

Instruction Manual (Basic Operations)

Thank you for purchasing our Handheld Advanced Tachometer.

Read through this manual in order to make full use of it.

Warnings and Cautions

In this document precautions are classified into two categories: WARNING and CAUTION. This depends on the degree of danger or damage possible if the precaution is ignored and the product is used incorrectly.

**WARNING** This symbol is used to indicate precautions where there is a risk of death or serious personal injury to the operator if the product is handled incorrectly.

**CAUTION** This symbol is used to indicate precautions where there is a risk of some personal injury to the operator or only material damage to the product if the product is handled incorrectly.

Omission of Issuance of Certificate

This product has been tested under strict conditions for normal operation before shipment. Please note that the issuance of certificate is omitted.

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Warranty

- This product is covered by a warranty for a period of one year from the date of purchase.
- This warranty covers free-of-charge repair during the warranty period for defects occurred while the product is used under normal operating conditions according to descriptions in this manual and notices on the unit label.
- For free-of-charge repair during the warranty period, contact your dealer or Ono Sokki sales office nearby.
- Even during the warranty period, the following failures will be handled on a fee basis.
  - (a) Failures or damages occurring through misuse, misoperation, or modification
  - (b) Failures or damages occurring through mishandling (dropping) during transportation after purchase
  - (c) Failures or damages occurring through natural calamities (fires, earthquakes, flooding, and lightning), environmental disruption, or abnormal voltage
  - (d) Replenishment of expendable supplies, spare parts, and accessories.

- \* This warranty does not limit any legal rights of customers.
- \* If a customer engineer is dispatched to remote locations, the customer will be demanded for actual expenses.
- \* For any questions such as those about repair after expiration of the warranty period, contact the dealer from which you purchased the product or the Ono Sokki sales office nearby. If the function of the product could be maintained through repair, it will be handled on a fee basis.
- \* This warranty covers only the product itself; it does not cover any damages resulting from failures of the product.

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Be Sure to Read Before Starting Operation

**WARNING**

- Be careful about rotating parts of an engine, motor, etc. during measurement. When using an optional detector and/or AC adapter, take care not to let the cables be rolled into the rotating part of the engine.

- Be careful about hot parts of an engine, motor, etc. during measurement.

**CAUTION**

- Do not let this product touch hot parts of an engine, motor, etc. This product is not heat-resistant. So, be careful not to let it touch hot parts (exhaust pipe, etc.).

- Do not let this product touch an ignition coil. Doing so may cause malfunction or failures.

- Accurate measurement may be disabled for an engine with faulty ignition system (distributor, high-tension cable, ignition plug, etc.).

- Be sure to use the dedicated AC adapter (optional), when necessary. Using other adapters may cause failures.

- When installing dry cell batteries in the product, take care of polarities. If dry cell batteries are installed in wrong direction, the fuse may blow.

- Avoid rapid temperature change. Do not move the product from a hot to cold place, or vice versa, in a short period of time. Dew condensation inside the device may cause failures.

- Prevent foreign substances such as water, oil, dust from getting into the device. Do not use the device in a place where it may get wet or oily or in environment subject to moisture or dust.

**CAUTION**

- Be careful not to let it fall or give strong vibration or shock to it. This product contains precision electronic parts. Be careful not to let it fall or give strong vibration or shock to it.

- If the product is contaminated, wipe it with dry cloth or cloth dipped in solution of neutral detergent and tightly squeezed. Do not use volatile oil such as thinner or benzene or alcohol.

Overview

1. Overview

This product is a tachometer of handheld type that measures rotational speed by analyzing sensor signal frequencies through FFT processing.

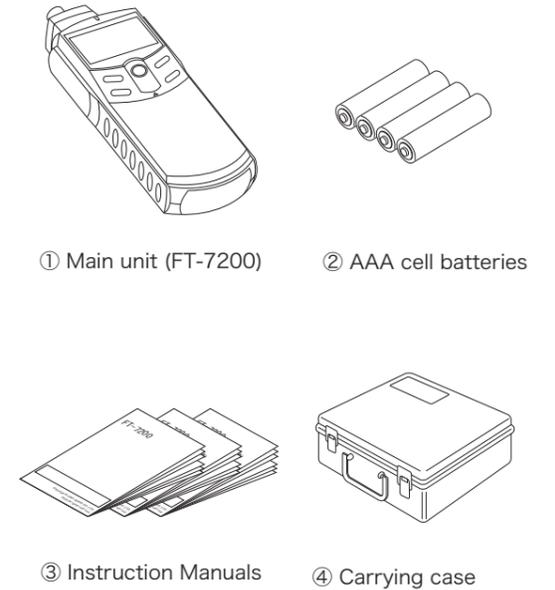
2. Features

- Applicable to various types of sensors
- Large and easy-to-read LCD
- Equipped with analog and sensor signal monitor outputs
- Both AAA cell batteries and AC adapter available
- Equipped with backlight function convenient for use in dark place
- Equipped with pulse output

3. Product Configuration

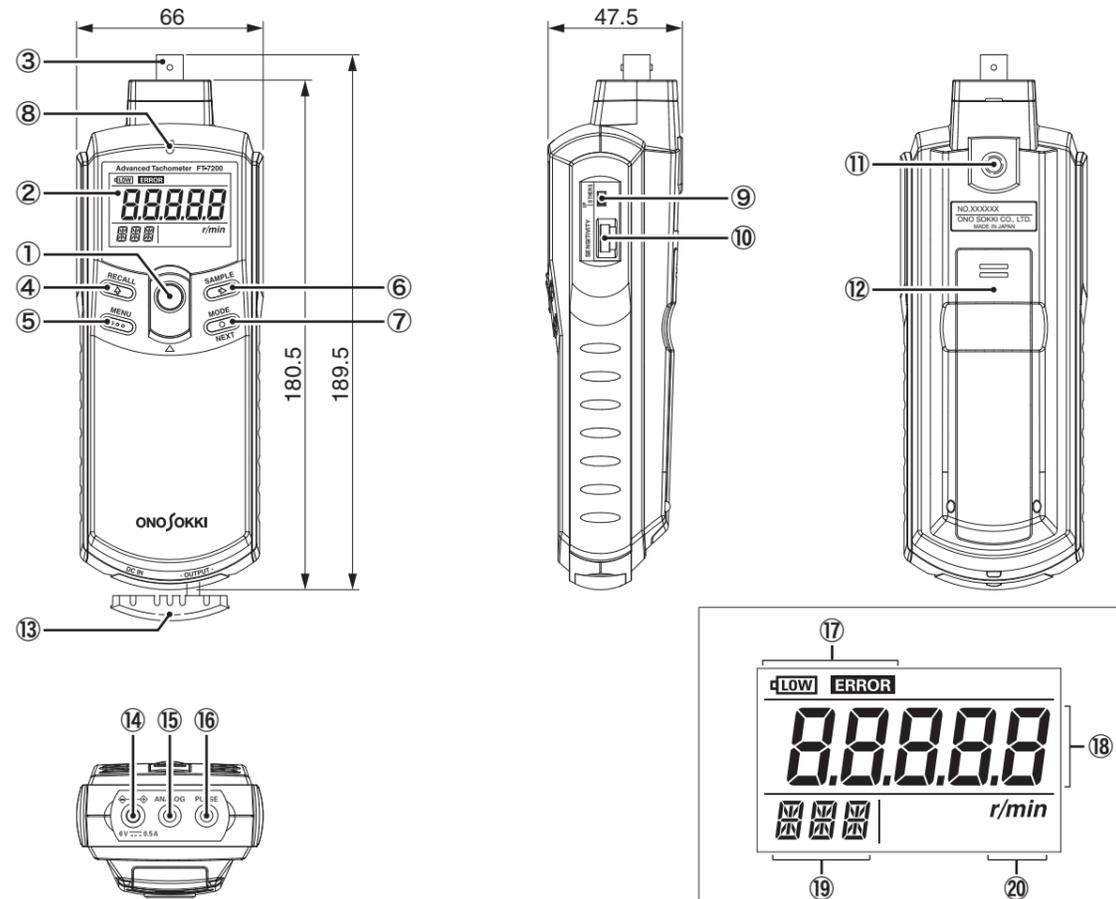
After opening the packing box, confirm that it contains all the items listed below.

