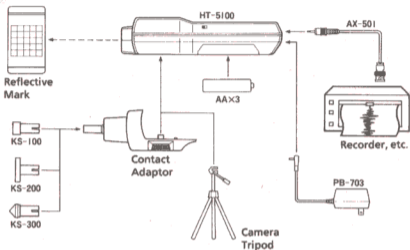


HT-5100 Handheld Tachometer

Instruction Manual



◆ PRECAUTIONS FOR USE ◆

- Observe the following safety precautions.
 - Take sufficient care when using an AC adaptor or analog output that the related cables do not get tangled around the rotating body.
 - When using a contact adaptor tighten the mounting screw securely by hand to hold it securely to the HT-5100.
 - Hold the HT-5100 securely when making measurements, particularly when making contact-type measurements. (Refer to page 25 for more information on safety warnings.)

1. INTRODUCTION

The HT-5100 is a visible-light type non-contact hand-held tachometer which measures rpm by means of a reflective mark on the rotating body.

The advanced HT-5100 features a full compliment of functions in a single compact unit, including an accessory contact adaptor that enables contact-type measurements as well.

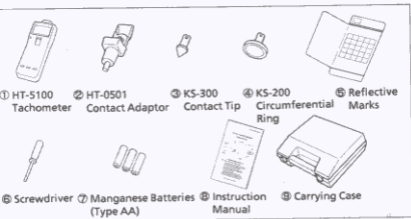
1.1 Features

- Autoranging measurements (non-contact mode) from as low as 6 rpm to as high as 99999 rpm
- Selectable measurement units: rpm, rps, m/min., count, ms
- Direct-reading measurement of tangential speed
- MAX and MIN modes display maximum and minimum values (except for count mode).
- A memory recall function enables easy verification of measurement results.
- An alarm function can be used to sound a beeper when the measured value exceeds a set value.
- Analog output
- An accessory contact adaptor (HT-0501) enables use as a contact-type tachometer.
- Tripod mounting is possible (non-contact measurements only).
- Operates on type AA batteries or an AC adaptor.

1.2 Configuration

Verify that you have the following items.

- ① HT-5100 Tachometer
- ② HT-0501 Contact Adaptor
- ③ KS-300 Contact Tip
- ④ KS-200 Circumferential Ring
- ⑤ Reflective marks
- ⑥ Screwdriver
- ⑦ Type AA manganese batteries (3)
- ⑧ Instruction manual (this document)
- ⑨ Carrying case

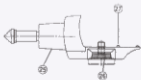
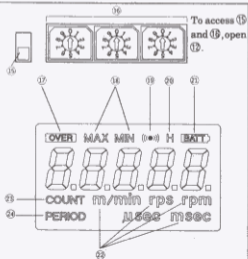
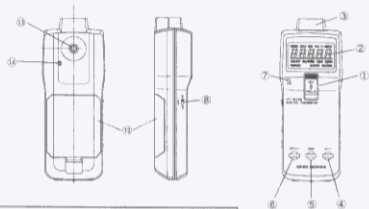


1.3 Options (Separately Sold)

- AX-501 Analog Output Cable
- PB-703 AC Adaptor
- HT-011 Reflective Marks (10 sheets, with 250 marks measuring 12 mm × 12 mm)
- KS-100 Circumferential Ring (mm/s)

2. NAMES AND FUNCTIONS OF PARTS

The names and functions of HT-5100 parts are keyed to the circled numbers in the figure below.



① Power switch (refer to page 18)

By sliding this switch to the ON position, power is applied to the HT-5100. When you release your finger, power is switched off. If you slide the switch to the HOLD position, it will lock in the on condition even when you remove your finger.

② Display

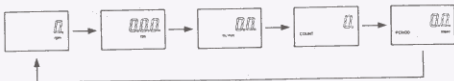
This display provides a direct reading of the measured values in all modes.

③ Detection section

This light projector-receiver is used in detected light reflected from the reflected mark (i.e., the rpm signal).

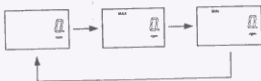
④ UNIT switch (refer to page 16 through 18)

Each time this switch is pressed, the measurement unit changes in the sequence rpm \rightarrow rps \rightarrow m/min. \rightarrow count \rightarrow period (ms).



