FT-2500 Advanced Tachometer

Operation manual

ONO SOKKI CO., LTD.

ONO SOKKI

Simplified Operation Manual for

FT-2500 Advanced Tachometer

FT-2500 Advanced Tachometer is a new rotational speed indicator that analyses signals received from a detector directly with Fast Fourier Transform (FFT) algorithm and computes the resultant order component to obtain the rotational speed. This tachometer provides you capability of determining an accurate rotational speed even with complex waveforms if the waveforms contain a signal with periodical factors proportional to the corresponding rotational speed. This tachometer facilitates rotational speed measurements when it is used in combination with our detectors applicable for each application such as MP-9000 series rotary encoders, ignition detectors, microphones, and accelerometers. This tachometer also allows you to measure rotational speed of objects having an unexposed rotational shaft or having a rotary part where any detector cannot be attached, which are hard to measure by conventional tools.

The following describes the flow of measurement and setup mode selections:

Flow of measurements

1. Select the basic configurations in setup mode without connecting detectors and in accordance with each detector to be used.
2. Turn off the power switch of FT-2500, put a detector used in position on the object to be measured and connect the detector to the FT-2500.
3. Switch on the power supply and perform a test measurement.
4. To ensure correct measurement, perform a fine sensitivity adjustment and set an algorithm and a filter as required.
5. Start measurement.
6. When the system power is switched off, it automatically stores the configuration conditions in the CONDITION area memory.
7. When the system power is switched on again, it is activated with the configurations stored in the CONDITION area.

Operating method

Two measurement modes are provided: CONSTANT and ACTIVE.

1. Selection of algorithms

FT-2500 uses a unique algorithm to detect the rotational speed of an object to be measured from the result of analysis with FFT algorithm for the input to a detector.

CONSTANT mode (in a constant or steady operation) and ACTIVE mode (in an accelerating or decelerating operation) are provided, where five different processing methods specified in the following table can be used:

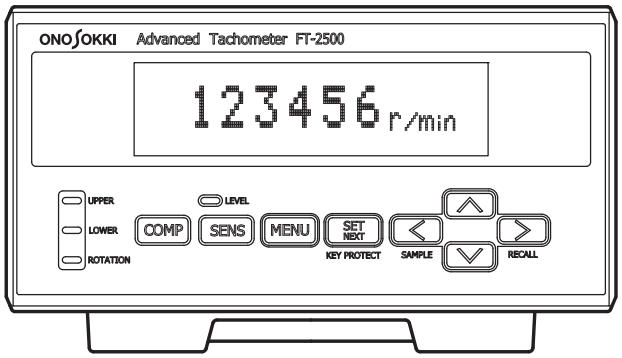
Measurement mode	MODE	Measurement algorithm
CONSTANT (Under steady operation)	**A**	Maximum power spectrum peak detection method
	B	Peak-interval mode method Among multiple power spectrum peak frequency intervals, this method takes the most frequently occurring interval for the computation.
ACTIVE (Under accelerating or decelerating operation)	**C**	Multi-order peak followup method This method allows the system to monitor and calculate a plurality of high orders in addition to first order spectrum.
	D	Maximum power spectrum peak followup method
	E	Specific spectral peak tracking method A method for monitoring and computing specific spectrum that have been selected.

While acceleration or deceleration of a certain degree can be followed up in CONSTANT mode, faster acceleration or deceleration can be followed up in ACTIVE mode by reducing the processing time.

Measurement mode	Display updating time
CONSTANT	0.5 s
ACTIVE	Within 0.25 s (Note that the resolution should be 1/2 of that in the CONSTANT mode.)

While MODE-A is commonly used, MODE-C or MODE-D is employed for a sharp acceleration or deceleration.

2. Front panel and the basic key operation



● Key operation in setup mode

Setup mode termination MENU	Switches the "measurement mode / setup mode." Pressing the key during measurement mode stops measurement Pressing the key during setup mode moves the cursor upward. Pressing the key for a few times brings you back to the setup mode.
Item selection / Value setting SAMPLE RECALL	∧, ∨: keys allow you to select items or to set values. <, >: keys shift the place of numbers.
Set / Item shift SET NEXT KEY PROTECT	Allows you to select items or set numeral values and shift to next item. Note that shifting to upper items with MENU key without pressing the SET/NEXT key lets any set value remain unchanged.