①	Main unit (FT-7200)	One
②	AAA cell battery	Four
③	Instruction Manuals	Three different manuals
④	Carrying case	One



Note: Detectors are optional.

Part Names and Functions



- Power switch**  
Used to set the power ON/OFF.
- Display**  
Displays measurement values and settings.
- Input connector**  
Connector for connecting sensors.
- RECALL/↑ switch**  
In setup mode, this switch is used to enter numeric values or change selections. For acceleration/deceleration rotation measurement (when algorithm E of "ACT" mode is selected) in measurement mode, this switch is used to select the rotational speed at the measurement start from sampled candidate values.
- MENU switch**  
Used to switch over between measurement and parameter setup modes.
- SAMPLE/→ switch**  
In setup mode, this switch is used for digit shifting. Before starting acceleration/deceleration rotation measurement (when "ACT" mode is selected) in measurement mode, this switch is used to calculate rotational speed candidate values for the measurement start by sampling rotational speed data.
- MODE/NEXT switch**  
For acceleration/deceleration rotation measurement (when algorithm E of "ACT" mode is selected), this switch is used to determine the candidate value selected with the ④ RECALL switch as the rotational speed at the measurement start.
- Indicator (input signal check light)**  
When the amplifier sensitivity is appropriately set for the sensor signal amplitude, this indicator blinks cyclically.

- This indicator is off when no sensor signal is input or the amplifier sensitivity is insufficient. It is lit when the amplifier sensitivity is excessive.
- Sensor selection switch**  
This switch is used to switch between IP Series and other sensors.
- Sensor amplifier sensitivity adjustment dial**  
Dial for adjusting the sensor amplifier sensitivity.
- Tripod mounting hole**  
Tapped hole for mounting tripod
- Battery cover**
- Connector cover**  
Cover of DC power input and output connectors
- DC power input**  
Input connector for connecting dedicated AC adapter (When the dedicated AC adapter and batteries are both used, the AC adapter is used in priority.)
- ANALOG output**  
Connector for connecting optional AX - 501 cord of recorder, etc.
- PULSE output**  
Connector for connecting optional AX-501 cord for outputting pulse converted from power spectrum frequency
- CONDITION display**  
Displays low battery level or an error.
- MAIN display**  
Displays measurement values, selected contents, set values, etc.
- SUB-display**  
Displays set items, etc.
- UNIT display**  
Displays measurement unit (r/min).

## Before Use

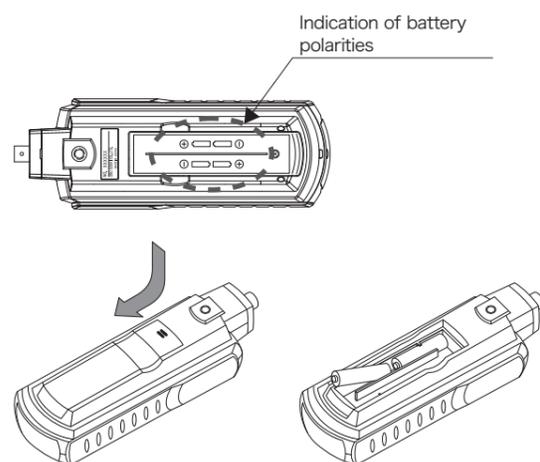
### 1. Power supply

This product is supplied the power from four AAA batteries or optional AC adapter (PB-7080).

When low battery mark "LOW" has appeared, replace the batteries with new ones. Make sure that the batteries to be installed are all new ones.

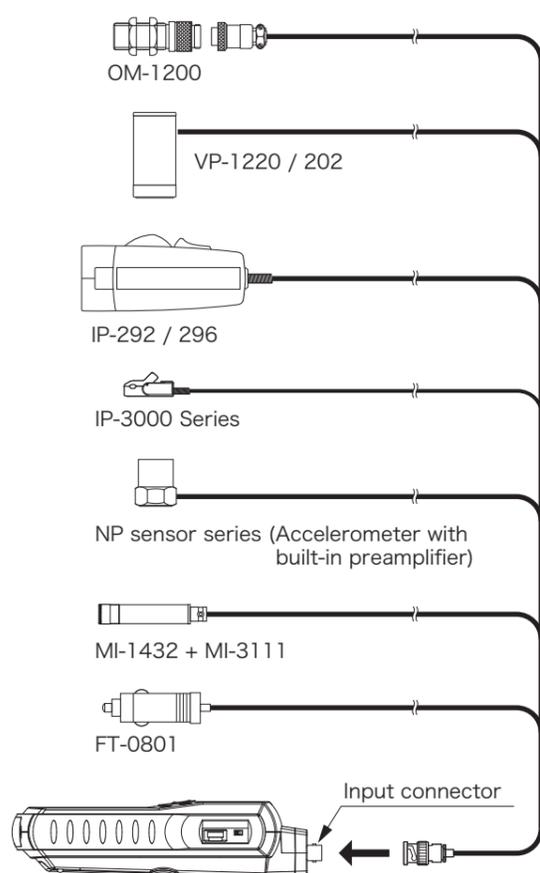
#### ● Replacing batteries

- Slide and remove the battery cover by lightly pushing the two grooves on the cover with your finger.
- Install batteries, making sure they are in correct directions. If batteries are installed in wrong direction, the protection circuit may function to cause the fuse to blow.
- Close the battery cover.



### 2. Measurement

- When using the product for the first time, make various settings of mainunit before connecting the sensor. Such as sensor selection to be used in setup mode. The settings once specified remain saved when the power is OFF. (See "Function Description"/"Description of Functions and Operations"/3 "Setup mode"/3 "Select Sensor".)
- Securely connect the connector of the detector used to the input connector of this product.
- Slide the power switch to set the power ON.
- Set the measurement algorithm. (See "Function Description", "Description of Functions and Operations"/3 "Setup mode"/5 "Set operation mode" and 6 "Set measurement algorithm".)
- Set the number of pulses (P/R) per rotation according to the object to be measured.
- In measurement state, turn the sensor amplifier sensitivity adjustment dial until the indicator blinks steadily.