⑤ MODE switch (refer to page 18)

This switch is pressed to switch between the MAX and MIN modes in the sequence (NORMAL) \rightarrow MAX \rightarrow MIN (in the NORMAL mode there is no display).



⑥ RECALL switch (refer to page 20)

When the power is off, this switch can be pressed to recall a measured value stored in memory to the display. When power is on, this switch acts as a reset switch for the maximum value, minimum value, and accumulated count value.

⑦ Indicator (input signal indicator lamp)

This LED lamp flashes when the detection section is detecting the reflected light from the reflective mark.

⑧ Backlighting switch

When this switch is slid into the ON position, the display backlighting is turned on.

⑨ ANALOG OUT connector (refer to page 19)

This connector provides an analog output signal for a recorder or other external device. Use the AX-501 cable (option) to make connection to this connector.

⑩ ANALOG RANGE switch (refer to page 19)

This switch is used to select the analog output range.

⑪ DC IN jack

This is the DC input jack for connection to a PB-703 AC Adaptor.

⑫ Battery cover

⑬ Threaded tripod mounting hole

This threaded hole is used to tripod mount the HT-5100. It is also used to mount the contact adaptor, and so both tripod mounting and the contact adaptor cannot be used at the same time.

⑭ Contact adaptor pin guide hole

When the contact adaptor is mounted to the HT-5100, the protrusion of the contact adaptor enters this hole, the HT-

5100 senses it and switches to the contact-type measurement mode.

⑮ Alarm on/off switch (refer to page 20)

This switch is located at the bottom of the battery compartment and is accessed by removing the battery cover. If it is slid to the ON (forward) position, the (((·))) mark will appear on the display, and if the measured value exceeds the set value a beeper will sound and "H" will appear on the display.

⑯ Preset switches

These switches are also located at the bottom of the battery compartment.

These three switches have the following two functions.

Alarm function (refer to page 20)

Tangential speed direct reading function (refer to page 13) (only for non-contact measurement)

⑰ OVER indicator

This indicator appears in the display when the measured value exceeds the measurement range.

⑱ Mode indicators (refer to pages 9 and 16-17)

MAX Maximum value is held.

MIN Minimum value is held.

⑲ Alarm setting indicator

This (((·))) indicator appears in the display when the alarm setting is on.

⑳ H indicator

This indicator appears in the display when the measured rpm value exceeds the set alarm limit. If the measured value exceeds the measurement range, it will appear together with the OVER indicator.

② BATT indicator

This mark warns that it is time to replace the batteries, and appears when the battery voltage drops below approximately 3.3 V. When this mark appears, replace the batteries as soon as possible.

②② Measurement unit indicators (refer to pages 9 and 18)

②③ COUNT indicator (refer to pages 15 and 18)

This indicator appears when the HT-5100 is in the accumulated count mode.

②④ PERIOD indicator (refer to pages 15 and 18)

This indicator appears together with the “msec” indicator when the HT-5100 is measuring period.

②⑤ HT-0501 Contact Adaptor (refer to pages 12 and 18)

This adaptor is mounted to the HT-5100 and used to convert the HT-5100 to a contact-type tachometer.

②⑥ Mounting screw

Used to mount the contact adaptor to the HT-5100.

②⑦ Protrusion

Provided to enable the HT-5100 to sense the presence of the contact adaptor and switch to contact-type measurement.

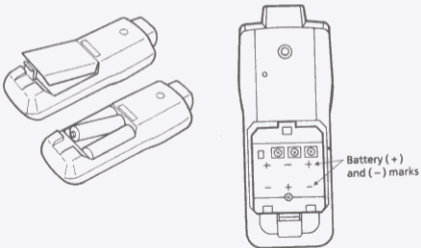
3. POWER SUPPLY

- The HT-5100 operates on 3 type AA batteries or a PB-703 AC Adaptor (option).
- If the batteries wear down and the BATT warning indicator appears in the display, replace the batteries.

When replacing batteries, be sure to always replace all 3 at the same time.

Battery Replacement Method

- ① Lift up the battery cover while pushing the button of the battery cover to remove the cover.
- ② Insert new batteries, taking care to observe proper (+) and (-) polarities (see figure below).
- ③ Close the battery cover.



