ONO SOKKI

DS-0227A Field Balancing Software
Operation Manual

It is said that the abnormality of rotating machinery is most often caused by imbalance. For that reason, balancing work is necessary, but the conventional method of creating vector diagram takes time to perform vector calculations and plotting, therefore it was hard to do on site.
The field balancing software DS-0227A can perform troublesome calculations internally, and display the result. Anyone can easily correct the balance in a short time, which is useful for improving work efficiency.

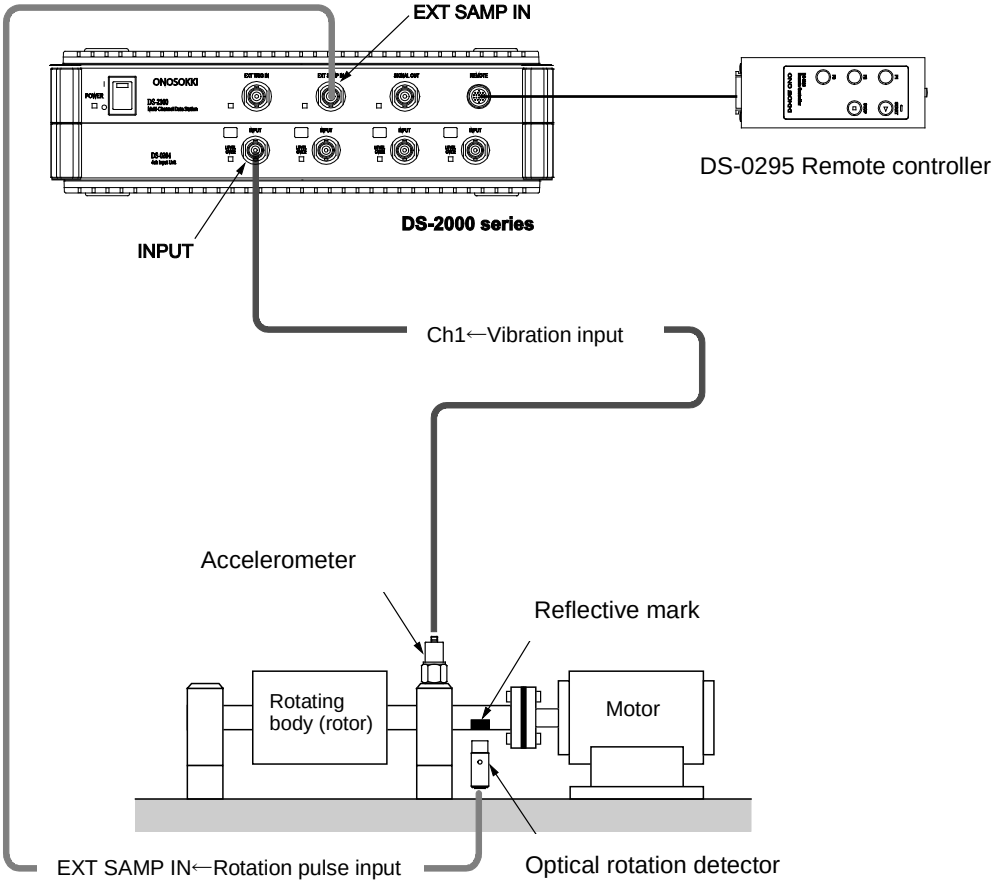
The DS-0227A has the ability to perform field balancing of 2 planes 2 conditions by 2ch input.
This section explains the most basic method, 1 plane 1 condition correction.

[Table of contents]

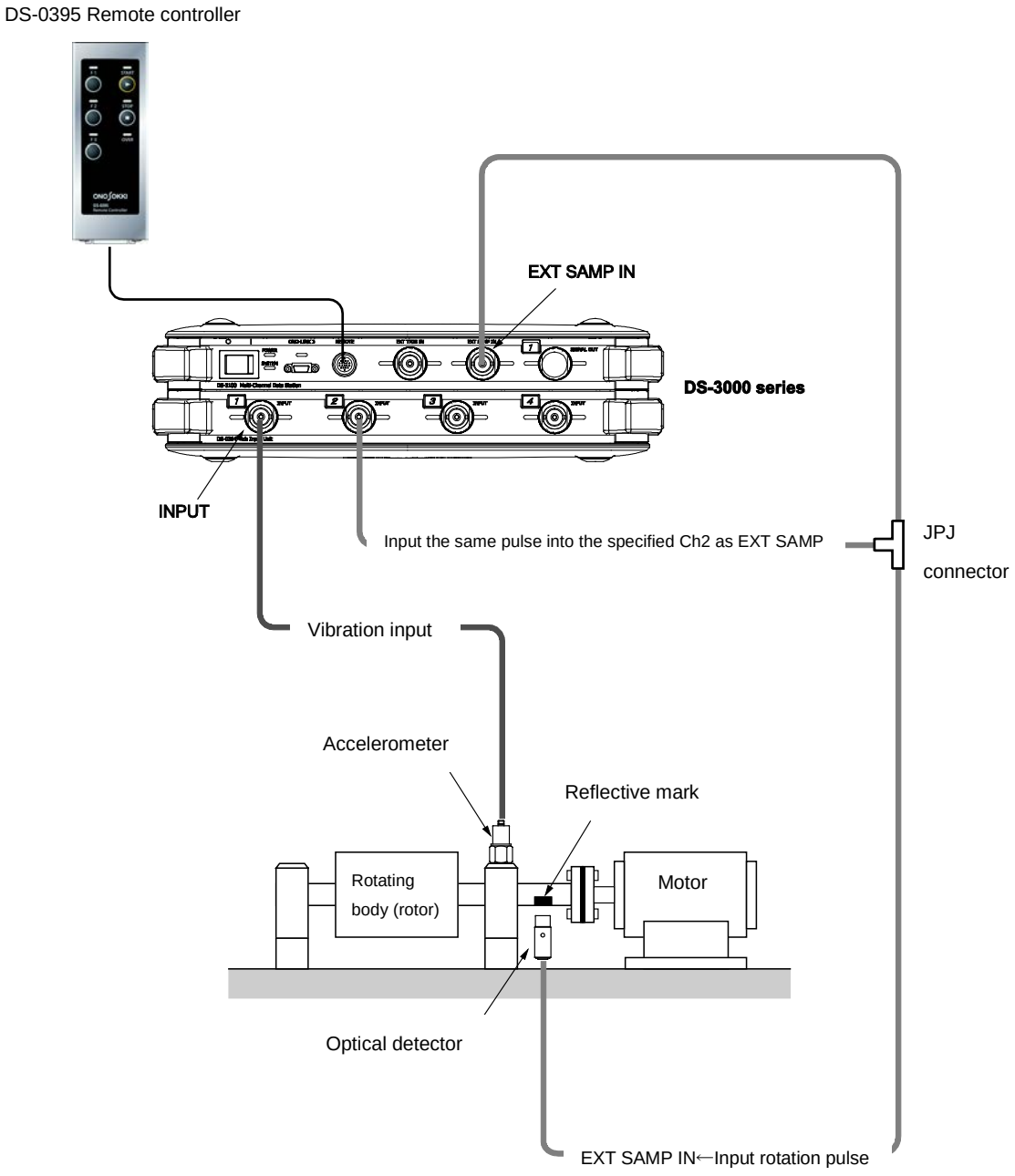
1.【System configuration 】

Model name	Item name	Remarks
DS-2000/3000 series	Multi-channel data station	-
DS-0227A	Field balancing software	-
NP-3000 series	Accelerometer	* It is possible to use the speedometer / displacement gauge
HT-5500	Handheld digital tachometer	Used for rotation detection