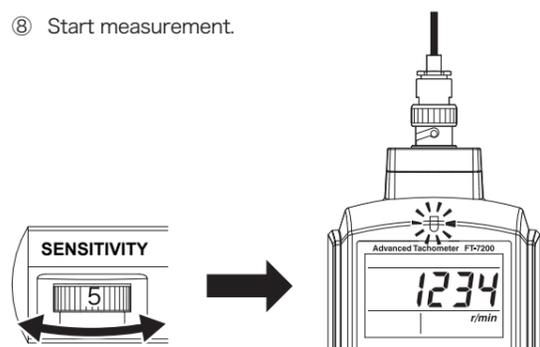


Note : All sensors are optional.

steadily.

- If the adjustment cannot be completed with the sensor amplifier sensitivity adjustment dial, change the input voltage level in setup mode and readjust the sensor amplifier sensitivity. (See "Function Description"/"Description of Functions and Operations"/3 "Setup mode"/1 "Select input voltage level".)

- Start measurement.



### 3. Precautions for Measurement

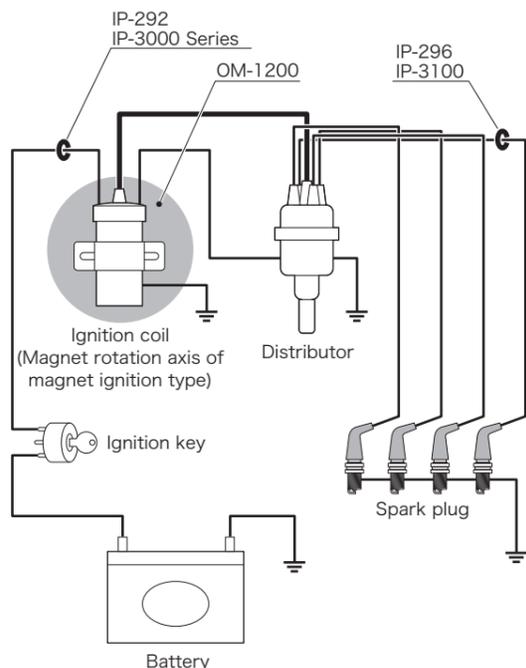
- During measurement, take care not to let this product touch an ignition coil. If this product has accidentally touched the ignition coil and the display has become unstable, once set the power switch OFF and then ON.
- If the sensor selection in setup mode is not correct, accurate measurement cannot be done. Make setting of sensor selection to be used in the setup menu or using the sensor selection switch.

### 4. Sensor Connection Locations

Each sensor has its own connection location defined. Connect the sensor to the correct location (see Instruction Manuals of the related sensor).

- If there is influence from another cylinder, keep the product away from its secondary cable.
- If there is influence from another cylinder, protect against it by shielding, etc.

Sample connections for engine rotation measurement



### Options

- Output cable: AX-501
- AC adapter: PB-7080 (manufactured by KAGA COMPONENTS) (Input: 100 to 240VAC, Output: 6VDC)
- Sensors: OM-1200, VP-1220, VP-202, IP-292, IP-296, IP-3000A, IP-3100, Various NP series sensor (Accelerometer with built-in preamplifier), MI-1432 + MI-3111, FT-0801

\*Custom-made sensors (magnetic flux leakage sensor, LED reflected light optical fiber sensor) are available.

### Storage

The storage temperature range of this product is -10°C to +50°C.

When storing the product, keep it in a well-ventilated place avoiding direct sunlight; a place with very high or low temperature or high humidity is not acceptable.

If the product is not to be used for a long period of time, be sure to remove batteries to avoid accidents resulting from battery liquid leakage, etc.

## Specifications

### 1. Measurement section

Objects to be measured: DC motors, compressors, gasoline engines, or other rotating bodies

Computing type: FFT

Measurement time: 250ms or less

Input frequency range: 2000Hz range; 30 to 2000Hz  
500Hz range; 7.5 to 500Hz  
250Hz range; 3.75 to 250Hz

Measurement unit: r/min (rotational speed)

Measurement accuracy:  $\pm 2 \times$  rotational speed resolution (r/min)  $\pm 1$  count  
\* The rotational speed accuracy depends on the frequency range.

Minimum rotational speed resolution: Frequency range (Hz)/6400x60/Set pulse count (P/R)  
\* When the rotational speed is increasing or decreasing, the resolution goes lower.

Filter function: Limiting the target frequency range (rotational speed range) within the selected frequency range

Averaging process: Moving-average method  
Average count; OFF, 2, 4, 8, 16

Sensor amplifier sensitivity adjustment dial: The dial on the right side of the main unit can be used to adjust the sensor amplifier sensitivity.

### 2. Detector section

Applicable sensors: OM-1200, VP-1220, VP-202, IP-292, IP-296, IP-3000A, IP-3100, NP series sensor (Accelerometer with built-in preamplifier), MI-1432 + MI-3111, FT-0801

\*Custom-made sensors (magnetic flux leakage sensor, LED reflected light optical fiber sensor) are available.

Voltage levels: 5V; Maximum  $\pm 5V$   
0.5V; Maximum  $\pm 0.5V$   
0.05V; Maximum  $\pm 0.05V$

Input coupler: AC coupling

Precaution for measurement: Correct detection may not be attained for some types of engines and objects to be measured.

Power supply for NP series sensor: Constant-current power supply (2.2 to 3.2mA at 25°C)

### 3. Display section

Number of digits: 5  
Character height: 10.2mm  
Display device: 7-segment LCD with backlight  
Display update time: 0.5  $\pm$  0.2s  
Display resolution: 1r/min

### 4. Measurement modes

CNS (Constant): Used for measurement objects with little variation in rotational speed (for example, when measuring rated rotational speed)

ACT (Active): Used for measurement objects with increasing/decreasing rotational speed (Note that correct measurement may not be attained for rapid changes.)

### 5. Analog output section

● REVO  
Output contents: Output related to rotational speed displayed value

Voltage range: 0 to F.S./0 to 1V

Conversion type: 10-bit D/A conversion

Linearity:  $\pm 1\%$  of F.S.

Output update time: 250ms or less

Temperature stability:  $\pm 0.05\%$  of F.S./°C (ZERO/SPAN)

Set error:  $\pm 0.5\%$  of F.S (Factory default of error set, ZERO/SPAN)

Load resistance: 100k $\Omega$  or more

Output connector: Super mini jack ( $\phi$  2.5)

#### ● SIG

Output contents: Analog output for monitor acquired by waveform shaping of sensor signal

Load resistance: 100k $\Omega$  or more

Output connector: Super mini jack ( $\phi$  2.5, shared with "REVO" output)

### 6. Pulse output section

Signal contents: Pulse of power spectrum frequency extracted by FFT processing

Output voltage: Lo; 1V or less  
Hi; 4.5V or more (with no load)

Output update time: 250ms or less

Load resistance: 100k $\Omega$  or more

Output connector: Super mini jack ( $\phi$  2.5)

### 7. General Specifications

Power supply: Four AAA batteries or optional AC adapter (PB-7080).