4. RELATIONSHIP OF MEASUREMENT MODES TO SWITCH SETTINGS AND UNITS

(Display units and symbols)

	[MODE Switch]	[UNIT Switch]			
		Rpm	Tangen. speed	Period	Accum. count
	NORMAL	Rpm, rps	m/min	Period, msec	Count
Non-contact measurement (HT-5100 only)	MAX value	Rpm, rps	MAX display m/min		Period, msec ---
	MIN value	Rpm, rps	MIN display m/min		Period, msec ---

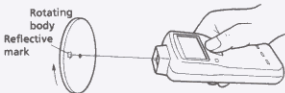
	[MODE Switch]	[UNIT Switch]			
		Rpm	Tangen. speed	Period	Accum. count
Contact measurement (HT-5100 + contact adaptor)	NORMAL	Rpm, rps	m/min (mm/sec)	Period, msec	Count
	MAX value	Rpm, rps	m/min (mm/sec)	Period, msec	---
	MIN value	Rpm, rps	m/min (mm/sec)	Period, msec	---

Note: "mm/sec" measurement is performed by mounting the KS-100 Circumferential Ring (separately sold) and displaying "rpm" measurement units. The unit "mm/sec" does not appear on the display.

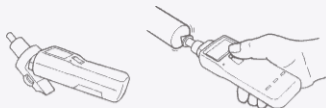
5. MEASUREMENT PREPARATION

5.1 Non-Contact Measurements

- ① When using the HT-5100 for the first time, install batteries. (This applies to contact type measurements as well.)
- ② Apply a reflective mark to the rotating body to be measured. (Refer to Section 9: Precautions for Non-Contact Measurements for details on applying the reflective mark.)
 - Ⓐ Clean any oil, water, and dust off of the surface to which the reflective mark is to be applied, and apply the mark to a flat part of the surface.
 - Ⓑ If the surface to which the mark is applied is shiny (e.g., a plated surface), either make measurements at an angle removed from the perpendicular to this surface, or paint the surface black before applying the reflective mark.
- ③ Press the power switch and shine the light from the light projector-receiver (detection section) onto the mark, verifying that the input signal indicator lamp flashes. (At high rpm, the lamp will appear to be lighted continuously.)
 - Ⓐ To ensure proper data, make each measurement for at least 3 seconds.
 - Ⓑ Maintain a proper distance between the reflective mark and the detection section of the HT-5100. (Refer to Section 9: Precautions for Non-Contact Measurements for details on the measurement distance.)



5.2 Contact Measurements



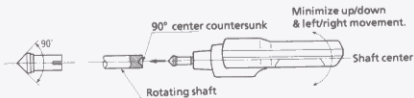
- ① Align the contact adaptor with the detector section of the HT-5100, so that the protrusion on the adaptor fits into the guide hole of the HT-5100, and tighten the screw of the adaptor securely into the threaded tripod mounting hole of the HT-5100.

(The protrusion of the adaptor is sensed in the guide hole to automatically switch the HT-5100 from non-contact measurement to contact measurement.)

- ② Turn the power of the HT-5100 on, and rotate the detection shaft to verify that the display comes on.
- ③ Mount the KS-300 Contact Tip, and use the UNIT switch to select the measurement units (rpm, rps, or msec).
- ④ Press the contact tip up against the rotating shaft to be measured so that there is no slippage between it and the hole in the center of the shaft end. When doing this, *hold the HT-5100 so that its axis is parallel with that of the shaft being measured.*


Ⓐ Do not attempt to use the HT-5100 with shafts not having a countersunk depression at the end.

Ⓑ Measurement error may occur, depending upon the material of the rotating body and the manner in which the contact adaptor makes contact with it.



6. MEASUREMENT METHODS

Measured Item	Switch Setting	Display/ Units	Description
Rpm	UNIT	rpm or rps	<ul style="list-style-type: none"> ① Measures the rpm of a rotating body. ② The rpm display is updated every 1 s.
Tangential speed ◆ Non-contact method	UNIT	m/min	<ul style="list-style-type: none"> ① The setting described below enables direct reading of tangential speed. ② Setting method <ul style="list-style-type: none"> Ⓐ Set the diameter of the rotating body on the preset switches located under the batteries. Ⓑ The setting can be made in the range 1 to 999 mm, in 1-mm steps. Ⓒ The weights of the preset switches are (from the left) 100, 10, and 1 mm.