● Example of DS-2000 series system configuration

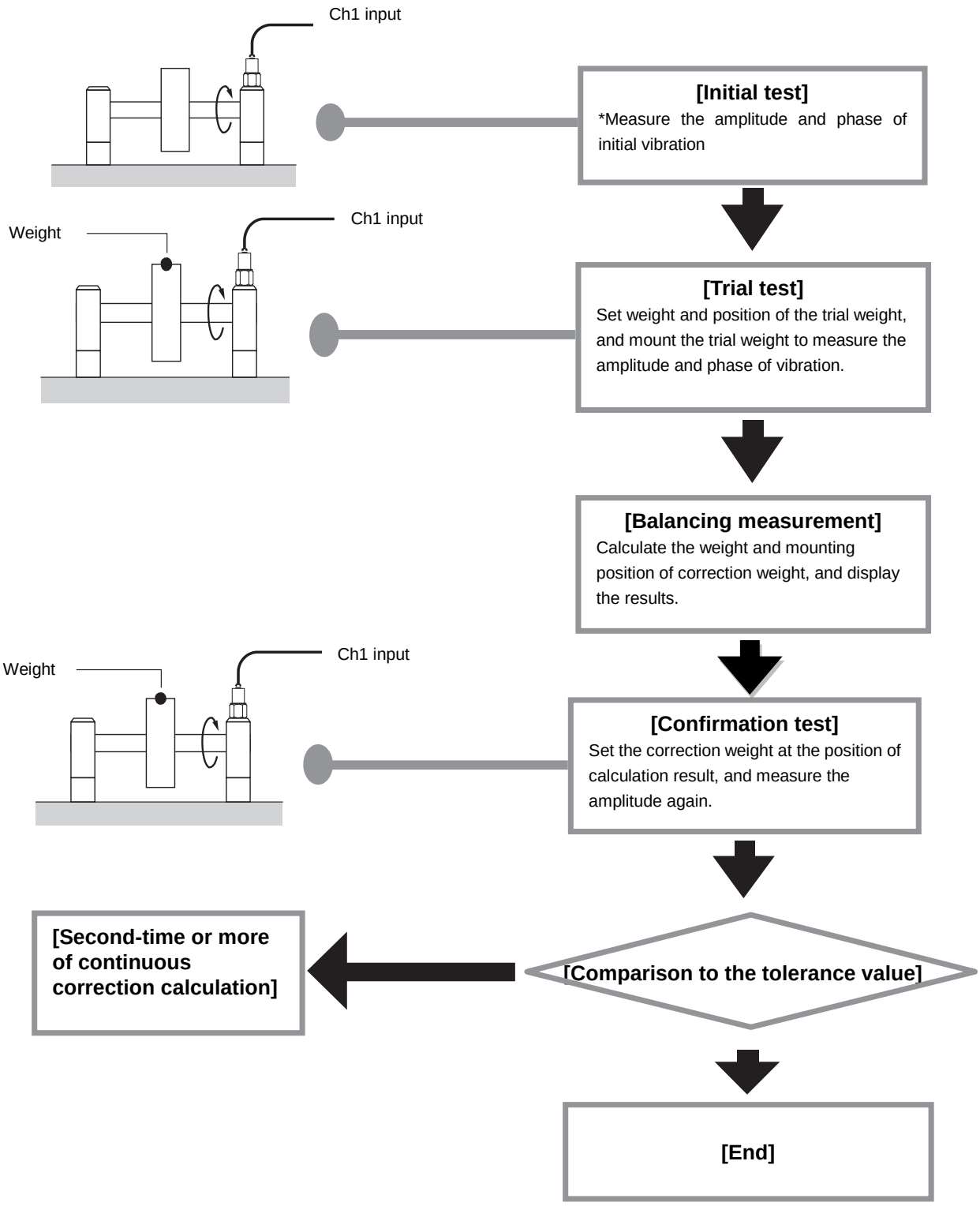


● Example of DS-3000 series system configuration

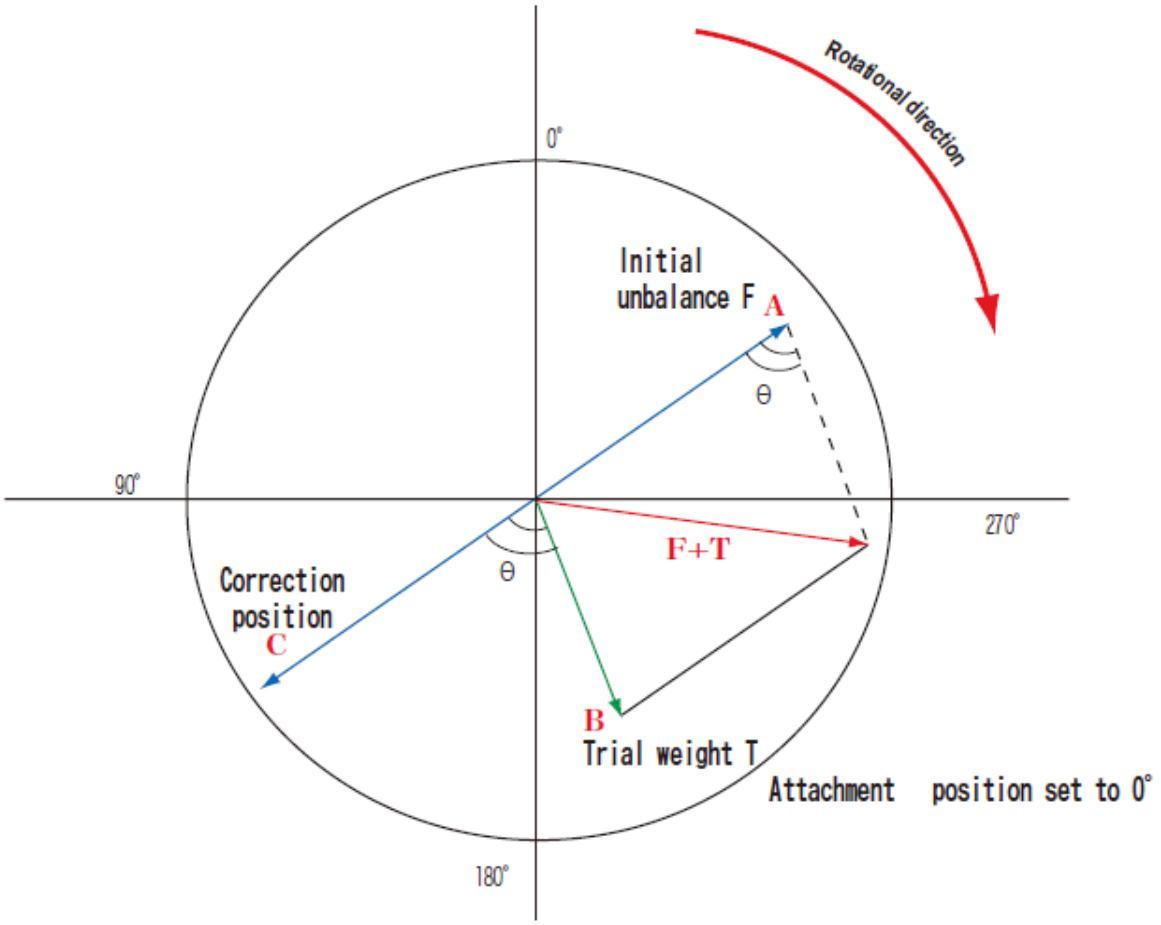


2. [Operating procedure of balancing adjustment (1 plane/1 condition)]

Field balancing measurement of one plane is performed according to the following flowchart.



3.【Principle of field balancing (1 plane 1 condition)】



The basic idea of field balancing is as shown in the figure above.

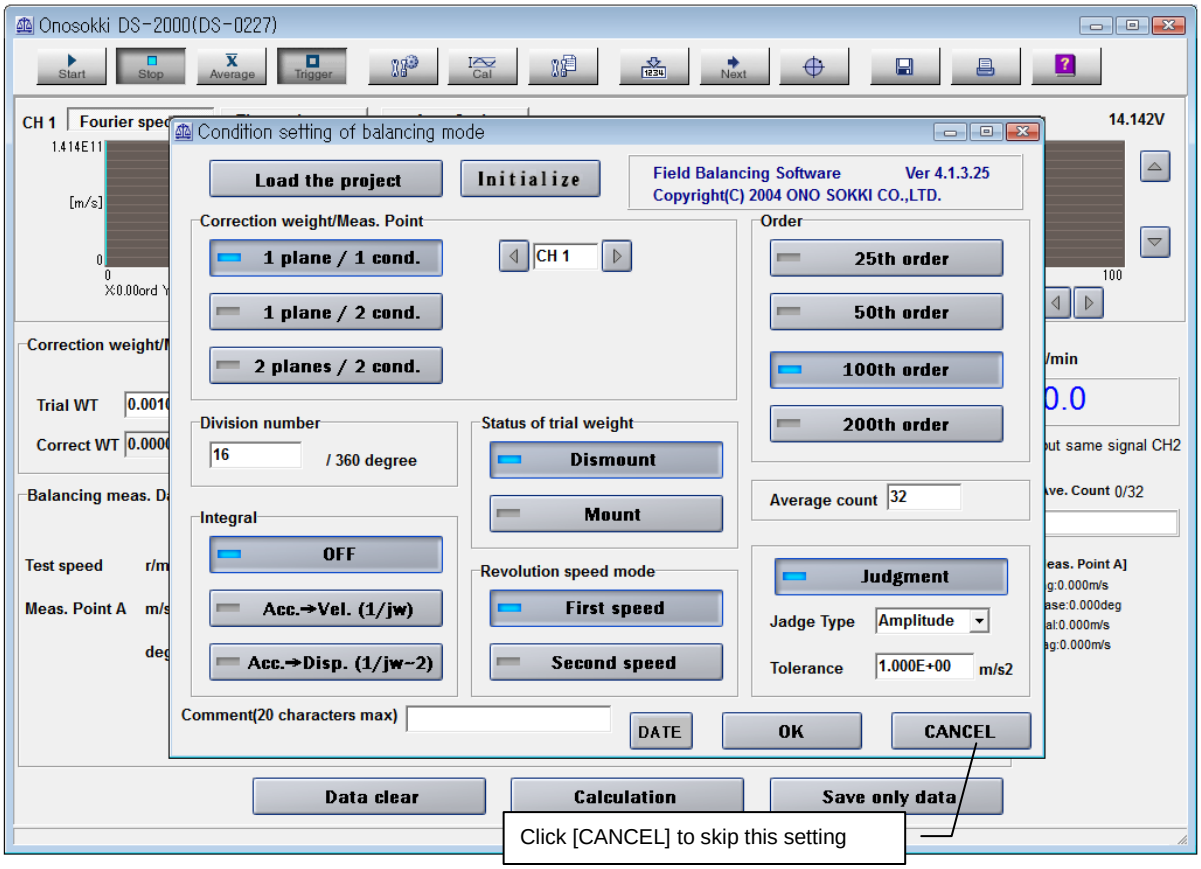
Suppose that an imbalance of F occurs at point A on the plane of revolution. It follows that the correction weight same to F should be mounted on the C point, which is 180 degrees opposite from A for the correction.
To obtain the C point, set the trial weight T to the B point. It will result that the initial imbalance shifts toward F+T by θ. The corrected position is the point C deviated by θ from the point B where the trial weight is mounted. The position of the correction weight is obtained by T × F / T.

This system can easily execute these calculations.

4.【Activation procedure】

To activate the field balancing software, double-click the shortcut icon of the field balancing software on the desk top, or click the buttons in order as follows [Start]→[All Programs]→[ONOSOKKI DS - 2000]→[DS 0227] in this order.

Immediately after activation, the condition setting of balancing mode screen appears. This condition setting screen is for the next field balancing measurement.



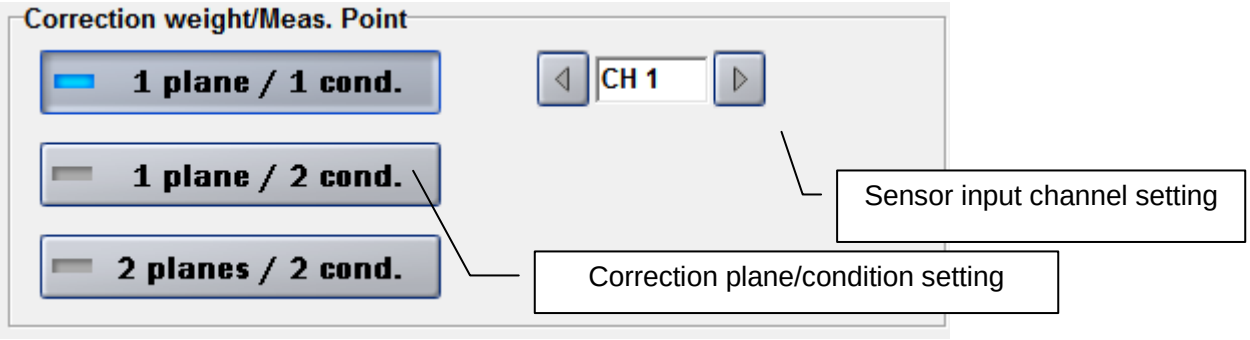
Hereafter we are going to set up the conditions for field balancing measurement.