Continuous operation time: Approximately 6 hours (with backlight OFF)  
Approximately 5 hours (with backlight ON)  
(with alkaline batteries used at 20 ° C and NP series sensor unused (\*1))

\*1 When using NP series sensor, use of the dedicated AC adapter is recommended because the consumption current increases for driving the constant-current power supply.

Low battery indication: Lit at approximately 4.2V

Operating temperature range: 0°C to +40°C

Storage temperature range: -10°C to +50°C

Operating humidity range: +35 to 85%RH (without condensation)

Storage humidity range: +35 to 85%RH (without condensation)

Mass: Approximately 230g (main unit only, without dry cell batteries)

Outer dimensions: 189.5 x 66.0 x 47.5mm (main unit only)

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**Description of Functions and Operations**

**1. Power switch**

- Slide the power switch upward to power the main unit.
- When the device is powered, the main display and subdisplay show the software version and product code "FT7", respectively, and then the unit enters measurement mode.
- Parameters hold the previous measurement conditions.
- When starting measurement for the first time, set parameters in advance.

**2. Functions of Switches**

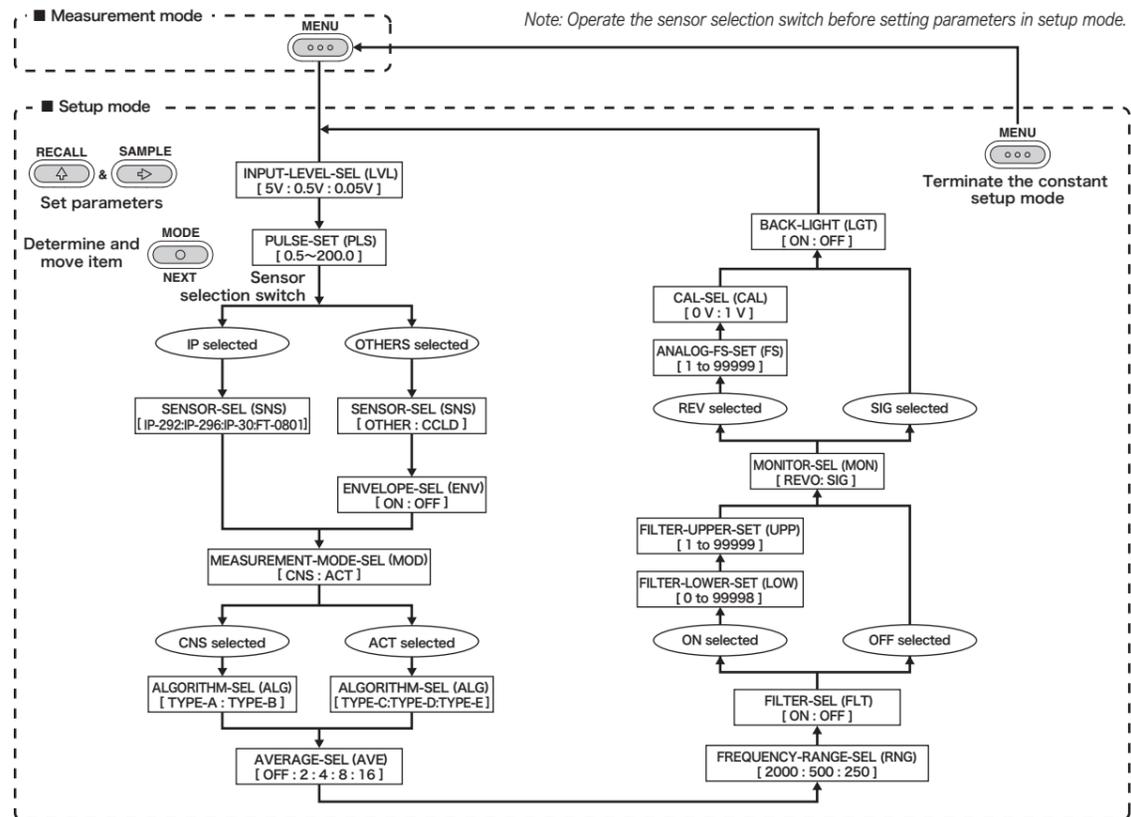
The functions of the switches at power ON vary depending on whether the device is in the measurement or parameter setup mode. They are as listed below.

	Measurement mode	Parameter setup mode
Power switch	Set the power OFF, terminating measurement mode.	Set the power OFF, canceling the current setup item.
RECALL/↑ switch	For acceleration/deceleration rotation measurement (when algorithm E of "ACT" mode is selected), this switch is used to select the rotational speed at the measurement start from sampled candidate values.	Change selections for the current setup item. While setting a numeric parameter, increment the numeric value of the current position. After "9", returns to "0".
MENU switch	Switch to parameter setup mode.	Switch to measurement mode, determining the current setup item.
SAMPLE/→ switch	Before starting acceleration/deceleration rotation measurement (when "ACT" mode is selected), this switch is used to calculate rotational speed candidate values for the measurement start by sampling rotational speed data.	While setting a numeric parameter, move the setup position rightward. After the least significant position, return to the most significant position.
MODE/NEXT switch	For acceleration/deceleration rotation measurement (when algorithm E of "ACT" mode is selected), determines the rotational speed selected with the RECALL/↑ switch as the rotational speed at the measurement start and starts the measurement.	Determine the current setup contents and move to the next item.

Note: When algorithm D is selected, rotational speed candidate values are not selectable.

**3. Setup mode**

In measurement mode, press the MENU switch to change to parameter setup mode. Thereafter, use the RECALL/↑ and SAMPLE/→ switches to set parameters and the MODE/NEXT switch to determine parameters and move to the next item. Operational flow in parameter setup mode is given below.



- Select input voltage level (LEVEL → LUL)  
Set the input voltage level.  
Also use the sensor amplifier sensitivity adjustment dial on the right side to make the indicator blink steadily.

LUL	5u	Input maximum amplitude ±5V
	0.5u	Input maximum amplitude ±0.5V
	0.05u	Input maximum amplitude ±0.05V
	* Factory default is "5u".	

- Set pulse count (Pulse → PLS)  
Set the number of pulses (P/R) per rotation according to the object to be measured.

PLS	Setup range	0.5 to 200.0
	Increment	0.5
	* Factory default is "001.0".	

- Select sensor (Sensor → SNS)  
Select a sensor to be sonected.  
First, select the type of the sensor to be used ("IP" or "OTHERS") with the sensor selection switch on the right side of the main unit.  
Then, select the sensor in setup mode.

IP	Sensor of IP Series	IP OTHERS
OTHERS	Sensor of other than IP Series	

OTHER	IP	IP292	Sensor IP-292
		IP-296	Sensor IP-296
		IP-30	Sensor IP-3000A, IP-3100
		Ft-0801	Sensor FT-0801
	OTHER	CCLd	Sensor of constant-current drive type
		OTHer	Sensor other than above
	* Factory default is "OTHER".		

Note: When IP-292 is selected and a sensor of voltage signal output type is connected, the sensor may be damaged. Be sure to select "OTHERS" for this sensor.