● Error code display

The following table describes error codes displayed, such as “E11”, and their corrective actions:

Error code	Details	Corrective action
E11	Input voltage level has overshot.	・ Raise the set value of input voltage. ・ Press SENSITIVITY key to adjust sensitivity.
E12	Displayed digit overflow occurs (measured value in 7 or more digits).	・ 1,000,000 r/min or more cannot be measured.
E13	In rotation acceleration/deceleration measurement mode, the power spectrum to be followed up has gone out of sight.	・ Press SAMPLE key to repeat the measurement.
E14	The power spectrum peak of power does not exist within the filter-set measuring range, but exists beyond the range.	・ Adjust the filter setting.
E15	In rotation acceleration/deceleration measurement mode, pressing the SAMPLE key while the front panel display area kept showing the massage "READY," could not cause any power spectrum that should/may be followed up to appear.	・ Adjust the sensitivity and sensor mounting position so that the level monitor LED is lit in green.

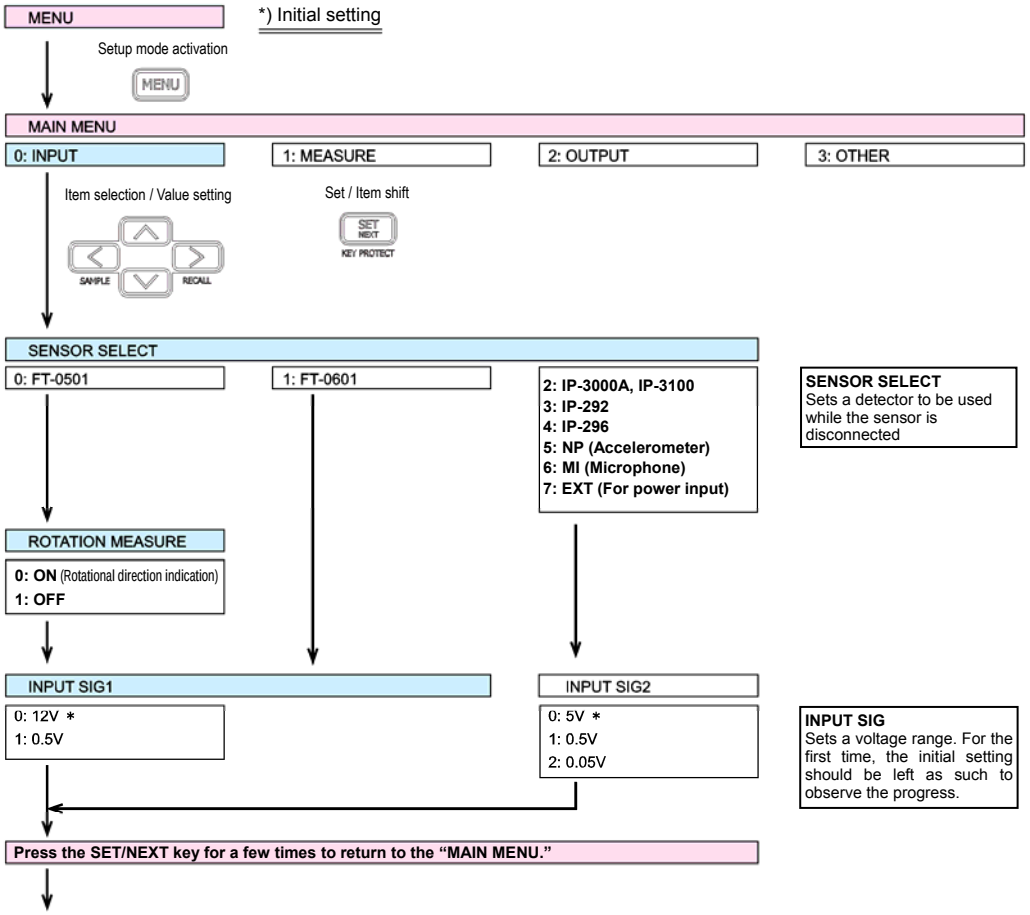
3. Flow of operations in the setup mode

For the details of connection with a detector and setting for each detector type, please refer to the operation manual. Note that basic settings are set as initial default values.