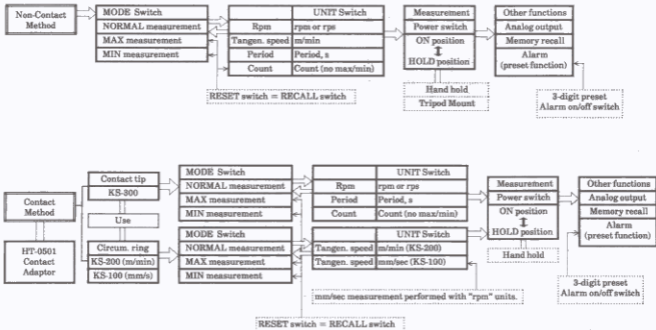
Measured Item	Switch Setting	Display/ Units	Description
<p>Tangential speed</p> <p>◆ Contact method</p> <p>Using the KS-200</p>	<p>UNIT</p>	<p>m/min</p>	<p>① Mount the KS-200 Circumferential Ring to the detection shaft, being sure that the pin of the shaft fits into the slot of the ring.</p> <p>② As shown in the figure, press the circumferential ring up against the object under measurement perpendicularly from the display side. As a safety measure, be sure to hold the HT-5100 with both hands.</p>  <p>Contact tip end angle</p>

Measured Item	Switch Setting	Display/ Units	Description
Tangential speed ◆ Contact method Using the KS-100	UNIT	mm/min (rpm)	① Mount the KS-100 Circumferential Ring to the detection shaft. ② Measure in rpm units. ③ Measurement precautions are the same as for the KS-200.
Period	UNIT	PERIOD and msec	① With this measurement unit, measurement is performed of the period of the periodic rotational pulse signal. ② The measurement range is 0.6 ms to 9999.9 ms. ③ Analog output is not available.
Count (accumulated count)	UNIT	COUNT	① With this measurement unit, only counting and accumulated display of pulses is performed. ② To begin counting, press the RESET (RECALL) switch.

Measured Item	Switch Setting	Display/ Units	Description
			<p>③ The 5-digit display has a maximum count of 99999.</p> <p>④ When the count exceeds 10000, the OVER indicator appears.</p> <p>⑤ If during counting the power is switched off and recall is made from memory, all values with other measurement units will be displayed as 0.</p> <p>⑥ Analog output is not available.</p>
MAX (maximum value)	MODE UNIT	rpm rps m/min msec	<p>① In this mode, press RESET (RECALL) to clear the maximum value recorded thus far.</p> <p>② For PERIOD, when the measurement is started, press RESET with the rotational signal applied.</p> <p>③ If the RESET switch is not pressed, " - - - - " will be displayed continuously.</p>

Measured Item	Switch Setting	Display/ Units	Description
MIN (minimum value)	MODE UNIT	rpm rps m/min msec	<p>① When the measurement is started, press RESET with the rotational signal applied.</p> <p>② If the measurement is stopped with the power applied, 0 rpm will be held as the minimum value. If you wish to hold the minimum value even after measurements are stopped, turn power off during the measurement and use the memory recall function.</p>

7. OPERATION GUIDE



8. OTHER FUNCTIONS

8.1 Analog Output

- ① Connect the ANALOG OUT connector to a recorder or other device using the AX-501 cable (option).
- ② Output is possible for measurement units of rpm, rps, and m/min.
- ③ Select the analog output range according to the maximum rpm (maximum tangential speed) and the recorder range.

	Hi	Mid	Lo
rpm	100,000	10,000	1,000
rps	1,000	100	10
m/min	10,000	1,000	100

At the values listed in the table (maximum values) the output is 1 V. The analog output resolution is 4 mV.

For example, in the rpm Hi range, since 100,000 rpm will result in 1 V output, an output of 4 mV corresponds to 400 rpm.

- ④ When rotation is detected, the output appears.
 - Ⓐ The analog output is updated approximately every 0.1 s.
 - Ⓑ Do not connect a load smaller than 1 k Ω to the analog output, as this will result in an improper voltage output.
 - Ⓒ Even in the MAX and MIN modes, an analog output corresponding to the NORMAL mode is made.
 - Ⓓ Do not apply external voltages to the analog output connector.
 - Ⓔ Take care that the AX-501 does not tangle around the rotating body.