- Select envelope processing (Envelope → ENU)  
Select whether to perform envelope processing.  
This item is enabled only when "CCLd" or "OtHer" is selected as a sensor.

ENU	OFF	Envelope processing is not performed.
	On	Envelope processing is performed.
	* Factory default is "OFF".	

- Set operation mode (Mode → Mod)  
Set operation mode.

Mod	CnS	Used for measurement objects with little variation in rotational speed (for example, when measuring rated rotational speed)
	ACt	Used for measurement objects with increasing/decreasing rotational speed Note that accurate measurement may not be attained for rapid changes.
	* Factory default is "CnS".	

- Set measurement algorithm (Algorithm → ALG)  
Set the measurement algorithm.  
When operation mode is set to "CnS", only "tYP-A" or "tYP-b" is enabled.  
When operation mode is set to "ACt", only "tYP-C", "tYP-d" or "tYP-E" is enabled.  
For description of algorithms, see "Description of Algorithms" in "Various Measurement Operations" in this manual.

tYP-A	Select algorithm A.
tYP-b	Select algorithm B.
tYP-C	Select algorithm C.
tYP-d	Select algorithm D.
tYP-E	Select algorithm E.
* Factory default is "tYP-A".	

- Set moving average count (Average → AUE)  
Set the moving average count.

AUE	OFF	Perform no moving average processing.
	2	Perform moving average processing using 2 latest data items.
	4	Perform moving average processing using 4 latest data items.
	8	Perform moving average processing using 8 latest data items.
	16	Perform moving average processing using 16 latest data items.
	* Factory default is "OFF".	

- Set frequency range (Range → RNG)  
Set frequency range.

RNG	2000	Set the input frequency range to 30 to 2000Hz.
	500	Set the input frequency range to 7.5 to 500Hz.
	250	Set the input frequency range to 3.75 to 250Hz.
	* Factory default is "250".	

- Select filter function (Filter → FLT)  
Select filter function On/OFF. When "On" is selected, settings of ⑨ and ⑩ are enabled.

FLT	OFF	Set filter function OFF.
	On	Set filter function ON.
	* Factory default is "OFF".	

- Select filter range lower limit (Lower → LOW)  
Set the rotational speed (r/min) of the filter range lower limit.  
This item is enabled only when "On" is selected for the filter function.

LOW	Setup range	0 to 99998
	* Factory default is "00000".	

Note: When "algorithm B" is selected, the filter function is disabled.

- Select filter range upper limit (Upper → UPP)  
Set the rotational speed (r/min) of the filter range upper limit.  
This item is enabled only when "On" is selected for the filter function.

UPP	Setup range	1 to 99999
	* Factory default is "99999".	

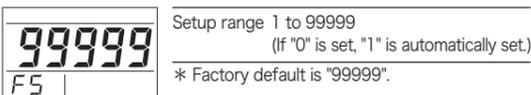
Note: When "algorithm B" is selected, the filter function is disabled.

- Select analog monitor output (Monitor → MON)  
Select signal used as analog output.

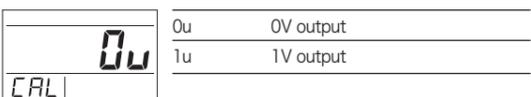
MON	rEu0	Voltage output proportional to rotational speed
	Sig	Sensor signal monitor output Waveform-shaped signal
	* Factory default is "rEu0".	

### 3. Setup mode

- ⑬ Set analog output full-scale value (Full Scale → FS)  
Set the rotational speed related to the analog voltage output full-scale value (F.S. value: 1V). This item is enabled only when "rEuO" is selected for the analog monitor output.

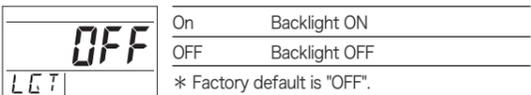


- ⑭ Set analog output calibration (Calibration → CAL)  
Output calibration signal 0V or 1V for analog voltage output.  
This item is enabled only when "rEuO" is selected for the analog monitor output.



Note: Settings to this function are not saved. When setting this item, "0u" is always selected initially.  
The selected analog output is only enabled while this item is valid.

- ⑮ Set the lighting condition of LCD backlight (Light → LGT)  
Select LCD backlight On/OFF.



### Output

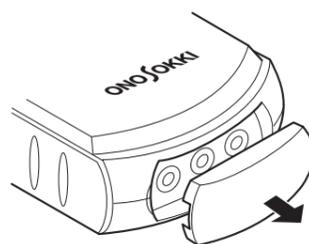
#### 1. Pulse Output

The measured power spectrum frequency is converted to pulse and output.

The frequency of the pulse output is the same as the measured value.

Therefore, the pulse output frequency differs from the displayed value.

The minimum load resistance of the pulse output terminal is 100kΩ.



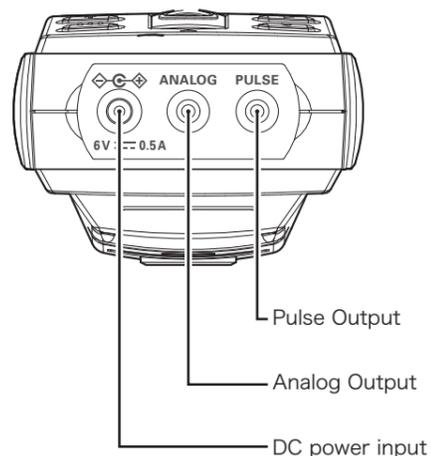
#### 2. Analog Output

##### ● When "rEuO" is selected

- An analog voltage with the value set from the analog output "FS" (full-scale) item of setup mode is output from the ANALOG jack.
- When the value on the main display coincides with the full-scale setup value, the analog output goes to 1V. The minimum load resistance of analog output is 100kΩ.

##### ● When "Sig" is selected

- Signal (before pulse waveform shaping) acquired by waveform shaping of sensor signal is output.



### Description of condition display

#### 1. ERROR display

When symbol " **ERROR** " goes lit, it indicates occurrence of one of errors listed below.

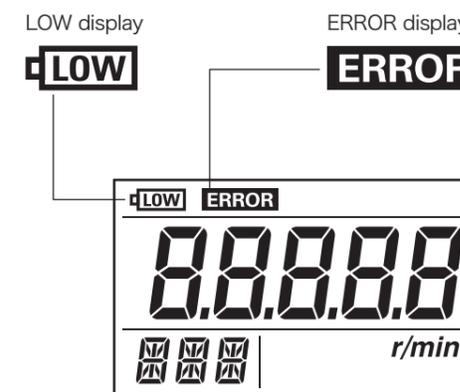
Error codes displayed on the SUB-display and error causes are listed below.

Error codes	Error causes
E01	Parameters backed up are not correctly set.
E02	FT-7200 is not correctly started.
E11	The sensor amplifier sensitivity is excessive.
E12	The detected rotational speed exceeded maximum display range "99999r/min".
E13	In acceleration/deceleration rotation measurement mode ("ACT" mode selected), accurate measurement of rotational speed is disabled (the rotational speed cannot be tracked).
E14	The rotational speed is outside the range set with the filter.
E15	In acceleration/deceleration rotation measurement mode ("ACT" mode selected), accurate sampling of rotational speed at the measurement start is disabled.
E21	Lower limit value $\geq$ upper limit value in filter settings

#### 2. LOW display

When symbol " **LOW** " goes lit, it indicates low battery level of the dry cell batteries used.