Flow of the major items is as follows: INPUT → MEASURE → OUTPUT → OTHER. Each major item has different subordinate setting, of which flow of items will be descried in the following. Meaning of each item is described it.

3-1 INPUT

Set the selected detector and voltage range.



To avoid any unforeseeable damage, connect a detector only after setting the detector type.

Set the voltage range to the maximum for an object to be measured for the first time.

In a test measurement stage, conduct the fine adjustment by using the SENS key under Step 4. "Fine adjustment of sensitivity." When fine adjustment is difficult to complete, modify the voltage range.

Since the system calculates a rotational speed by analyzing the frequency, importance is placed on the periodicity of a signal, rather than the magnitude of amplitude.

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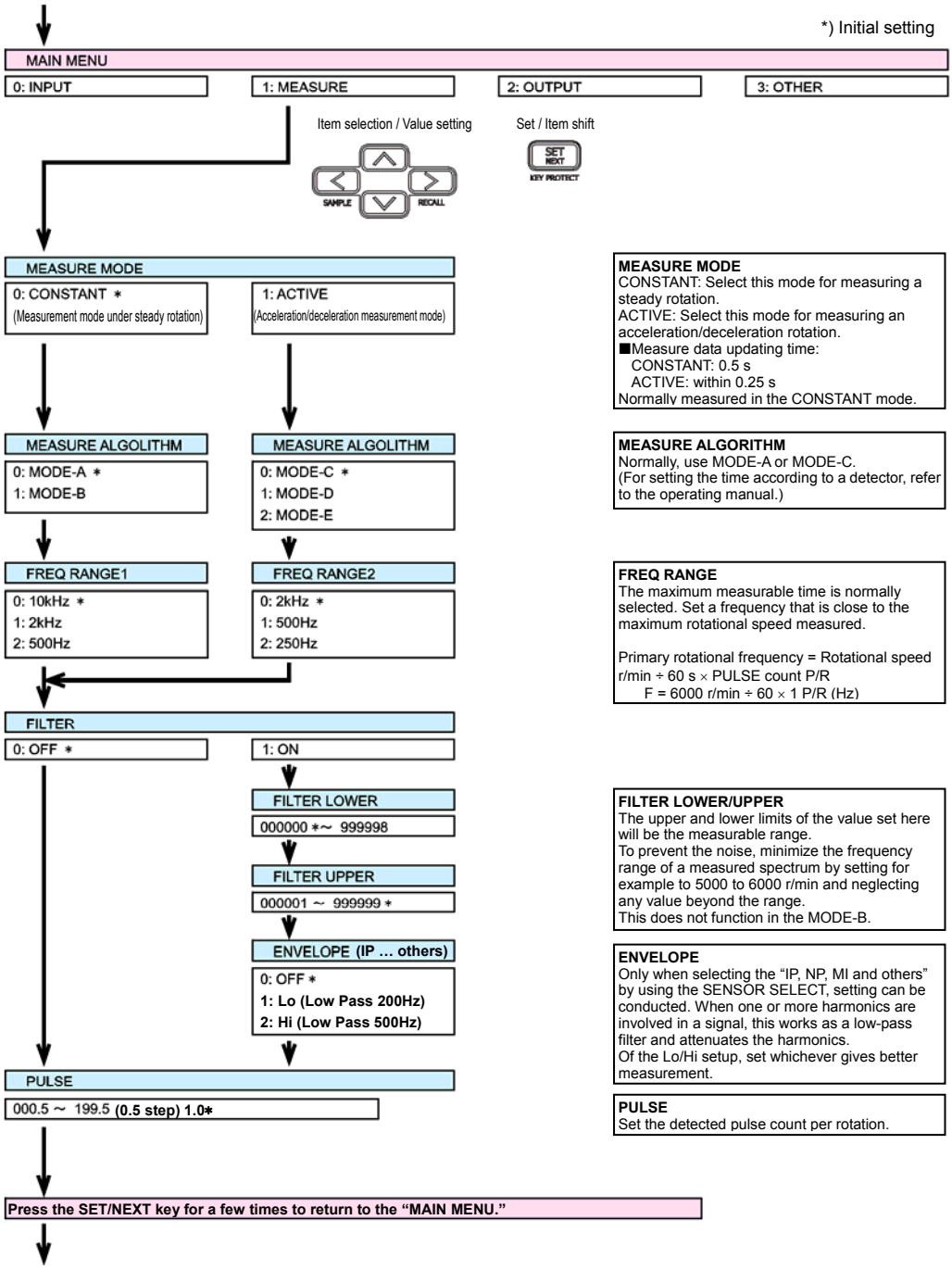
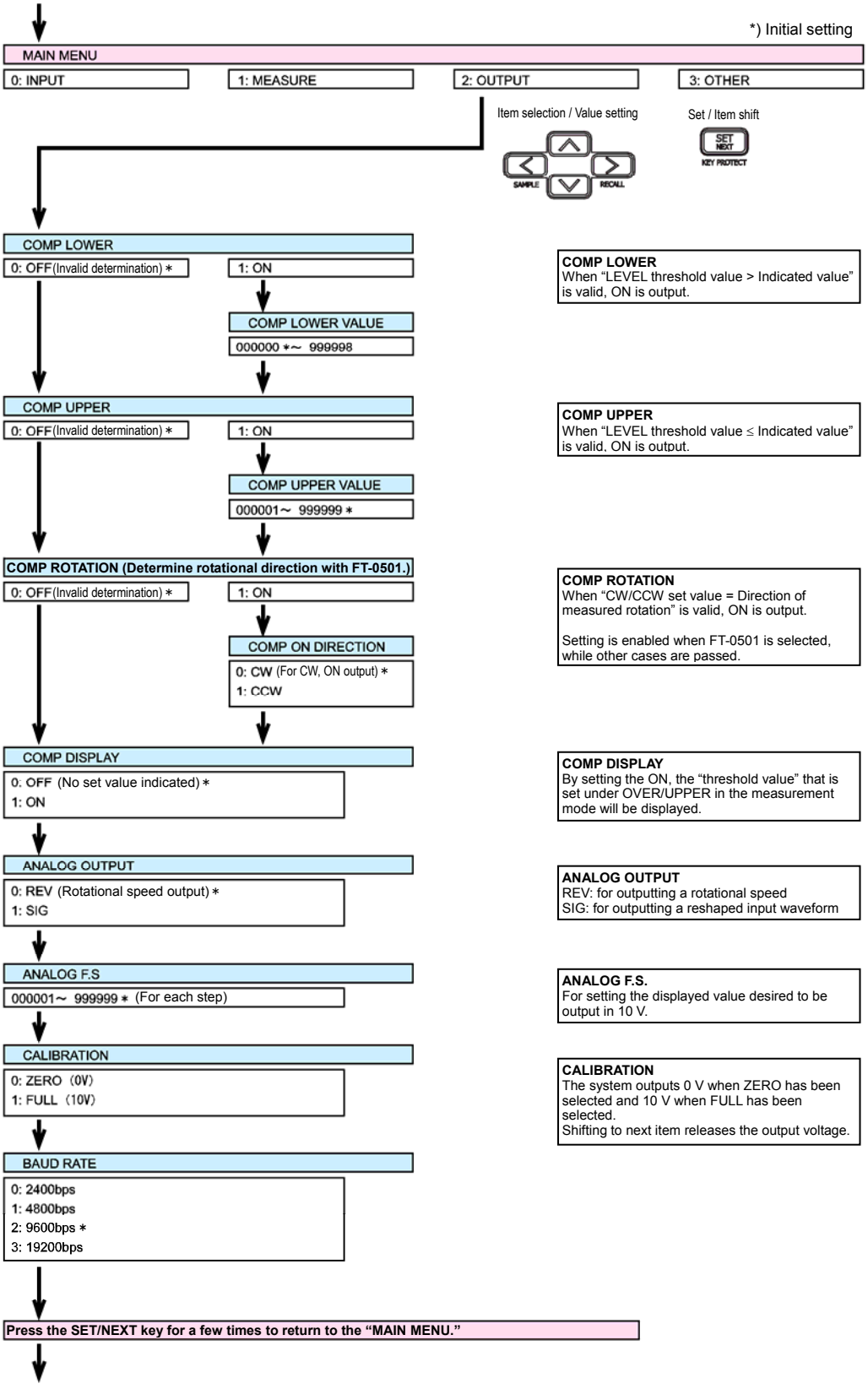
3-2 MEASURE