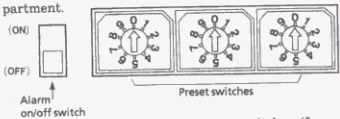
8.2 Memory Recall

- ① In cases in which it would be hazardous to perform a measurement while viewing the display, or in locations which make viewing the display difficult, use the memory recall function.
- ② To use this function, simply switch power off during a measurement. Then bring the HT-5100 somewhere you can read the display easily, and press the RECALL switch to recall to the display the value on the display at the instant the power was switched off.
- ③ If a dark location makes reading the display difficult, use backlighting.

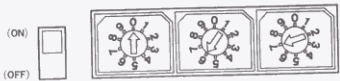
8.3 Alarm Function Setting

For example, suppose we wish to sound a beeper when the rpm exceeds 6700 rpm.

- ① Remove the battery cover and remove the batteries if they were installed to reveal the alarm on/off switch and the 3 preset switches at the bottom of the battery compartment.



- ② Using a screwdriver, set the preset switches (from the left) to 0, 6, and 7.
- ③ Slide the alarm on/off switch to the ON position.



The setting ranges are as follows.

In units of rpm:

100 to 99900 rpm, with switch weights (from the left) of 10000 rpm, 1000 rpm, and 100 rpm.

In units of rps:

1.00 to 999.0 rps, with switch weights (from the left) of 100 rpm, 10 rps, and 1 rps.

- ④ If you are using batteries for power, reinstall the batteries and replace the battery cover.

After the above setting has been made, when an actual measurement is performed, the following will occur.

- At less than 6700 rpm, the (((·))) mark will appear in the display.
- At 6700 rpm and higher, the (((·))) mark will appear in the display with the “H” indicator, and a beeper will sound.

9. OPERATING PRECAUTIONS

9.1 Non-Contact Measurements

(1) Measurement Distance

The maximum measurement distance of 30 cm as noted in the specifications is applicable for a 12 mm × 12 mm reflective mark on a flat surface *and* light shone on the reflective mark perpendicularly to the mark. Under the following conditions, the maximum usable measurement distance will be shorter.

- ① When the reflective mark is applied to a curved surface (e.g., when the reflective mark is applied to a shaft).
- ② When the reflective mark is cut smaller than its normal size.
- ③ When the light is shone on the reflective mark at an angle removed from the perpendicular.

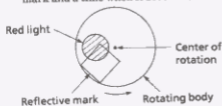
(2) Method of Shining Light Onto the Reflective Mark

The HT-5100 measures rpm by the existence or lack of reflected light. Detection will, therefore, not be possible if light is constantly shone on the reflective mark. Shine the light from the HT-5100 onto the rotating body so that during each revolution of this body, there is a time in which the light is striking the reflective mark and a time in which the light does not strike the reflective mark.

Particular care is required when the reflective mark is applied near the center of the axis of rotation.

[Proper Application]

(There is a time at which red light is striking the reflective mark and a time when it does not.)



[Improper Application]

(Light is always striking the reflective mark.)



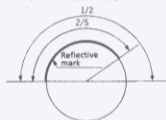
(3) Applying the Reflective Mark

- ① Ratio of the part onto which the reflective mark is applied to the circumference.

Apply the reflective mark so that ratio of the part X onto which the reflective mark is applied to the circumference Y of the rotating body is below the following values.

0 to 80,000 rpm: $X/Y < 0.5$ (less than $1/2$ of the circumference)

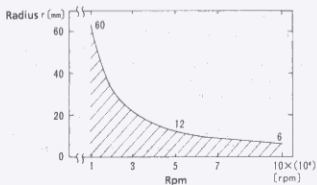
80,000 to 100,000 rpm: $X/Y < 0.4$ (less than $2/5$ of the circumference)



- ② Position of reflective mark application

In order for the HT-5100 to be able to detect the rotational signal, light reflected from the reflective mark must have a duration of at least approximately 0.2 ms.

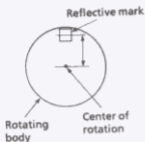
The relation of the rpm range to the reflective mark position (in terms of radial distance from the center of rotation) is shown in the figure graph below.