*To set the condition of field balancing measurement later, click [Cancel] button..

5. [Condition setting of balancing mode]

In the condition setting of balancing mode, set the following items.

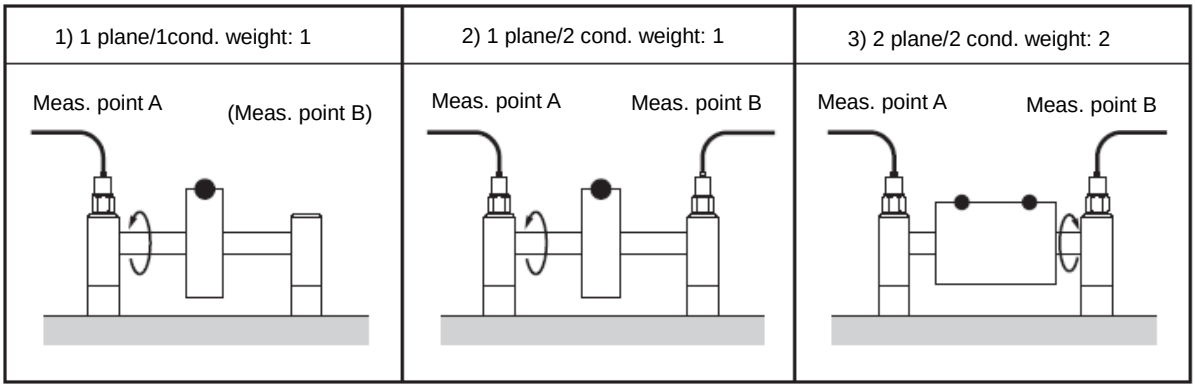
1) Number of correction plane/measurement condition



■Setting of the number of correction planes/measurement conditions

In this section, selection of the number of correction planes and measurement conditions is explained.

"Correction plane" is the plane for balancing by mounting a balance weight, scraping the weight by drilling and so on. The number of correction surfaces, whether it will be limited to one surface or two surfaces are subject to correction is decided according to the target and conditions. When the target is long rotor etc, correction for two planes is required.

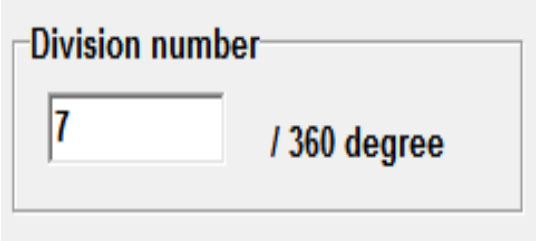


■Setting for sensor input channel

Set the channel to which the sensor is connected.

※ When "two conditions" setting is selected, the input channel for the second sensor appears.

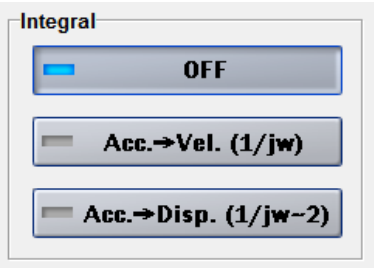
2) Number of divisions



Input the mounting position of the weight to be added to the circumference of the object as the number of divisions. For propellers, turbines, etc., enter the number of blades. Input the numerical number of divisions that you can physically mount as the correction weight by ten-key.

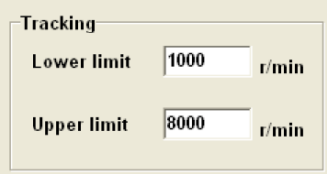
*The figure above shows the example of 7 fans (example of 7 divisions).

3) Setting of integral



When the revolution speed mode is set to [Speed 1], it is set as integral condition.

* When the revolution speed mode is set to [Speed 2], input the velocity values both of upper and lower limit as tracking condition.



- OFF : no integration processing
- Acceleration → velocity (1 /jω) : It converts the Fourier spectrum of acceleration into velocity by single-integration.
- Acceleration → velocity (1 /ω^2): It converts the Fourier spectrum of acceleration into displacement by double-integration.

*The term "integral condition" referred here means the setting that divides the Fourier spectrum value of the acceleration by the angular velocity (ω:omega) (2 × π × f (frequency)), and converts it in order [acceleration] →[velocity]→[displacement], and then observes and evaluates in each unit. When using velocity sensor and displacement sensor, select【OFF】for this setting.

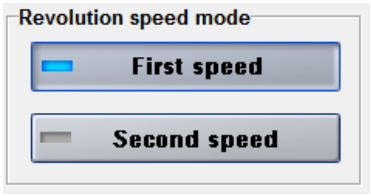
4) Status setting of trial weight

Select the state of the trial weight to one of the followings.

- Dismount: Dismount the trial weight, mount the correction weight to perform the confirmation test.
- Mount: Mount the correction weight with the trial weight being mounted to perform the confirmation test.

5) Setting of revolution speed mode

Select the revolution speed condition whether [First speed] or [Second speed].



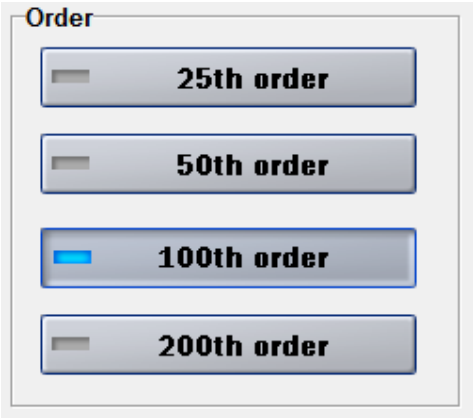
As long as the rotating body is not a perfect rigid body, the amount of balance adjustment changes along with the change in the revolution speed. In the actual balancing operation, balancing is performed at a constant revolution speed.

First speed: Used for balancing operation of a rotating body in a state of constant rotation
Second speed: Used for balancing operation of a rotating body with variable speed machine such as turbine

When the revolution speed changes, the amount of vibration (balance amount) also changes.
In this case, use rotation tracking measurement by increasing (or decreasing) rotation, and perform averaging of two rotation speeds (the operating rotation and the rotation which is occurring resonance) for lowering the vibration level averagely in the operation speed range.

CAUTION! The measured data of [Second speed] may fluctuate if the stable sweeping of increasing revolution speed is not ensured by controlling the load at the time of increasing revolution speed. In this case, please select the balancing work by [First speed].

6) Setting of order



Set analysis order.

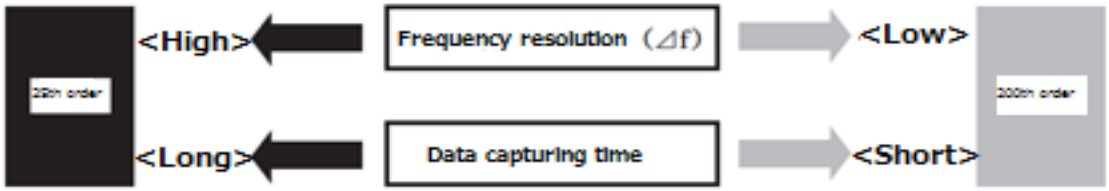
The smaller the maximum analysis order, the finer the order resolution becomes. As shown in the table below, the numbers of sampling points for one revolution changes according to the maximum analysis order.

Set the maximum order with reference to the following table.

Maxx. Order	Measurement revolution range	Sampling
25	150 to 40000 r/min	64 points/1 revolution
50	150 to 20000 r/min	128 points/1 revolution
100	150 to 10000 r/min	256 points/1 revolution
200	150 to 5000 r/min	512 points/1 revolution

The field balancing software DS - 0227A uses the vibration data of rotation first order for calculation. If there is disturbance noise where close to the rotation first order vibration data, use the following methods to increase the rotation angle resolution and separate the two.

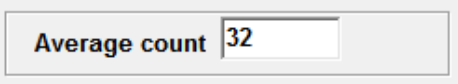
1. Reduce the maximum analysis order
2. Increase the number of sampling points



The maximum analysis order should be set appropriate numerical value by taking the above matters into account.

Note: Measurement rotation speed range varies according to the number of maximum analysis order.

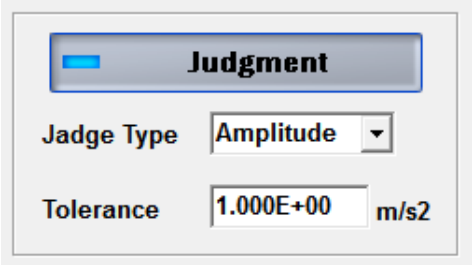
7) Setting the number of averaging



Input the number of averaging processing times when executing averaging measurement with a numeric keypad.

Set the number of averaging processing times of Fourier spectrum here. If there are many disturbances or large noise, setting the number of averaging items a little larger makes it easier to obtain stable results. However, while the measurement time is longer.

