: press "F.", "1", "2", "3" in turn, then "support state 1" display is extinguished, "support state 2" display flickers, and the electric measuring instrument enters the calibration state.

6.1.3 Start the balancing machine, the electric measuring instrument begins to measure the initial unbalance of the rotor, and the data is stabilized by pressing the'memory'key and then pressing the 'sto ' key. Then shut down.

6.1.4 At this time, the electric measuring instrument only shows the size and angle of the label quantity (M1) which needs to be installed on the left side (initially set at 100g-0 degrees), but not on the right side (n).

The calibration mass block (M1) is added on the left side. The size of the actual calibrated mass block (M1) is directly inputted with the keyboard, and the "angle" on the left side can be inputted by pressing "b" and then pressing the numeric key. If no new parameters are input, the quantity should be added according to the size and angle of the display of the electric measuring instrument.

6.1.5 Start the balancing machine, the electric measuring instrument begins to re-measure the unbalance, the data is stable by pressing the'memory'key and then pressing the 'sto ' key.

Shut down and remove the label M1 added on the left.

6. 1. 6 At this time, the electric measuring instrument only shows the size and angle of the standard quantity (M2) on the right side (initially set at 100g-0 degrees), and no display on the left side (n).

The calibrated mass block (M2) is added on the right side. The keyboard is used to modify the number of grams of the actual calibrated mass block (M2), and the "angle" of the installation is modified by pressing ” c” key.

6.1.7 Start the balancing machine, the electric measuring instrument begins to re-measure the unbalance, the data is stable by pressing the 'memory' key and then pressing the 'sto' key. The calibration is over.

Shut down and remove the labeled M2 mounted on the left.
6.1.8 Balancer can be measured normally with the parameters of this calibration. That is to say, the residual unbalance of the rotor can be measured by starting the balancer now.

Customers can make a calibration rotor and do two positions with 100 g increment in the zero phase of left and right sides, so that the calibration process does not need to input the calibration parameters to accelerate the calibration speed.

6.1.9 In the downtime state, the key "F", "7", "8", "9" in turn can be restored to the original factory calibration data.

6.1.10 Because of the non-linearity of the data of the whole measurement operation, too large initial amount is not conducive to the compensation operation with high accuracy. It is suggested that the compensation operation should minimize the initial unbalance.

Led mode uses tachometer as mode indicator. Each time the tachometer enters the speed display, when there are compensation parameters, it provides 2S mode display time. If there is no mode, it directly enters the speed state.

7. Brief Introduction to the Principle of Electrical Measurement System

7.1 Brief Introduction to the Principle of Electrical Measurement System

Voltage stabilized power supply: 220 V AC supplied by transformer is converted into +15V and 5V DC for measuring system.

CPU board: After the input reference signal is phase locked and frequency doubled, it provides tracking band-pass pulse and tachometer signal, and generates self-check signal.

Pre-filter part: Pre-filter the support surface signals of (1) and (2) sensor inputs, and switch the measurement or self-test at the same time.

The main filter part: the signal of the calibration radius of the first or second correction plane after pre-filtering and processing is sent to the computer part to realize high-speed sampling, correlation filtering, a, b, c, r1, R2 operation, bandwidth switching and memory functions.

The adjustment of the matching of the two sensors is processed by computer software.

7.2 Digital Table:

Two digital tables on the left show (1) plane unbalance and its phase.

Two digital tables on the right show (2) plane unbalance and its phase.

The middle digital meter measures the rotational speed of the rotor in the unit of rotation/minute.

8. Maintenance and maintenance

Maintenance and maintenance of balance machine measurement

system is the key to ensure the balance machine works well. The electric measuring instrument should be placed in a ventilated, dry and clean room. There should be no strong electromagnetic interference nearby. The electric measuring instrument should be electrified 2-3 times a week by a special person under the condition of self-examination, 2-3 hours each time. When the electric measuring instrument is out of service, it should be covered with dust-proof cover and desiccant. The cover plate of the electric measuring instrument should be opened every 3-6 months to replace the desiccant. Each index should be checked according to the technical requirements of the electric instrument every 1-2 years, and the accuracy of the machine should be adjusted by mechanical and electrical coordination.

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