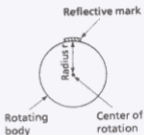
< Definition of radius r >

The radius r has the following meanings.

[Applied to flat surface]



[Applied to shaft]



If the reflective mark cannot be applied at a location within the shaded portion of the graph, apply two or more marks, overlapping them so that they join to serve as one mark.

(4) Cases in Which the Reflective Mark Flies off at High Speed

At high speeds such as 10,000 rpm, if the reflective mark flies off, apply the reflective mark with a separate adhesive.

In doing this, take care that the upper limit of the ratio of reflective mark to circumference (indicated in ①) is not exceeded.

(5) Cases in Which Application of the Reflective Mark is Not Possible

If for some reason it is not possible to apply the reflective mark to the rotating body, provided another means of establishing a light-reflective and non-light-reflective portion on the rotating body. Even in this case, the conditions noted in (3) must be satisfied.

In addition, be aware that the usable measurement distance and angle will differ in comparison with measurement using an actual reflective mark applied to the rotating body.

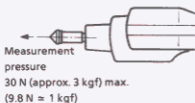
9.2 Measurements Using a Contact Adaptor

Using a contact adaptor it is not possible to measure the tangential speed of a rotating body as is done with the non-contact method by setting the diameter of the rotating body on the preset switches.

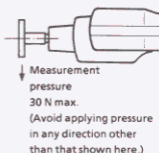
Be sure to observe the following safety warnings.

In making contact-type measurements, a risk is involved by virtue of the fact that the HT-5100 is pressed directly up against a rotating body. When making measurements, always observe the precautions listed below.

- ① When mounting the contact adaptor to the HT-5100, insert the adaptor securely onto the detector section of the HT-5100, *securing it tightly with a screw*. Also be sure that measurement pressures listed in the figures below are not exceeded.



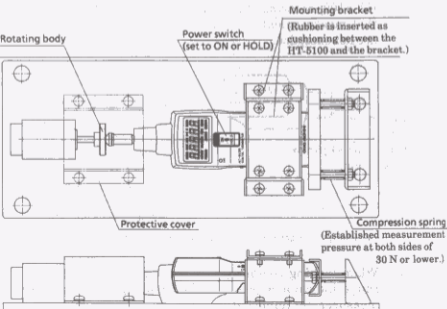
Using a Contact Tip



Using a Circumferential Ring

- ② When making contact-type measurements, if the over-range indicator appears in the display, terminate the measurement immediately.

- ③ The contact tip should be accurately positioned in the depression at the end of the rotating shaft being measured. If it is at an angle, excessive stress might be placed on both the contact adaptor and the rotating shaft.
- ④ When making measurements at high speeds of over 5,000 rpm, hold the HT-5100 with both hands to ensure that the contact tip remains in good contact with the center of the rotating shaft throughout the measurement. If it slips away from the center of the shaft, excessive force will be applied to the HT-5100.
- ⑤ In high-speed measurements of 10,000 rpm and higher, when pressing the contact tip up against the rotating body, if there is eccentricity between the center of rotating and the shaft center, an extremely hazardous condition will occur. In particular if the contact tip deteriorates or if the method of pressing it up against the rotating body is not proper, it might fly off, causing injuries. Use a setup as shown below to ensure safe measurements.



- ⑥ During a measurement, if the RECALL switch is operated, even if the measured rpm is below 10,000 rpm, be sure to hold the HT-5100 with both hands while pressing the switch.

Use switches other than the RECALL switch (e.g., UNIT and MODE switches) before measurements, and avoid making switch operations during measurements.

- ⑦ Measurements with a circumferential ring are specified up to 400 m/min. (mm/s). From a safety standpoint as well, it is recommended that tangential speed measurements be made only up to this specified speed.

10. OVERRANGE DISPLAY

- ① Non-contact type measurements

When the measured value exceeds 99999 rpm, 999.99 rps, or 9999.9 m/min., the value will be fixed on the display, the "OVER" indicator will appear in the display, and a beeper will sound as a warning.

- ② Contact measurements

When the measured value exceeds 20000 rpm, 400.00 rps, or 2000.0 m/min, the value will be fixed on the display, the "OVER" indicator will appear in the display, and a beeper will sound as a warning.