8) Setting to make judgment (tolerance setting)



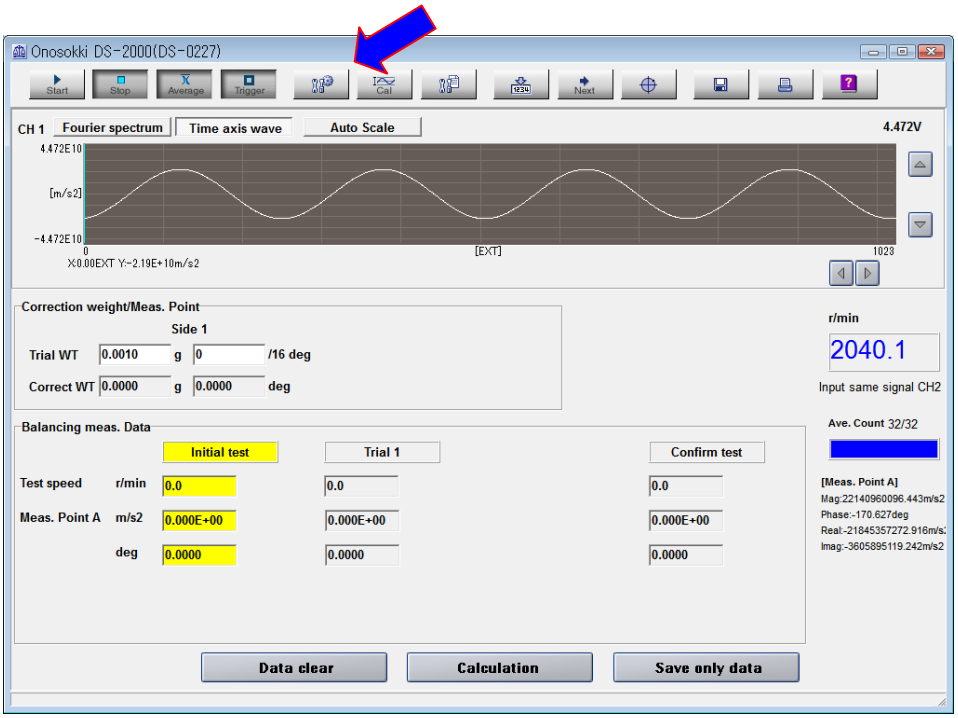
Turn ON/OFF the judgment setting.
Also, enter the acceleration as the criterion for judgment as tolerance by using the numeric keypad.

When the judgment setting is ON, "OK" appears when the judgment result is within the set tolerance value (acceleration), and "NG" appears when the result exceeds the tolerance value.

◎ Completion of setting

After the condition setting is complete, press OK to accept the settings.

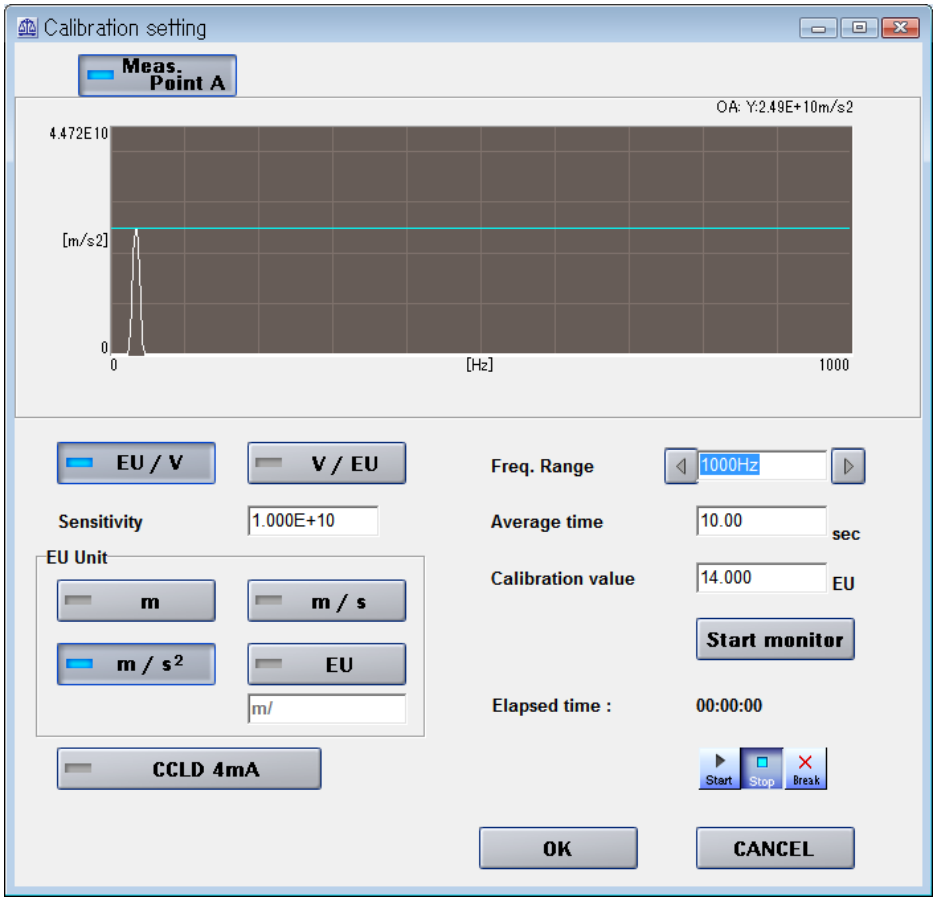
You can display the setting screen again by clicking the icon on the toolbar at the top of the main screen.



6.【Calibration setting】

Set the type of sensor that detects phenomena caused by imbalance, calibration the physical quantity that the sensor has, and ON/OFF of the constant current circuit that drives the constant current sensor.

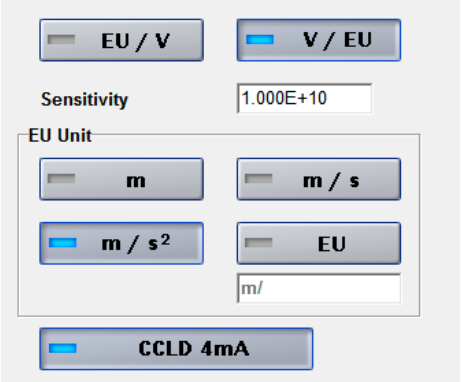
Click the "Calibration" icon on the tool bar to display the "Calibration setting" screen.



Calibration setting screen

1) Calibration of sensor ①

Input the physical quantity and sensitivity information of the sensor to be used.



You can check the effect of balancing using the physical quantity such as acceleration and displacement by calibrating with the physical unit of the sensor.

Select according to sensor sensitivity notation.
EU (Engineering Unit) contains m (displacement), m/s (speed), m/s^2 (acceleration), and other EU (physical units of other optional setting).

◎ Example of unit calibration (when using accelerometer (NP-3412))

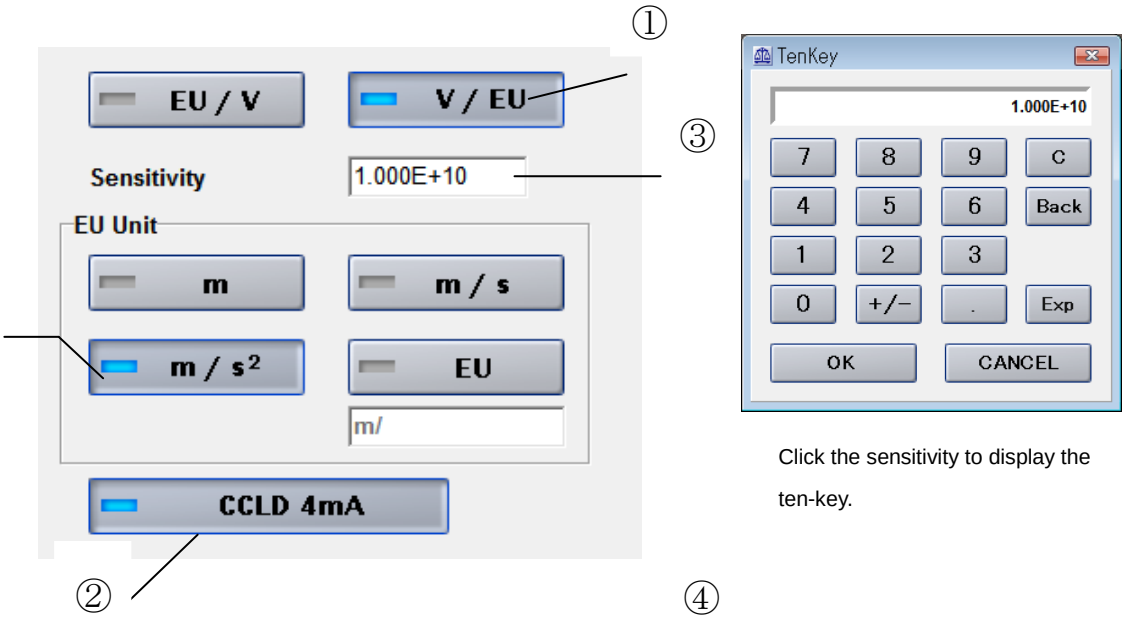
From the specification of the accelerometer (NP-3412),

Sensitivity: 1.0 mV / s^2 → select "V/EU". (EU: s^2) : ①

Since it is an accelerometer→select "m/s^2". : ②

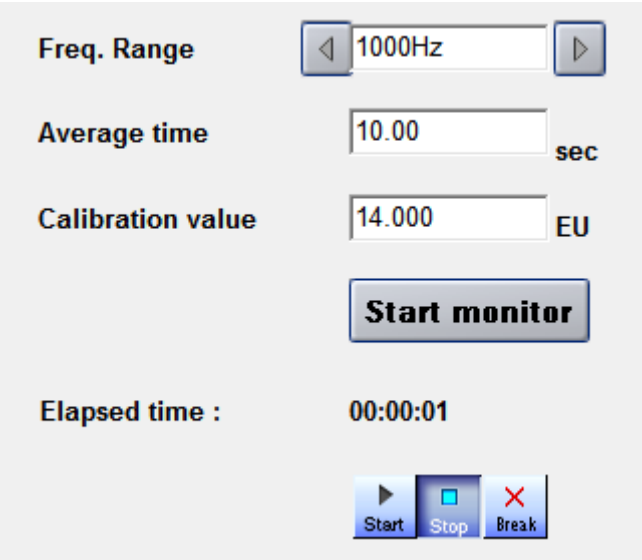
(Input "1.000 E-3 (0.01)" with the ten-key). :③

Make sure "CCLD 4mA]" is ON. The NP-3412 accelerometer with built-in preamplifier is operated by CCLD (Constant Current Line Drive).