- This symbol goes lit when the battery voltage is approximately 4.2V or less.
- When this symbol goes lit, immediately replace the four batteries with new ones. Without replacing low-level batteries, accurate measurement may be disabled.
- If the batteries are further exhausted during operation, measurement will be disabled showing "-----" on the MAIN display.
- If the battery voltage goes lower than 4.5V, the backlight becomes dark, but it is not an error.



### Various Measurement Operations "Descriptions of Each Algorithm"

#### 1. Steady Rotation Measurement Mode "CNS"

This mode is effective for measurement objects with constant rotational speed. In this mode, one of two algorithms given below can be selected according to the measurement object from the algorithm setup on the setup menu.

- TYPE-A (Algorithm A/Maximum Power Spectrum Peak Detection Method)**  
This is the basic algorithm applicable to measurement of rated rotational speed, etc.
- TYPE-B (Algorithm B/Peak-Interval Mode Method)**  
This is an algorithm placing stress on the stability. Note that the following performance is lower than that of TYPE-A; accurate measurement may not be attained when a rapid rotation change occurs. In addition, accurate measurement may not be attained for some sensor signal waveforms. Due to the principle of the algorithm, the input frequency upper limit is approximately 1/3 of the frequency range.

Note: When algorithm B is selected, the filter function is disabled.

#### 2. Acceleration/Deceleration Rotation Measurement Mode "ACT"

This mode is effective for measurement objects with increasing/decreasing rotational speed. In this mode, one of three algorithms given below can be selected according to the measurement object from the algorithm setup on the setup menu.

- TYPE-C (Algorithm C/Maximum Power Spectrum Peak Detection Method: Plural degree peak flattery)**  
This algorithm allows measurement of changing rotational speed by monitoring other order components for the basic frequency instead of considering only one power spectrum.
- TYPE-D (Algorithm D/Maximum Power Spectrum Peak Detection Method: Peak flattery)**  
This algorithm is effective for measurement objects with increasing/decreasing rotational speed. For this measurement, the measurement time changes depending on the rotational speed change.
- TYPE-E (Algorithm E/Maximum Power Spectrum Peak Detection Method: Rotational speed candidate selection)**  
This algorithm keeps a balance between the following performance and stability of the rotational speed. The selected power spectrum is considered for measurement. Note that the following performance is lower than that of TYPE-C and TYPE-d; accurate measurement may not be attained when a rapid rotation change occurs.

#### 3. Measuring in "ACT" mode

##### ● Algorithm: TYPE-C

- After setting the power ON or closing setup mode, "rEAdY" appears on the MAIN display.
- Set a rotational speed at the measurement start for the measurement object (set a rotational speed in stable state, if possible). After the measurement is readied, press "SAMPLE" switch.

- Measurement starts.  
\* Measurement does not start unless rotation signal is input.
- To terminate (interrupt) measurement and restart it, press "SAMPLE" switch during measurement.
- Restart measurement.

##### ● Algorithm: TYPE-D

- Perform measurement similarly to steady rotation mode.

##### ● Algorithm: TYPE-E

- After setting the power ON or closing setup mode, "rEAdY" appears on the MAIN display.
- Set a rotational speed at the measurement start for the measurement object (set a rotational speed in stable state, if possible). After the measurement is readied, press "SAMPLE" switch.
- From a maximum of 8 measurement start rotational speed candidate values displayed, select the value closest to the current rotational speed using the "RECALL" switch and determine it with "MODE/NEXT" switch.
- Measurement starts.
- To terminate (interrupt) measurement and restart it, press "SAMPLE" switch.
- The display returns to the state of ① above; restart measurement from ②.

### Troubleshooting

If the product seems to malfunction, check the points listed below.

If the product still malfunctions after checking, contact your dealer or your nearest Ono Sokki sales office.

Phenomena	Checks	Actions
No display	<ol style="list-style-type: none"> <li>Are batteries installed?</li> <li>Are battery polarities (+/-) correct?</li> <li>Are batteries in low level?</li> <li>Is the dedicated AC adapter, if used, connected to an outlet and to the DC input connector of the main unit?</li> <li>Is the dedicated AC adapter used?</li> </ol>	<ol style="list-style-type: none"> <li>Install batteries.</li> <li>If the polarities are incorrect, the batteries are exhausted. Replace them with new batteries with correct directions. *1</li> <li>Replace all batteries with new ones.</li> <li>Connect the dedicated AC adapter to an outlet and the DC plug to the DC input connector.</li> <li>Use the dedicated AC adapter. *1</li> </ol>
Unstable display	<ol style="list-style-type: none"> <li>Is the sensor correctly selected?</li> <li>Is the amplifier sensitivity correctly adjusted?</li> </ol>	<ol style="list-style-type: none"> <li>Select the sensor to be used from the setup menu or using the sensor selection switch.</li> <li>Adjust the sensor amplifier sensitivity adjustment dial so that the indicator blinks steadily. If adjustment with the dial is insufficient, change the input voltage level from the setup menu.</li> </ol>
Rotational speed too high or low	<ol style="list-style-type: none"> <li>Is the pulse count correctly set?</li> </ol>	<ol style="list-style-type: none"> <li>Set correctly the number of pulses (P/R) per rotation according to the object to be measured.</li> </ol>

\*1. If the operation is still abnormal after actions ② and ⑤ above are taken, the internal protection circuit may have functioned causing the fuse to blow; contact Ono Sokki sales office nearby.

Thank you for purchasing our Handheld Advanced Tachometer.

Read through this manual in order to make full use of it.

**■Omission of Issuance of Certificate**

This product has been tested under strict conditions for normal operation before shipment. Please note that the issuance of certificate is omitted.

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**■Warranty**

1. This product is covered by a warranty for a period of one year from the date of purchase.
  2. This warranty covers free-of-charge repair during the warranty period for defects occurred while the product is used under normal operating conditions according to descriptions in this manual and notices on the unit label.
  3. For free-of-charge repair during the warranty period, contact your dealer or Ono Sokki sales office nearby.
  4. Even during the warranty period, the following failures will be handled on a fee basis.
    - (a) Failures or damages occurring through misuse, misoperation, or modification
    - (b) Failures or damages occurring through mishandling (dropping) during transportation after purchase
    - (c) Failures or damages occurring through natural calamities (fires, earthquakes, flooding, and lightning), environmental disruption, or abnormal voltage
    - (d) Replenishment of expendable supplies, spare parts, and accessories.
- \* This warranty does not limit any legal rights of customers.
- \* If a customer engineer is dispatched to remote locations, the customer will be demanded for actual expenses.
- \* For any questions such as those about repair after expiration of the warranty period, contact the dealer from which you purchased the product or the Ono Sokki sales office nearby. If the function of the product could be maintained through repair, it will be handled on a fee basis.
- \* This warranty covers only the product itself; it does not cover any damages resulting from failures of the product.