- ③ In making period measurements, when the rpm is 6 rpm, the "OVER" indicator appears in the display.

11. TROUBLESHOOTING

Should a failure occur in your HT-5100, return it to your sales representative or nearest Ono Sokki sales office. However, before assuming that repair is necessary, reread this manual carefully, and verify the operation of the HT-5100 once again.

Pay particular attention to the following points.

Symptom	Check	Correction
<ul style="list-style-type: none">● No display appears	<ol style="list-style-type: none">① Batteries installed?② Batteries installed with correct (+) and (-) polarities?③ Batteries worn down?④ AC adaptor inserted into AC outlet?	<ol style="list-style-type: none">① Install batteries.② Re-install batteries with the proper polarity.③ Replace all batteries with new ones.④ Plug AC adaptor into AC outlet.
<ul style="list-style-type: none">◆ Non-contact method● Displayed value is not the actual value	<ol style="list-style-type: none">① Is there a reflective mark applied to the rotating body?② Is the light projector shining light on reflective mark?③ Is the method of shining light on the reflective mark proper?	<ol style="list-style-type: none">① Apply a reflective mark to the rotating body under measurement.② Shine light from the light projector onto the reflective mark.③ Shine the light on the reflective mark so that the light strikes the mark just one time each rotation.

Symptom	Check	Correction
	<p>④ Is the distance proper?</p> <p>⑤ Does the rotating body have a shiny, plated surface?</p>	<p>④ The distance range over which measurement is possible is 20 to 300 mm. Keep the distance in this range. However, depending upon how the reflective mark is applied (e.g., when it is applied to a narrow shaft), measurement as far away as 300 mm might not be possible.</p> <p>⑤ Take measures such as winding black tape around the shaft or shining the light onto the shaft at an angle.</p>
<p>◆ Non-contact method</p> <p>● Displayed value is not the actual value</p>	<p>① Are scratches and unevenness in the surface of the rotating body causes random reflections?</p> <p>② Have 2 reflective marks been applied with a space between them?</p> <p>③ Is the distance proper?</p>	<p>① Take measures such as winding black tape around the shaft.</p> <p>② Reapply them without a space between them.</p> <p>③ Maintain the proper distance.</p>

Symptom	Check	Correction
<ul style="list-style-type: none"> ◆ Contact method ● Displayed value is not the actual value 	<ul style="list-style-type: none"> ① Is the contact tip worn and disfigured? ② Is there slippage between the rotating body and the contact tip? 	<ul style="list-style-type: none"> ① Replace the contact tip. ② Hold the HT-5100 securely so that slippage does not occur.

12. SPECIFICATIONS

12.1 Measurement Section

Measurement units	Rotational speed (rpm, rps), tangential speed (m/min.), accumulated count, period (ms)
Measurement ranges	Non-contact measurement: 6 to 99,999 rpm 0.10 to 999.99 rps 0.6 to 9999.9 m/min 0 to 99999 counts 0.6 to 9999.9 ms Contact measurement: 6 to 20000 rpm 0.10 to 400.00 rps 0.6 to 400.0 m/min. 0 to 99999 counts 0.6 to 9999.9 ms
Number of display digits	5
Display type	5-digit LCD (liquid-crystal display) with backlighting
Time base	Quartz crystal oscillator (32.768 kHz)

Measurement display time	1 s, automatically updated (except 2 times the maximum period for 60 rpm and below)	
Accuracy	6 to 11,999 rpm:	± 1 rpm
	12,000 to 29,999 rpm:	± 2 rpm
	30,000 to 49,999 rpm:	± 4 rpm
	50,000 to 99,999 rpm:	± 10 rpm
	0.10 to 199.99 rps:	± 0.02 rps
	200.00 to 499.99 rps:	± 0.4 rps
	500.00 to 999.99 rps:	± 0.06 rps

In the case of tangential speed, the accuracy depends upon the rpm speed of the rotating body.