Click the sensitivity to display the ten-key.

2) Calibration of the sensor ②



This calibration is a method of calibrating the detector actually used for balancing by using the reference exciter.

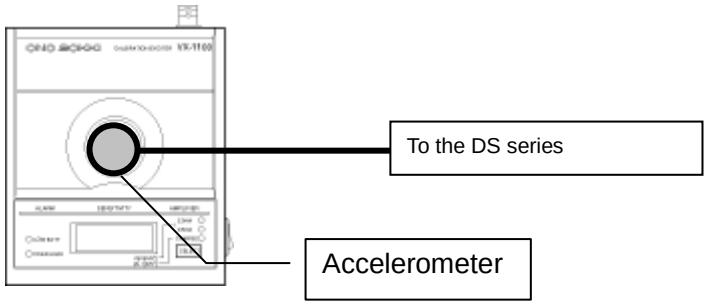
Since calibration is performed in the actual measurement system, it is possible to simultaneously perform calibration and operation check of the whole system.

Physical calibration is possible for detectors without data sheets.

Calibration procedure (when using accelerometer)

<< Equipment used >>

· Calibrator: VX-1100 (Simple type calibrator, manufactured by Ono Sokki Co., Ltd.)



① Fix the accelerometer to the vibrated area using the wax or the like.

② Turn on the switch of the VX-1100, excite it, and press the "Start monitor" button to confirm that the spectrum is visible.

※VX-1100

The excitation frequency: 159.2 Hz±1%

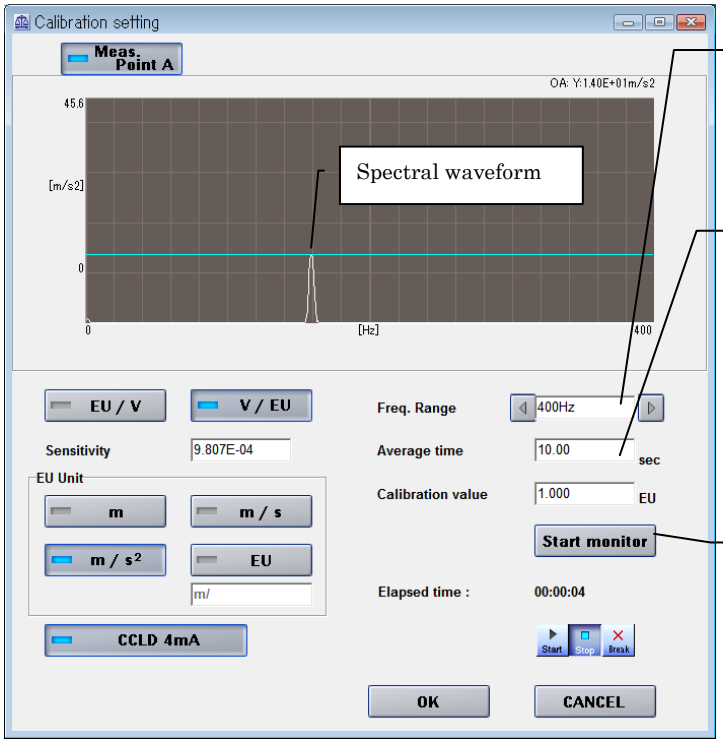
-Vibration acceleration	: 10 m/s^2±3% (rms)
-Vibration speed	: 10 mm/s±4% (rms)
-Vibration displacement	: 10 μm±5% (rms)

These vibrations can be given to the detector.

③ In the calibration setting screen,

· Set the frequency range.

· Set the average time.

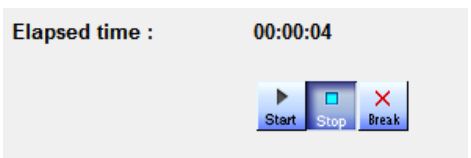


Frequency Range
Here, set it to 400 Hz.

Average time
Here, set it to 10 seconds.

Monitor starts.
Displays the waveform

④ Averaging



Perform the time averaging that has been set to stabilize the data. Averaging starts by pressing "Start" and the elapsed time is displayed. When averaging is completed, "Stop" button is active again.

⑤ Input of calibration value

After averaging, input the calibration value into the OA (overall value) of displayed Fourier spectrum for performing calibration.

In this software, it reads single amplitude of wave. Input the calibration value 14.14, not the rms value 10 m/s^2.

Click [OK] to complete the calibration operation.

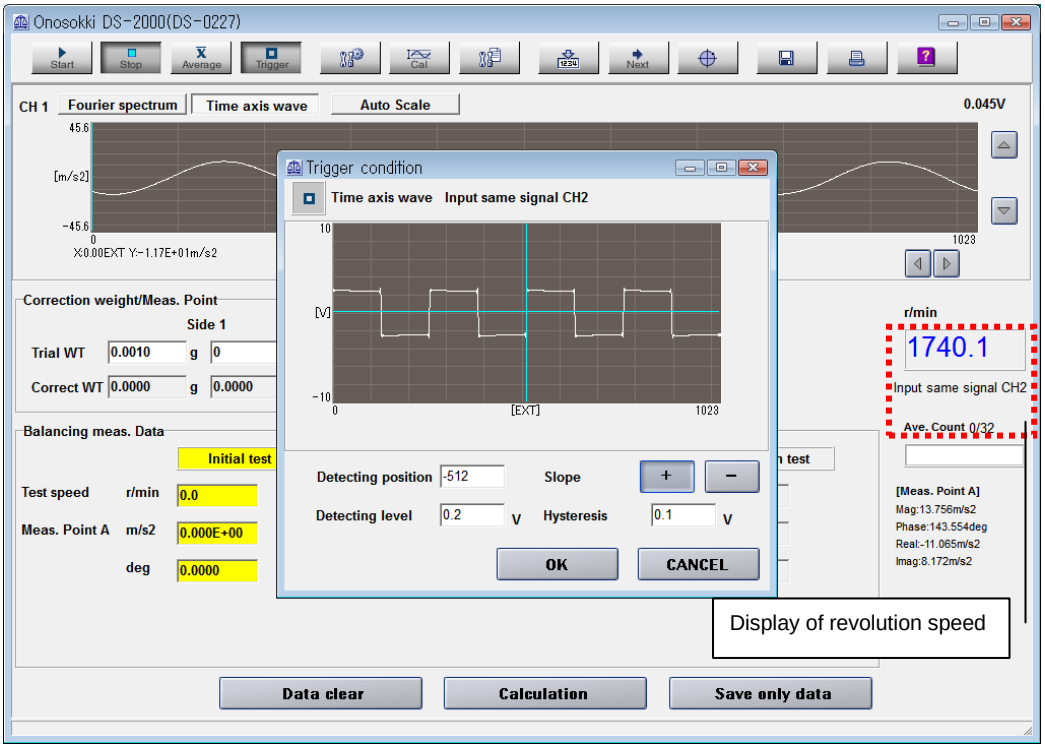
7. [Setting trigger condition]

For accurate detection of the rotation pulse, set the detection position and detection level of the rotation pulse (trigger condition).

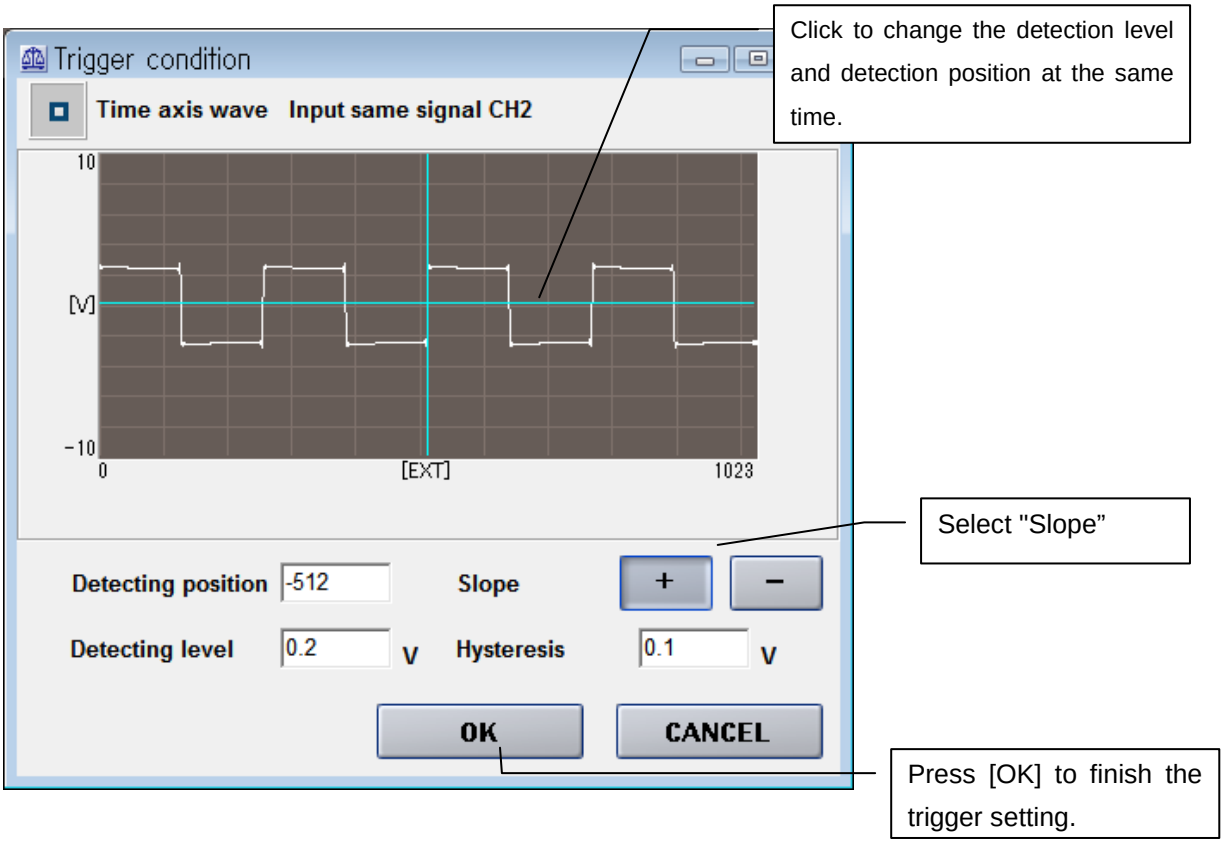
Click "Trigger" icon on the tool bar to display the "Trigger Condition" setting screen.