Set the measurement algorithm, frequency range, filter, pulse count and other measuring conditions.



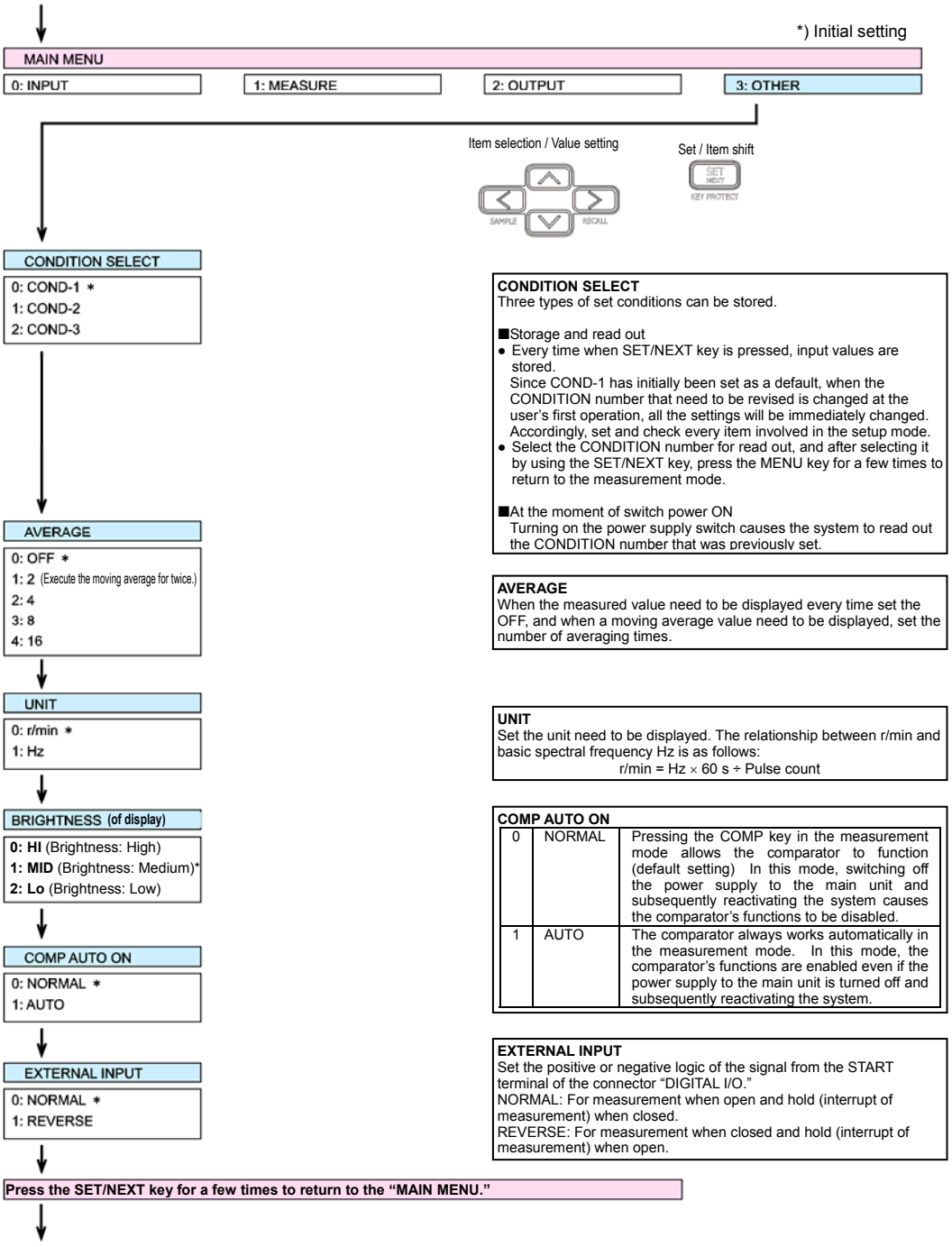
3-3 OUTPUT

Set the comparator and analog output conditions.



3-4 OTHER

Set the values related to displays such as averaging display and condition number to be used.



CONDITION SELECT
Three types of set conditions can be stored.

■Storage and read out
- Every time when SET/NEXT key is pressed, input values are stored.
  Since COND-1 has initially been set as a default, when the CONDITION number that need to be revised is changed at the user's first operation, all the settings will be immediately changed. Accordingly, set and check every item involved in the setup mode.
- Select the CONDITION number for read out, and after selecting it by using the SET/NEXT key, press the MENU key for a few times to return to the measurement mode.

■At the moment of switch power ON
Turning on the power supply switch causes the system to read out the CONDITION number that was previously set.

AVERAGE
When the measured value need to be displayed every time set the OFF, and when a moving average value need to be displayed, set the number of averaging times.

UNIT
Set the unit need to be displayed. The relationship between r/min and basic spectral frequency Hz is as follows:

r/min = Hz × 60 s ÷ Pulse count

COMP AUTO ON

0	NORMAL	Pressing the COMP key in the measurement mode allows the comparator to function (default setting) In this mode, switching off the power supply to the main unit and subsequently reactivating the system causes the comparator's functions to be disabled.