(Example)

For a diameter of 10 cm, if the tangential speed is 1000 m/min., the rpm corresponding to this speed is 3183.1 rpm, and the error would be ± 1 rpm. Therefore the tangential speed error would be

$$\begin{aligned} & \pm 1 [\text{rpm}] \times 10 [\text{cm}] \times \pi \\ & = \pm 0.314 [\text{m/min}] \pm 0.3 [\text{m/min}] \end{aligned}$$

(assuming that there is no error in diameter)

* The above errors are all for non-contact measurement, but do not include the error caused by hand movement. In contact measurements, contact tip slippage, error, and other factors would have to be added.

Overrange indication

Non-contact measurement:

When the measured value exceeds 99999 rpm, 999.99 rps, or 9999.9 m/min., the value will be fixed on the display, the "OVER" indicator will appear in the display, and a beeper will sound as a warning.

Contact measurement:

When the measured value exceeds 20000 rpm, 400.00 rps, or 2000.0 m/min, the value will be fixed on the display, the "OVER" indicator will appear in the display, and a beeper will sound as a warning.

12.2 Detection Section

Detection method

Visible light reflection

Reflection detection distance

20 to 300 mm (Refer to the graph on the following page for the relationship between the angle and the distance.)

Light source

Red light-emitting diode

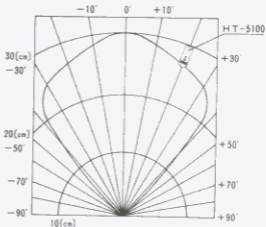
Light receiver

Phototransistor

Detection mark

1 reflective mark per rotation

(The 0° point is taken as the angle at which the light axis and reflective mark are mutually perpendicular.)



12.3 Analog Output

Measured value

3 ranges:

rpm: 1000, 10000, 100000

rps: 10.00, 100.00, 1000.00

m/min.: 100.0, 1000.0, 10000.0

Output voltage

0 to 1 V (full scale)

Linearity

$\pm 0.5\%$ of full scale

Zero drift

$\pm 0.01\%$ of full scale/ $^{\circ}\text{C}$

Span drift

$\pm 0.01\%$ of full scale/ $^{\circ}\text{C}$

Output update interval

Approx. 100ms

Resolution

4 mV

Load resistance

1k Ω min.

Zero offset

$\pm 0.5\%$ of full scale

12.4 Storage Time

The last measured value, maximum value, and minimum value are stored in memory until batteries wear down or until supply of current from an AC adaptor is interrupted.

12.5 Calculation Method

60 rpm or higher	Gate calculation
Below 60 rpm	Period calculation

Measurement down to 6 rpm is possible, and if there is no signal for 1 second, since 0 rpm is displayed, the CPU performs a prediction calculation.

12.4 General Specifications

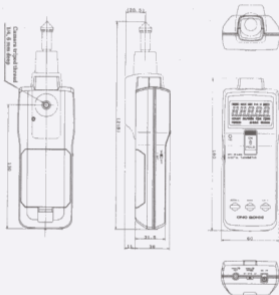
Power requirements	Type AA batteries Continuous operation time: (using manganese batteries at 20°C) Approx. 40 hours Approx. 10 hours (using backlighting) Operation is also possible from the PB-703 AC Adaptor (option).
Battery low indicator	"BATT" appears in the display when the battery voltage drops below approximately 3.3 V.
Operating temperature range	0 to +40°C
Storage temperature range	-20 to +60°C
Dimensions	160 × 60 × 36 mm (HT-5100 alone) 218 × 60 × 47 mm (HT-5100 with contact adaptor mounted)

Weight

Approx. 130 g (not including batteries)

Approx. 185 g (including contact adaptor but not batteries)

13. OUTER DIMENSIONS



14. STORAGE METHOD

The storage temperature range for the HT-5100 is -20 to $+60^{\circ}\text{C}$. Avoid storing it in locations subject to particularly high or low temperatures. Also avoid locations having high humidity, and locations which are subject to direct sunlight. Store the HT-5100 in a location having good ventilation.

If the HT-5100 is to be left for a long period unused, be sure to remove its batteries to prevent damage, should battery fluid leakage occur.

15. WARRANTY

This product is covered by a warranty for a period of one year from the date of purchase. While this product has been subjected to a severe series of inspections and a complete program of quality control, should a failure occur within the 1 year warranty period, repair shall be performed free-of-charge. However, Ono Sokki shall not be held responsible for failures occurring through ignoring the precautions for use in this document or by other misuse or misoperation will be handled on a fee basis, even during the warranty period.