1) Turn on the HT-5500 Handheld Tachometer and check the detection light. Then rotate the target rotation body, and see the operation of the HT-5500 and the rotation fluctuation of the target.

2) Check that the rotation pulse waveform from the handheld tachometer is displayed on the screen and the rotation speed is the same value as the handheld tachometer.



3)If the detecting position of rotation pulse and detection level setting (trigger condition) etc. are inappropriate, make adjustments and ensure that rotation detection is enabled.



* When the rotation speed is not displayed

If neither the rotation speed nor the waveform is displayed, the followings may be the causes.

① Rotation speed is not detected by the HT-5500.

② Rotation pulse signal is not correctly input to the "EXT SAMP IN" of the DS-2000/3000. (connection mistake)

DS-2000

DS-3000

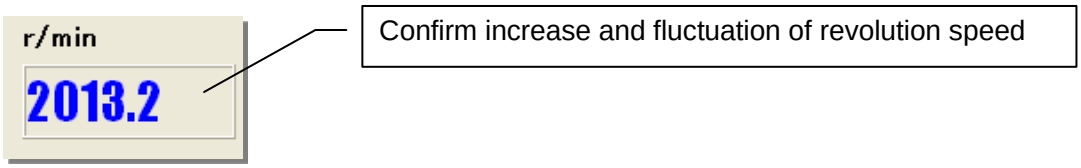
Check that the LED for operation confirmation of EXT SAMP IN (external sampling input) is lit at the time of rotation.

The preparation is completed.

8. [Initial test]

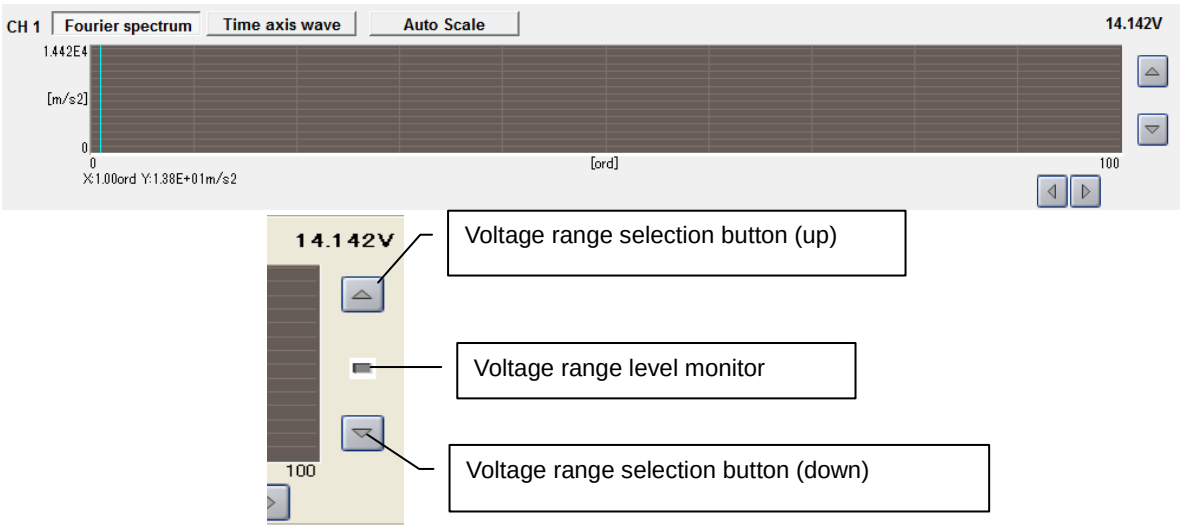
Rotate the target body at the rotation speed that requires balance correction, and acquire the vibration data that occurs at the present time.

1) Adjust the waveform level by setting the rotation speed to the required.(Confirm the revolution speed with software.)

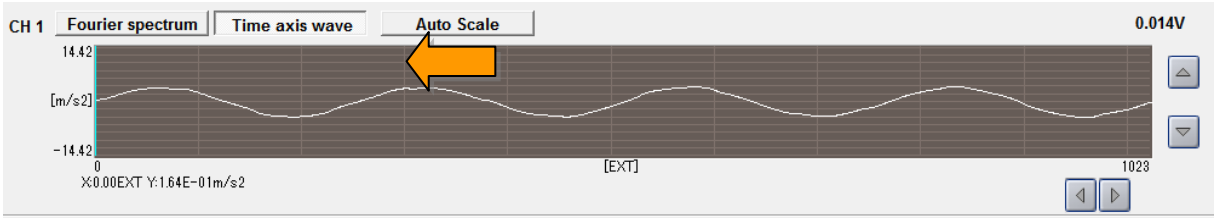


2) Input the vibration signal and adjust the input level.

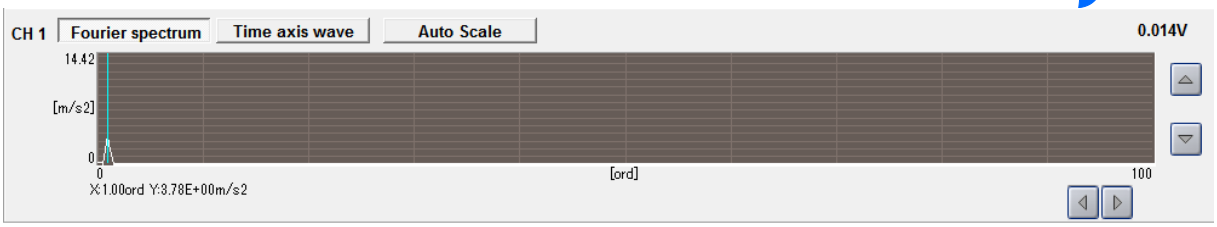
Set the input voltage range to an appropriate value according to the magnitude of the vibration waveform. The set value is good as long as A / D over does not turn on. If the voltage range level monitor is lit or the input range is too large, adjust the voltage range by pressing the voltage range switch button.



On the data display screen on the balancing window, confirm the signal input of Ch1.



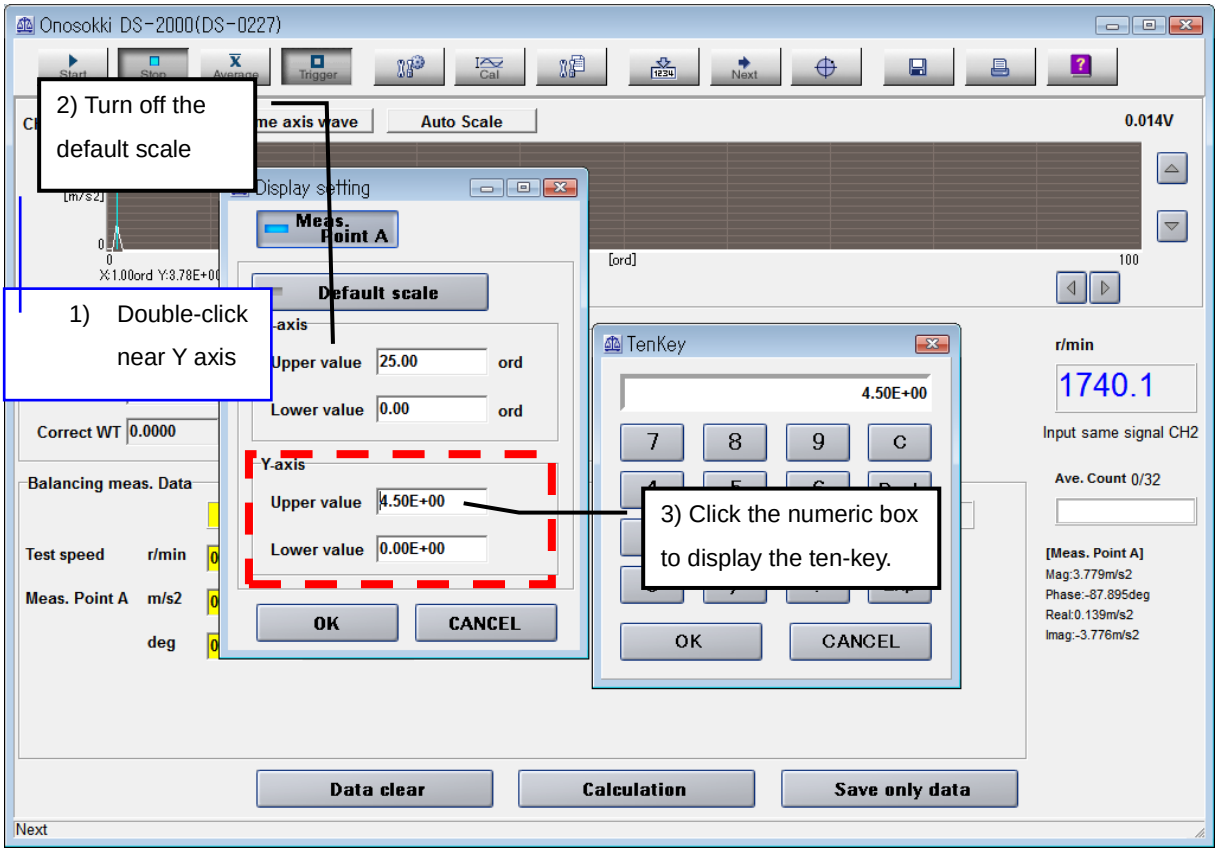
Signal confirmation with time axis waveform



Confirmation with Fourier spectrum waveform

◎Field balancing is performed by value observation of the Fourier spectrum. Appropriate settings of voltage range and Y axis (vertical) scale are both required for. If the setting of Y axis scale is insufficient for waveform observation, you can make adjustment.
It does not affect the precision even if Y axis scale adjustment is not made.