1	AUTO	The comparator always works automatically in the measurement mode. In this mode, the comparator's functions are enabled even if the power supply to the main unit is turned off and subsequently reactivating the system.

EXTERNAL INPUT
Set the positive or negative logic of the signal from the START terminal of the connector "DIGITAL I/O."
NORMAL: For measurement when open and hold (interrupt of measurement) when closed.
REVERSE: For measurement when closed and hold (interrupt of measurement) when open.

● **CONDITION SELECT**

Storing the set conditions

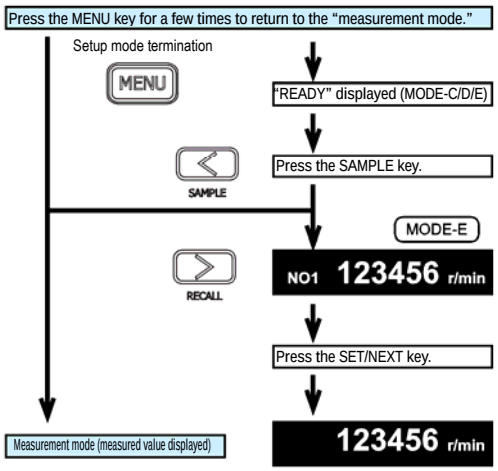
- When setting values, their storage is performed each time of pressing the SET/NEXT for confirmation.
- Values for initial setting are stored in COND-1, which is the initial setting.
- When a CONDITION number is changed, check the overall status of set modes.

Read out method

- Select CONDITION number and enter set values by pressing the SET/NEXT, and then press the MENU key for a few times to return to the measurement mode. Note that when switching on the power supply, the CONDITION number for the power off moment is read out.

3-5 Measurement mode

After setting the measuring conditions in the setup mode, return to the measurement mode.



MODE-C/D/E
In each case of the above, when returned to the measurement mode, the sign "READY" is displayed.
In the operating state before change of rotation, press the SAMPLE key.
A following up spectrum is set, and the measurement starts.