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Measurement Procedure

**1. When Rotational Speed Is Constant  
(Measuring Rated Rotational Speed, etc.)**

- ① Activate setup mode  
After FT-7200 is powered and the software version appears, press MENU switch to activate setup mode.
- ② Select input voltage level  
From the input voltage level setup menu, select the input voltage level so that the indicator blinks in measurement mode (select from 5V, 0.5V, 0.05V according to the sensor used and measurement object).
- ③ Set pulse count  
Select the number of per rotation of the measurement object pulses which is detected by the sensor.
- ④ Select a sensor  
Set the sensor selection switch on the right side of the main unit to "OTHERS" when using a non-IP sensor or to "IP" when using an IP sensor and then select the sensor to be used from the sensor selection menu.

Note:

- \* When IP-292 sensor is selected, the input impedance becomes 100Ω or less. When IP-292 is selected and a sensor of voltage output type is connected, the sensor may be damaged. In such a case, be sure to select "OTHERS" and then connect the sensor.
- \* When "CCLd" sensor is selected, constant current is applied. In such a case, only connect a constant-current type sensor.
- \* Do not connect a sensor before making settings; connect the relevant connector correctly after all settings have completed.

- ⑤ Set operation mode  
From the operation mode setup menu, select "CnS" (steady rotation measurement mode).
- ⑥ Set measurement algorithm  
From the measurement algorithm setup menu, select "tYP-A" (Algorithm A).

**2. When Rotational Speed Is  
Accelerating/Decelerating**

- ⑦ Set frequency range  
Set frequency range from the setup menu. Determine the frequency range considering the estimated maximum rotational speed and the input pulse count per rotation.

Note: \* Selecting an excessive frequency range may cause measurement errors to occur.

- ⑧ Exit setup mode  
Press MENU switch to exit setup mode and return to measurement mode.
- ⑨ Connect the sensor  
Connect the sensor to be used to the input connector. (For sensor installation, etc., see Instructions Manual of the relevant sensor.)

- ⑩ Adjust sensitivity  
Adjust the sensor amplifier sensitivity adjustment dial on the right side of the main unit so that the indicator blinks when the measurement object is rotating in a constant rotational speed or restart setup mode and change the input voltage level. After adjustment completes, start measurement.

- ⑩ Adjust sensitivity  
Adjust the sensor amplifier sensitivity adjustment dial on the right side of the main unit so that the indicator blinks when the measurement object is rotating in a constant rotational speed (idling, etc.) or restart setup mode and change the input voltage level. After adjustment completes, press SAMPLE switch. Measurement starts.

Note:

- \* If rotation signal is not input, pressing SAMPLE switch does not start measurement.

**1. When Rotational Speed Is Constant  
(Measuring Rated Rotational Speed, etc.)**

● When measurement values are unstable

Try sequentially the steps given below beginning with A.

- A. Adjust sensor amplifier sensitivity adjustment dial  
For some measurement objects, stable measurement values may not be acquired even when the indicator is blinking. In this case, fine adjustment may lead to stable measurement. If measurement is not stabilized by adjusting the sensor amplifier sensitivity adjustment dial, also try the voltage range.
- B. Use filter function (disabled for Algorithm B)  
Select filter function On in setup mode and set the lower and upper limits of the rotational speed measurement range.
  - Lower limit setup example  
If the measurement result is 1/2 or less of the estimated rotational speed, set the lower limit to approximately 0.6 times (1/2 x 1.2) the estimated rotational speed.
  - Upper limit setup example  
If the measurement result is 2 times or more of the estimated rotational speed, set the upper limit to approximately 1.8 times (2 x 0.9) the estimated rotational speed.
- C. Change sensor detecting position  
Since the sensor detects very weak signal, the measurement may be stabilized by changing the detecting position.

- D. Change measurement algorithm  
The measurement may be stabilized by selecting "tYP-b" (Algorithm B) from algorithm setup.

- D. Change measurement algorithm  
Algorithm D, due to its principle, may be disabled for some sensors and/or measurement objects. In this case, select "tYP-C" (Algorithm C) or "tYP-E" (Algorithm E) from measurement algorithm setup.

- E. Use envelope function (only when "OTHERS" is selected)

- When using NP or OM sensor, measurement may be stabilized by setting the envelope function On in setup mode.

● Precautions for using CCLD sensor:

- \* Since cyclic signal (vibration) caused by rotation is used for measurement, accurate measurement may not be attained when there is notable vibration due to disturbance.
- \* When using CCLD sensor, use of the dedicated AC adapter is recommended because the consumption current increases for driving the constant-current power supply.

## Detailed steps for measurement in Acceleration/Deceleration Rotation Mode ("ACT" mode/Algorithm E)

The flowchart on the right shows successive steps for acceleration/deceleration rotation measurement ("ACT" mode) in setup and measurement modes.

### ● Algorithm E setup procedure

- ① Select "tYP-E" from algorithm setup.
- ② Press MENU switch to return to measurement mode.  
("rEAdY" appears.)
- ③ Set the measurement object to the rotational speed at the measurement start (set the rotational speed in stable state, if possible).  
After the measurement is ready, press "SAMPLE" switch.
- ④ From a maximum of 8 measurement start rotational speed candidate values displayed, select the value closest to the current rotational speed using the "RECALL" switch.
- ⑤ Press "MODE/NEXT" switch to determine the selected rotational speed and start the measurement.