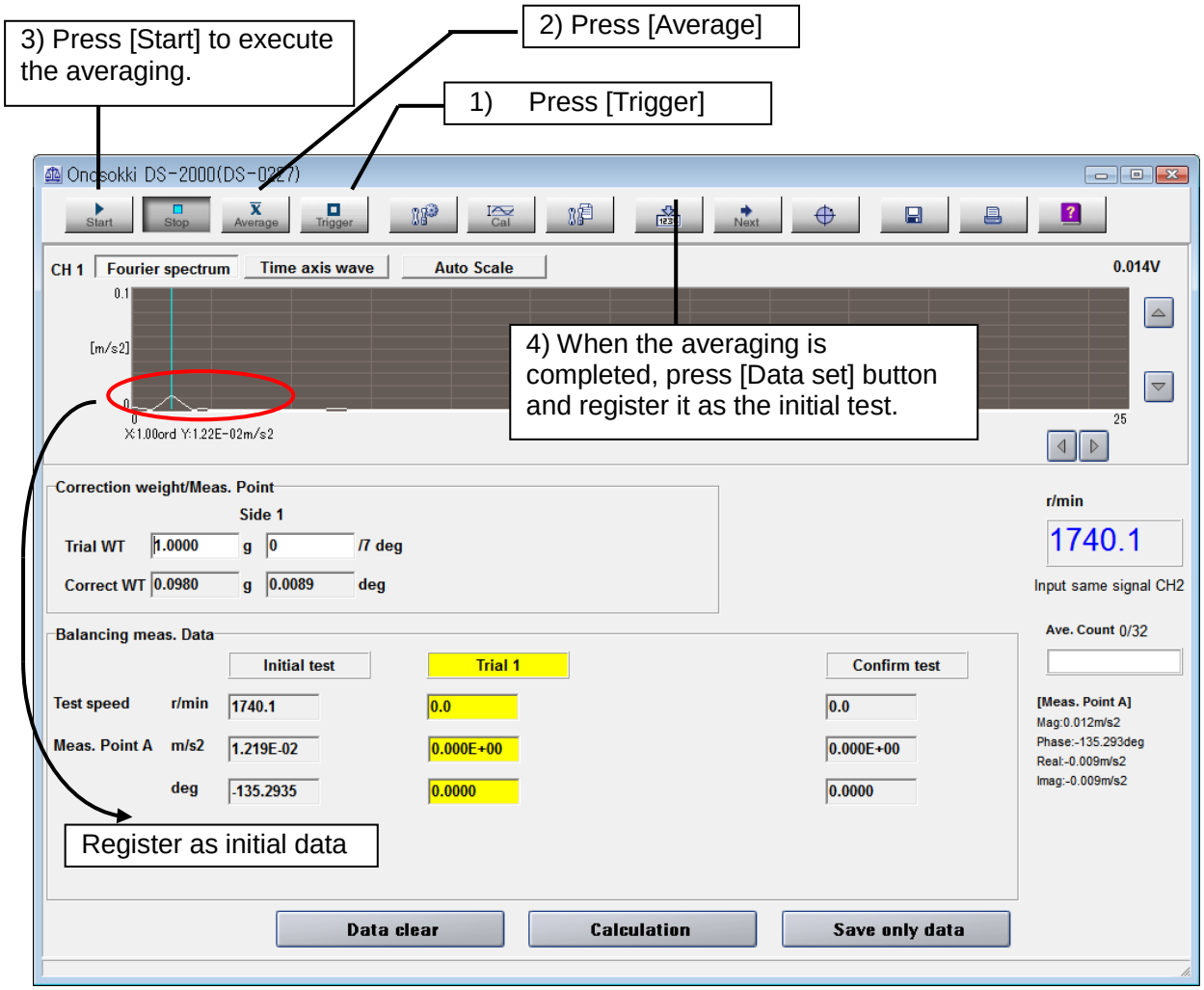
"Adjustment of Y axis scale"
Double-click near the Y axis scale, the setting screen of X axis and Y axis is displayed.



3) Execute the averaging process using the trigger function.

To synchronize with the rotation pulse signal, click the "Trigger" on the toolbar of the main screen and switch ON. Next, click [Averaging] on the toolbar on the main screen to execute the averaging process. You can set the appropriate count of averaging according to the fluctuation state of the signal.

(Up to 2048 times it can be set. The initial value is set to 32 times.)

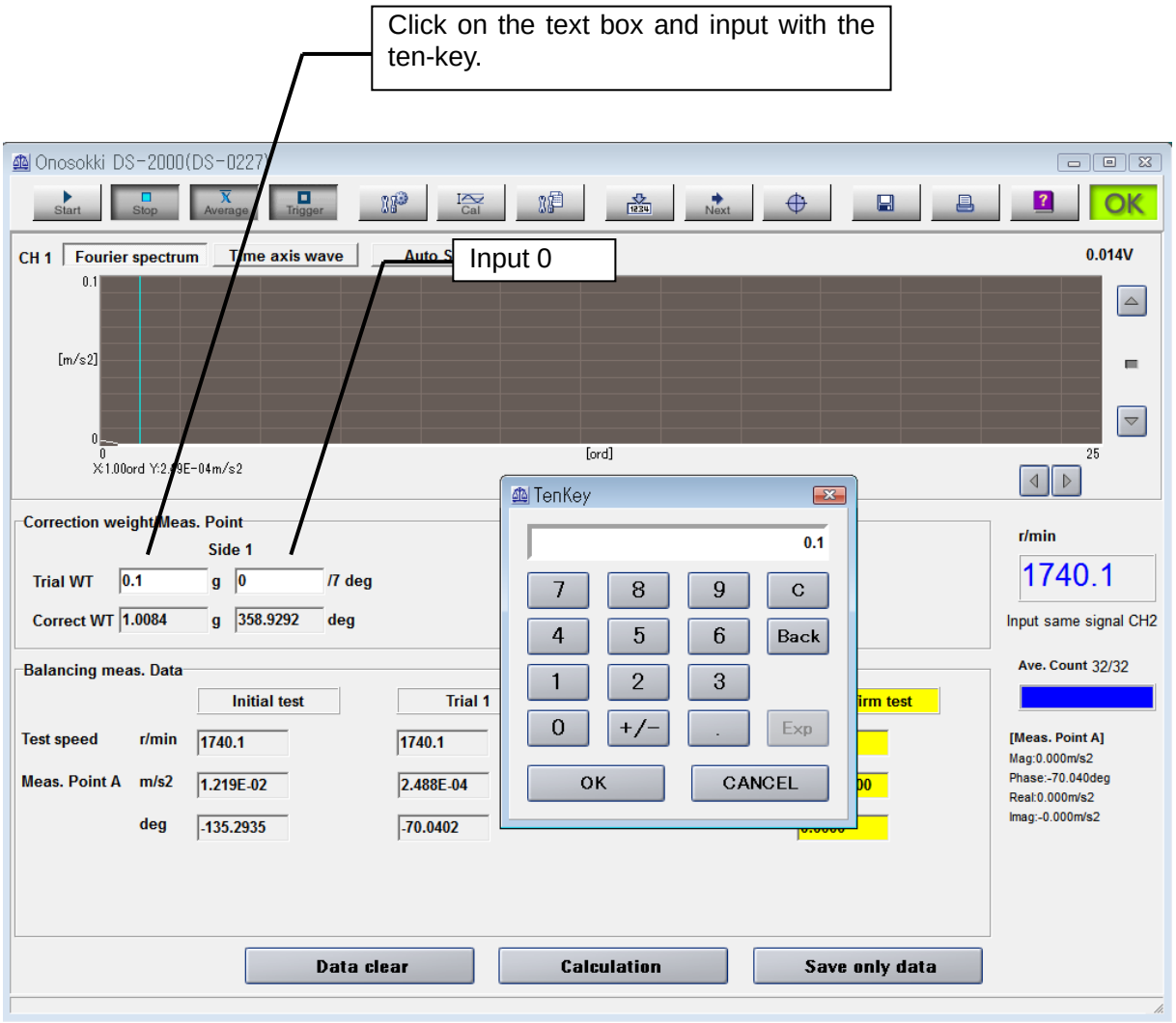


4) Set the trial weight.

Set the trial weight for trial test. The amount of trial weight can be set optionally. If the vibration appears to be intense, reduce the weight of the trial weight.

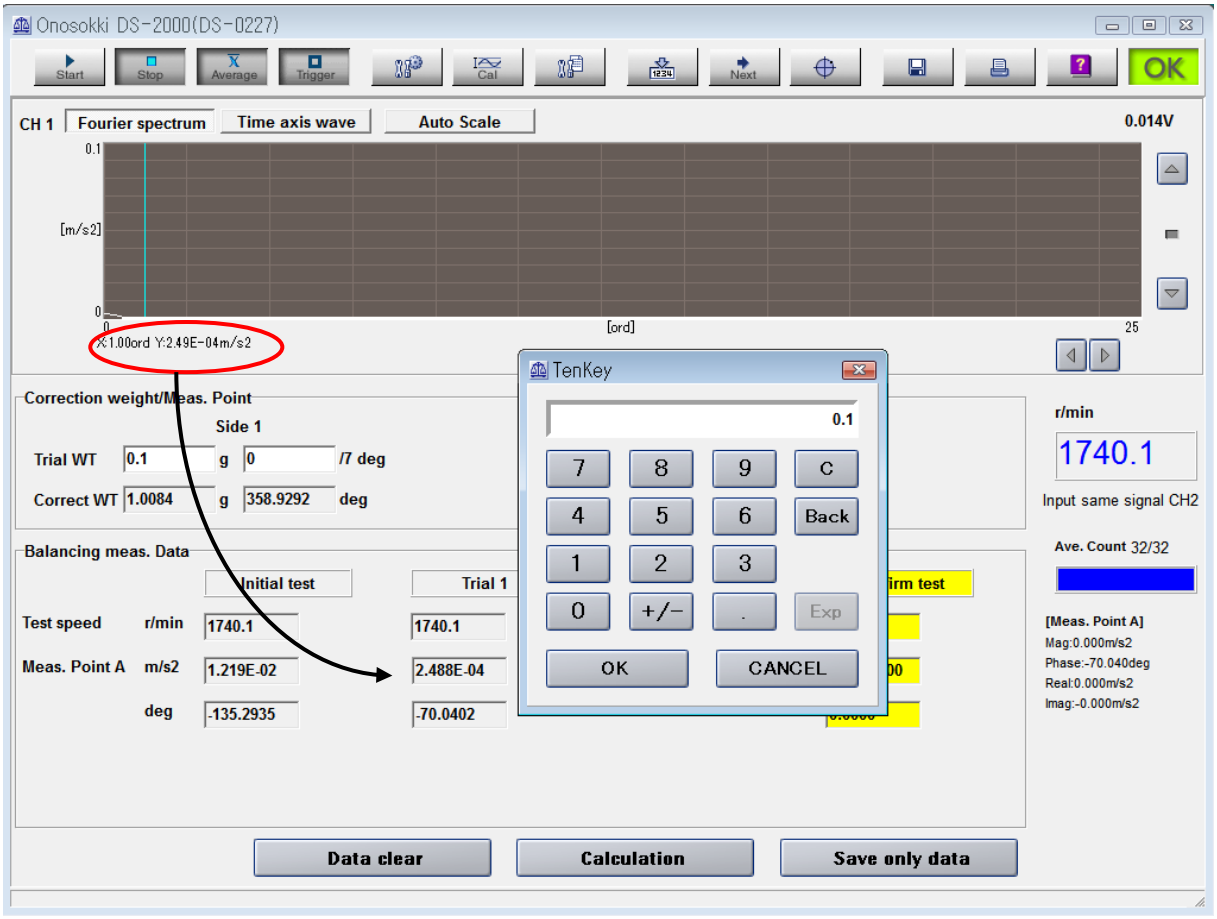
Regardless of the number of divisions of the plane, set the trial weight position to 0.