Note that pressing the SAMPLE key in MODE-E allows the system to display the candidate "No. 1." If the No. 1 is not a correct display, press the RECALL key to switch to No. 2 through No. 8.
Maximum number that can be switched to differs with the signal status. Selecting that with a correct rotational speed display and subsequently setting the value by pressing the SET/NEXT key will cause the system to return to the measurement mode.

3-6 Conducting a test measurement to verify correct measurements

Set algorithms and filters for correct measurement by referring to the instructions in Step 4. "Fine adjustment of sensitivity" and Step 5. "Troubleshooting.

4. Fine adjustment of sensitivity

Pressing the SENS key causes such a message as “SENSITIVITY 05” to appear. Adjust the sensitivity level 0 to 10 (maximum sensitivity at 10) by using ∧, ∨ keys so that the green LEVEL lamp is lit. When fine adjustment is difficult to complete, modify the voltage level in the INPUT of the setup mode. Pressing the SENS key again brings you back to the measurement mode. However, for both of the detectors FT-0501 and FT-0601, this method does not work.

5. Troubleshooting

The followings are excerpted from the operating manual.

When a failure is suspected, first check the following. If the system fails to function properly even after the checking, contact our distributor from whom you purchased the product or our sales office nearby.

■ **Measured rotational speed fails to remain constant.**

Try the following actions:

A Relocate the sensor's detecting position.
Since measurements are achieved by using weak signals, changing the sensor's detecting position often gives stable measurements.

B Replace or modify the algorithm
Since each algorithm has unique characteristics, changing it may be worth a try.

● Constant rotation measurement mode
MODE-A → Effective when the first order frequency component is significantly large.
MODE-B → Effective when the first, second, third ...order 1 frequency components are clearly recognized.
●Rotation Acceleration/deceleration measurement mode
MODE-C → Effective when any order component(s) other than the first order are included.
MODE-D → Effective when the first order frequency component is significantly large.
MODE-E → Allows the system to follow up the peak initially specified by the user.

C Avail the filtering function.
A filtering function restricts the measuring range. When the measured value of an object of measurement can be assumed in advance, limiting the range may lead to a

stable measurement. However, since a filtering function becomes invalid in MODE-B, use MODE-A for a constant rotation measurement mode.

Example setting of lower limit:
When a measure rotational speed is 1/2 or less than the estimated rotational speed, set the value to approximately 60% of the estimated rotational speed.
Example setting of upper limit:
When a measure rotational speed is 2 times or more of the estimated rotational speed, set the value to approximately 180% of the estimated rotational speed.

D Modify the frequency range

If feasible, change the frequency range to a lower frequency range. Selecting an unnecessarily high frequency may cause an erroneous measurement.

E Change detecting method (sensors)

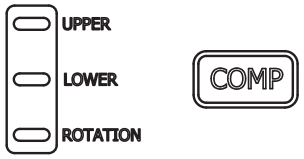
If the above-mentioned actions fail to enable stable measurements, try changing the detecting method (sensors).

6. Comparator functions

In each of the comparator setup mode, different actions will be performed as specified in the following table:

Setup mode	Action
OTHER－ COMP AUTO ON: AUTO	Turning power switch on causes the comparator function to be automatically activated.
OTHER－ COMP AUTO ON: OFF	Pressing the COMP key on the front panel causes to activate the comparator function. Note that switching off the power supply releases the function.
OUTPUT－ COMP DISPLAY	LO: LOWER, HI: UPPER The upper and lower threshold values are displayed, respectively. Either one is displayed regardless of ON/OFF of the comparator. 

Determined results are output in the four types on the rear panel through DIGITAL I/O connectors as shown in the following table and the lamp is lit.