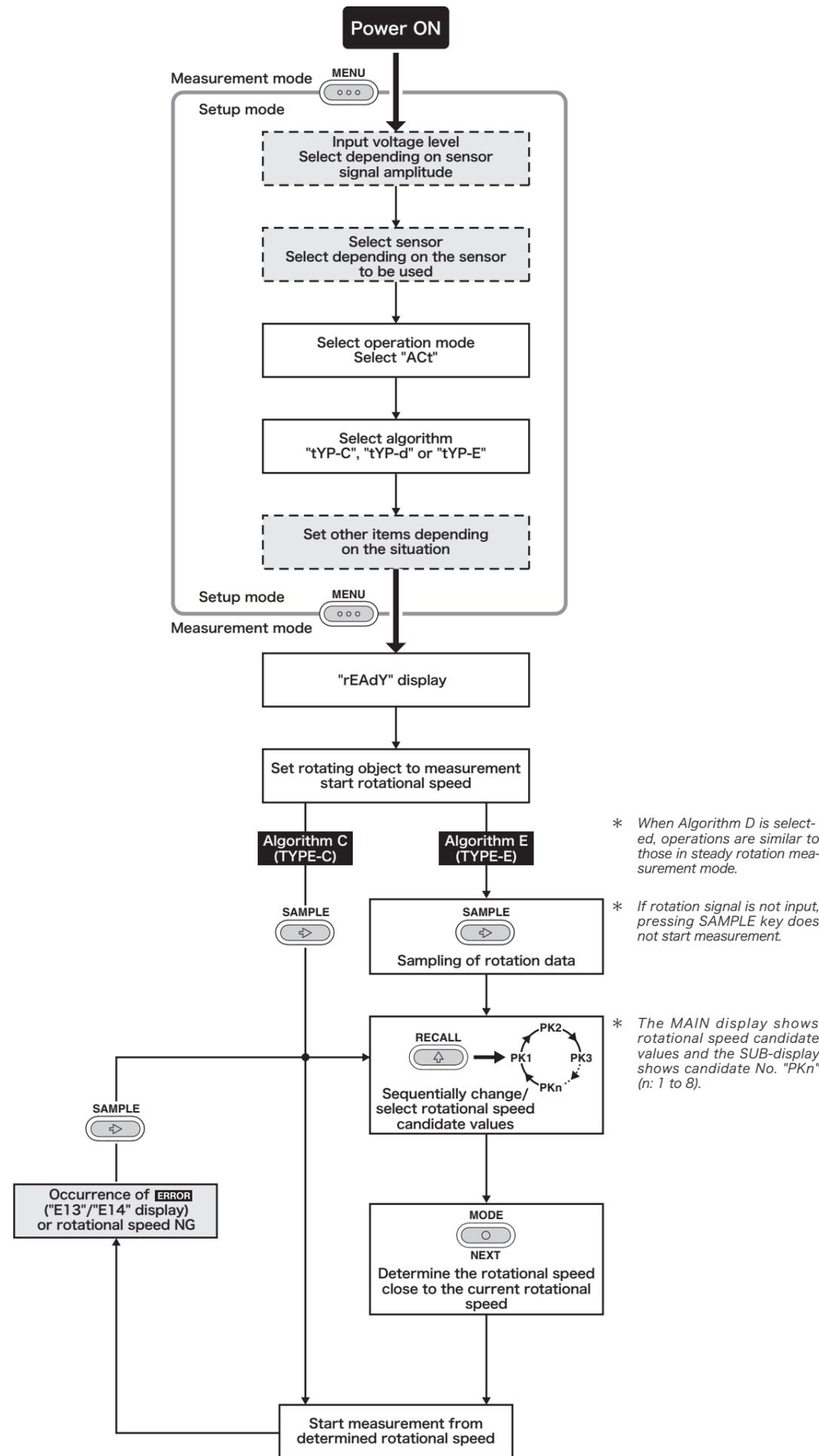
\* *Precautions for using acceleration/deceleration rotation measurement ("ACT" mode)*  
Though this mode is available for accelerating or decelerating rotational speed, accurate measurement may not be attained when a rapid rotation change occurs.

In acceleration/deceleration rotation measurement ("ACT" mode), input signal characteristics are recognized by sampling the rotational speed of the rotating object at the measurement start.

Especially when Algorithm E ("tYP-E") has been selected, operations following rotation data sampling by pressing SAMPLE switch have meanings given below.

### Example: When rotational speed sampled is 1000r/min

- Each time "RECALL" switch is pressed, rotational speeds given below appear on the MAIN display.
- PK1: 500r/rim (1/2 the actual rotational speed)
- PK2: 1000r/min (actual rotational speed)
- PK3: 2000r/rim (twice the actual rotational speed)
- PK4: 3000r/rim (three times the actual rotational speed)
- ⋮
- ⋮
- From these candidate values, select PK2: 1000r/min using "RECALL" switch and determine it by pressing "MODE/NEXT" switch.
- It starts measurement considering characteristics of the signal.
- At the same time, other candidates than the determined rotation signal are filtered and eliminated from measurement objects.



## Setup Example for each Sensor

Sensor types	IP sensor				Non-IP sensor							
	IP-292	IP-296	IP-3000A	IP-3100	FP-0801	OM	VP	NP	MI	Magnetic flux leakage	LED reflective light sensor	
Sensor model names												
Measurement objects	Gasoline engine						Engine	Compressor engine	Pump engine	DC motor	Motor fan	
	Fuel pump				*1		*2	*3				
Sensor selection switch *4	IP				OTHERS							
Sensor selection menu *5	IP-292	IP-296	IP-30	Ft801	Other		CCLd		Other			

\*1 : For vehicles equipped with cigarette lighter socket \*4 : side of main unit  
\*2 : Motor, pump, etc. generating vibration \*5 : SNS  
\*3 : Motor, etc. generating sound

## Measurement Examples

	Measuring constant rotational speed	Measuring accelerating/decelerating rotational speed
Major purpose	Measuring rated rotational speed of motor, etc. for product shipping inspection	Measuring increasing/decreasing rotational speed of engine, motor, etc.
Select measurement mode "MOD"	"CNS" (CONSTANT: Steady rotation measurement mode)	"ACT" (ACTIVE: acceleration/deceleration rotation measurement mode)
Algorithm selection candidate 1 "ALG"	"TYPE-A" (Algorithm A/Maximum Power Spectrum Peak Detection Method) General measurement algorithm	"TYPE-D" (Algorithm D/Maximum Power Spectrum Peak Detection Method: Peak flattery) Algorithm placing stress on the acceleration/deceleration rotation. For this measurement, the measurement time changes depending on the rotational speed change.
Algorithm selection candidate 2 "ALG"	"TYPE-B" (Algorithm B/Peak-Interval Mode Method) Algorithm placing stress on the stability <i>Note: Unavailable to some measurement objects.</i> <i>Note: Unavailable to measurement of rapid rotation acceleration/deceleration.</i>	"TYPE-E" (Algorithm E/Maximum Power Spectrum Peak Detection Method: Rotational speed candidate selection) Measurement algorithm placing stress on rotation acceleration/deceleration and the stability The selected power spectrum is considered for measurement. <i>Note: Unavailable to measurement of rapid acceleration/deceleration rotation measurement.</i>
Set filter function "FLT"	Measurement of stabilized rotational speed is enabled by limiting the measurement range with the filter function. <i>Note: Unavailable to Algorithm B.</i>	<i>Note: The filter function is available; however, setting a narrow measurement range may disable acceleration/deceleration rotation measurement.</i>
Set envelope function "ENV"	When sensor signal wave includes harmonic signal component (for example, when using NP sensor to measure rotational speed by variation of vibration or using OM sensor), measurement of stabilized rotational speed may be attained by setting the envelope function ON. <i>Note: Available only when "OTHERS" is selected with slide switch.</i>	

## Solutions for Error in Acceleration/Deceleration Rotation Mode ("ACT" Mode)

When the rotational speed rapidly changes or it goes out of the measurement range set with the filter during acceleration/deceleration rotation measurement ("ACT" mode), subsequent measurement may not be correctly performed.

In this case, the measurement is disabled, "ERROR" goes lit and the SUB-display shows "E13" or "E14". Restart the measurement in the steps given below.

- ① Press "SAMPLE" switch to reset the error.
  - ② When "tYP-E" (Algorithm E) has been selected, a maximum of 8 measurement start rotational speed candidate values appear.  
Sequentially change the rotational speed candidate values using "RECALL" switch and select the value closest to the current rotational speed using the "MODE/NEXT" switch.  
When "tYP-C" (Algorithm C) or "tYP-d" (Algorithm D) has been selected, rotational speed candidate values are not selectable.
  - ③ Measurement restarts.
- \* When the rotational speed is not correctly displayed with no error display, retry the measurement in the procedure above.
- \* When the displayed rotational speed differs from the actual value, readjust the sensor amplifier sensitivity, sensor mounting location, etc.