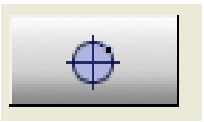
From now on, the reference position of the phase will be the point with the trial weight.



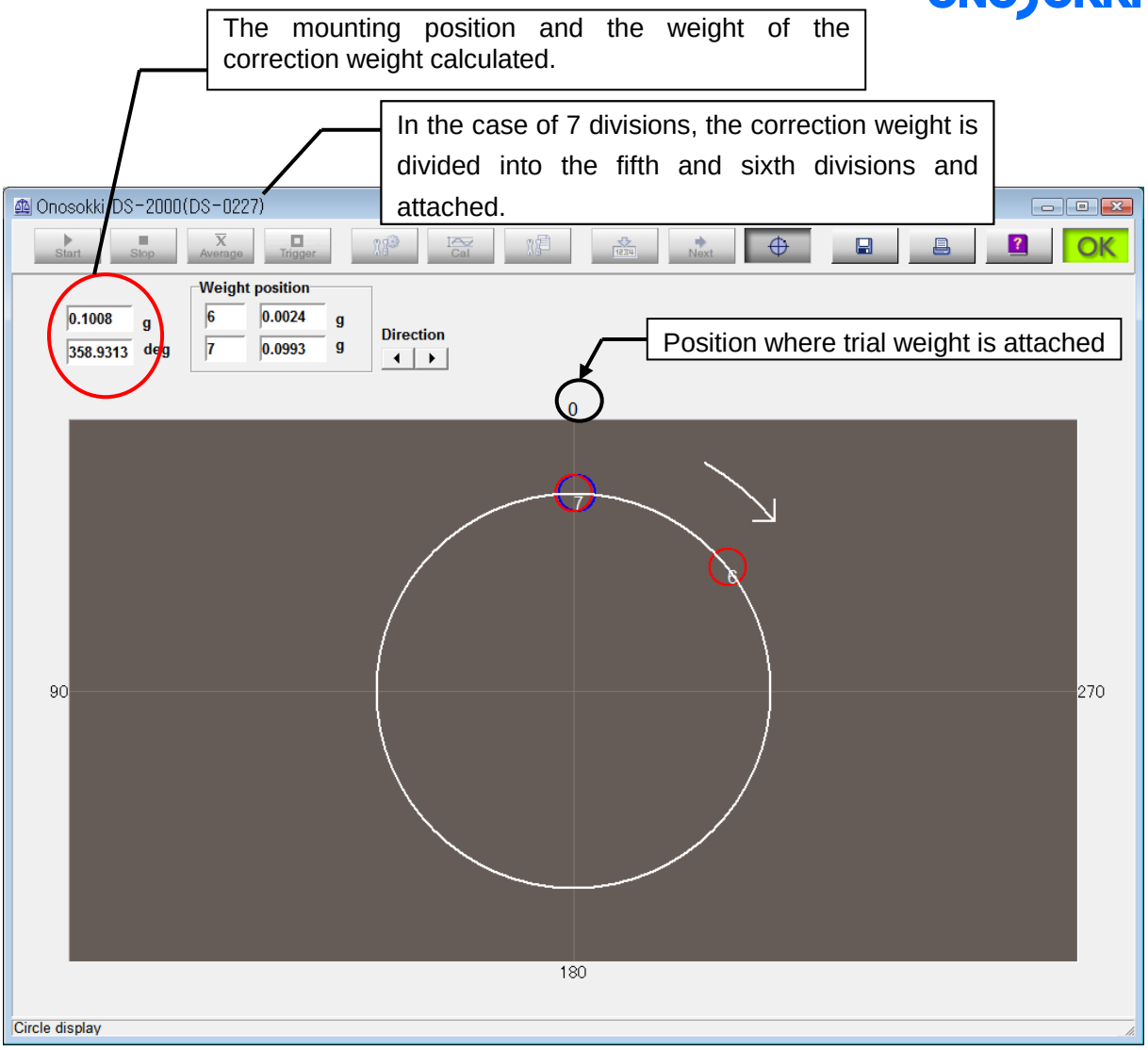
As with the initial test, execute the averaging while triggering, and after the average is completed, press [Data set] button to register the value.

Press [Data set] and register the result of the trial test.





After registering the value of the trial test, press the button of the pie chart to display the position of the correction weight.



As shown above, see the rotation direction as clockwise, and divide the angle in the opposite direction. (It is unified in this direction) In this example, since the weight 0.1 g or less could not be set, the 0.1 g corrective weight was installed at the 5 th.

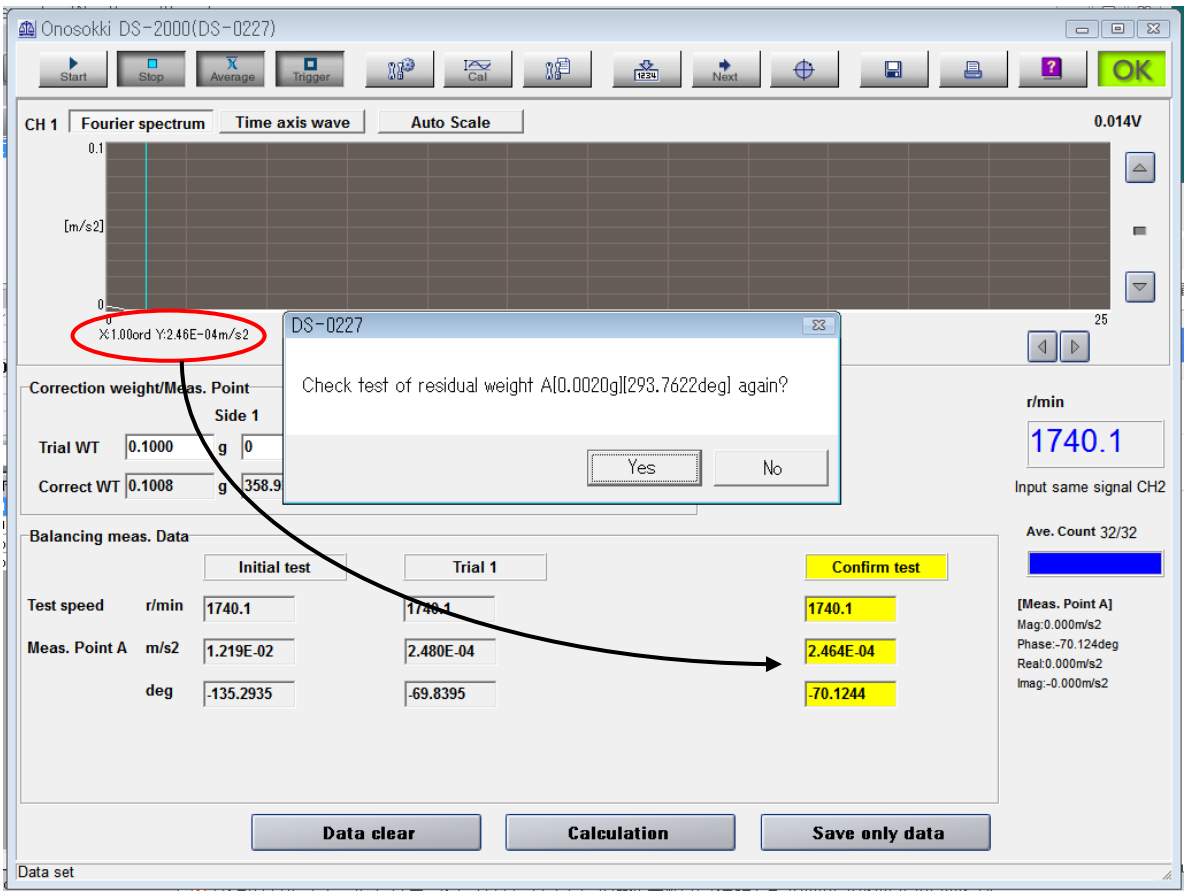
Before conducting the confirmation test, remove the trial weight.

⑤ Confirmation test

Mount a correction weight, and confirm whether unbalance is actually corrected.

Turn off the pie chart button and return to the previous screen.

As well as done in the initial test and trial test, execute the average while triggering.



Press [Data set] to register the result of the confirmation test.

Corrected weight and position of residual vibration are displayed. If the unbalance is sufficiently corrected, press "Yes" to finish the balancing work.

- End-