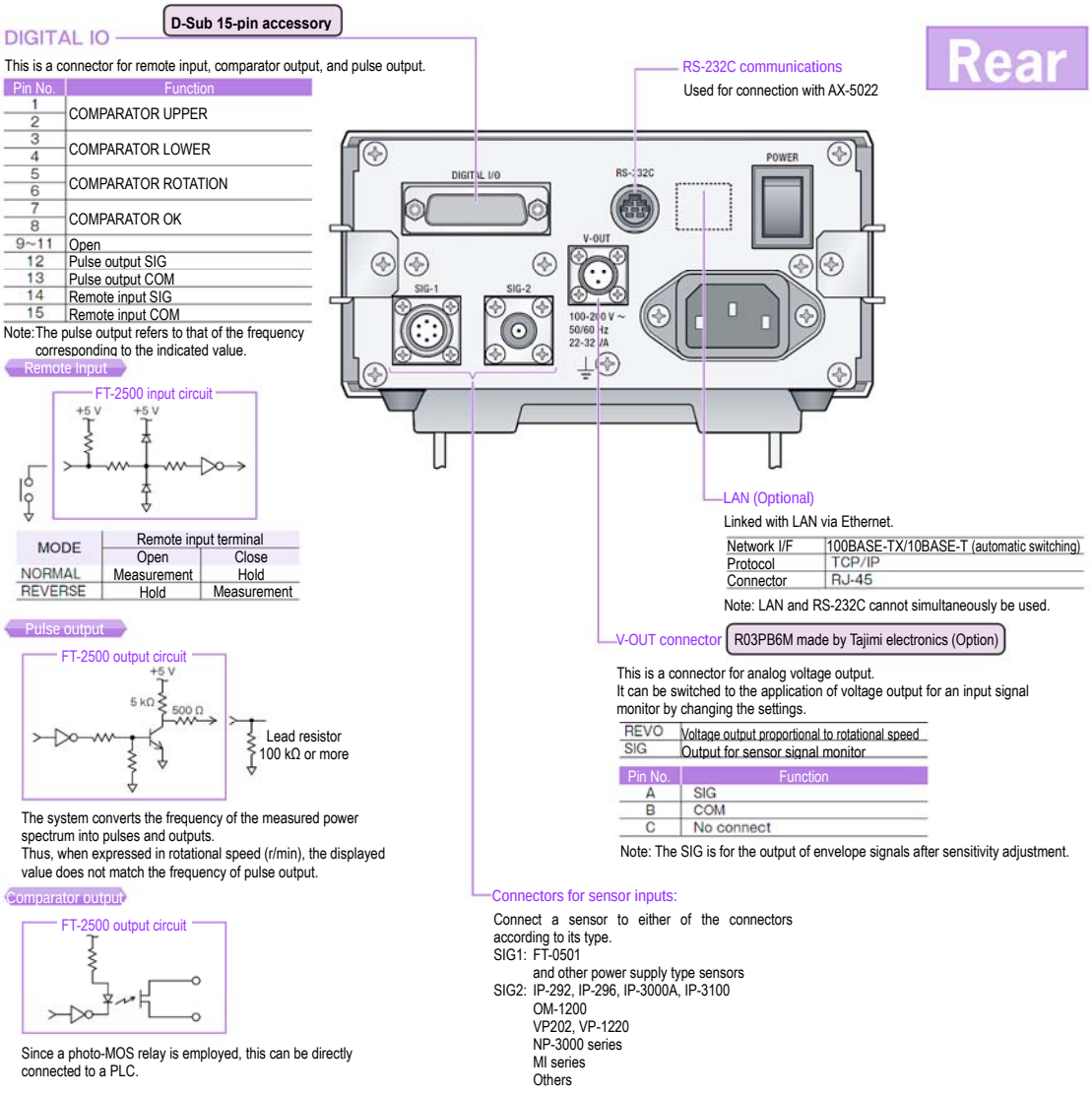
LOWER	Threshold value > Displayed value
UPPER	Threshold value ≤ Displayed value
ROTATION	Set value for the comparator acting direction = Direction of rotation for measurement
OK	All the above comparators are turned off.

7. Protect key

Pressing the SET/NEXT (KEY PROTECT) key for 2 s or more enables the setting of protect key ON/OFF.

Setting system	Pressing the SET/NEXT key for about 2 s in the measurement mode enables the key protect function.
Releasing method	Pressing the SET/NEXT key for about 2 s with the key protect function enabled releases the function.
Protecting range	Every key except the < (SAMPLE) when restoring the measurement preparation state in the accelerating/decelerating rotation mode.

8. Rear panel



- End.