

# Advanced Tachometer

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## FT-1500

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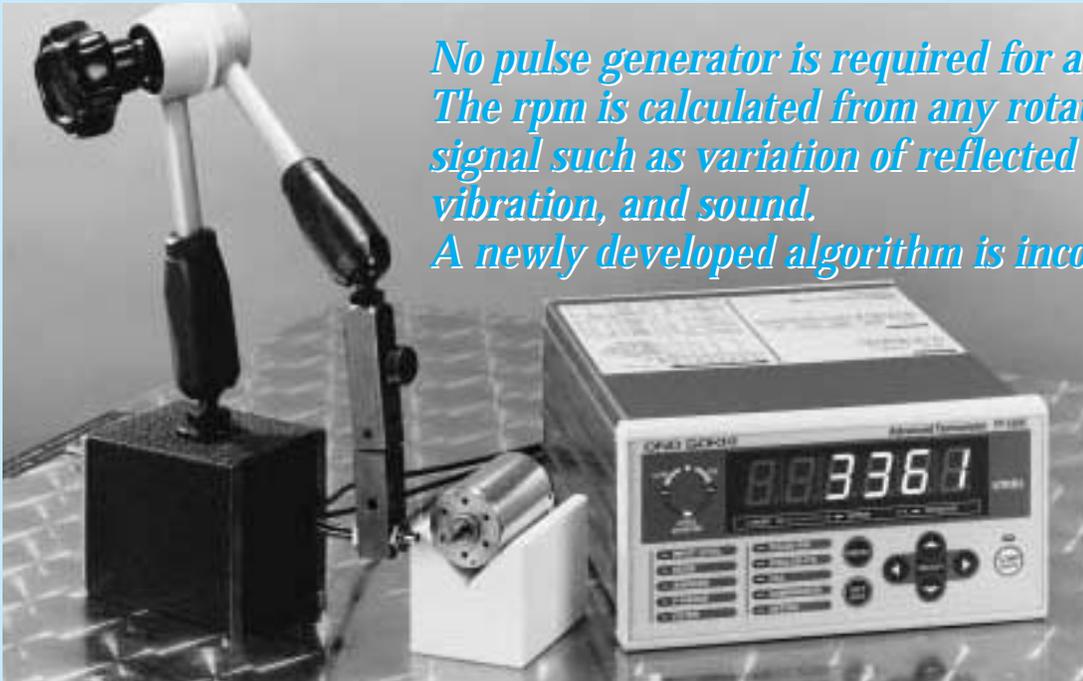
*A digital tachometer that doesn't require rotational pulse signals*

*FFT calculations performed by the device enable measurement of rotational speed by sensing fluctuations in rotation-synchronized signals like reflected light, magnetism, vibration, and sound. The FT-1500 is ideal for evaluating stand-alone motors or compressors in which pulse sensors can't be installed.*



**ONO SOKKI**

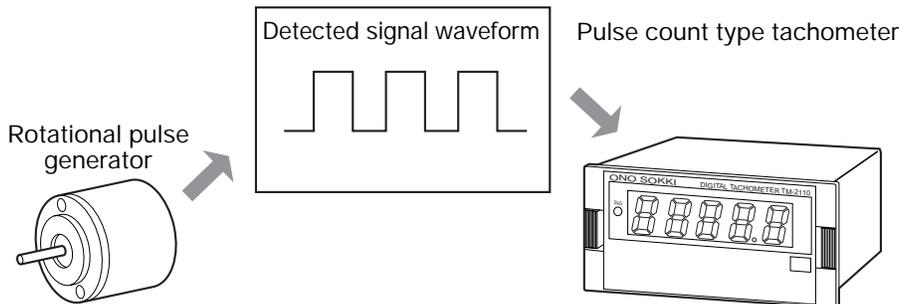
# More and more customers in the world are adopting the FT-1500 for their inspection lines of motors, home appliances, car parts, etc.



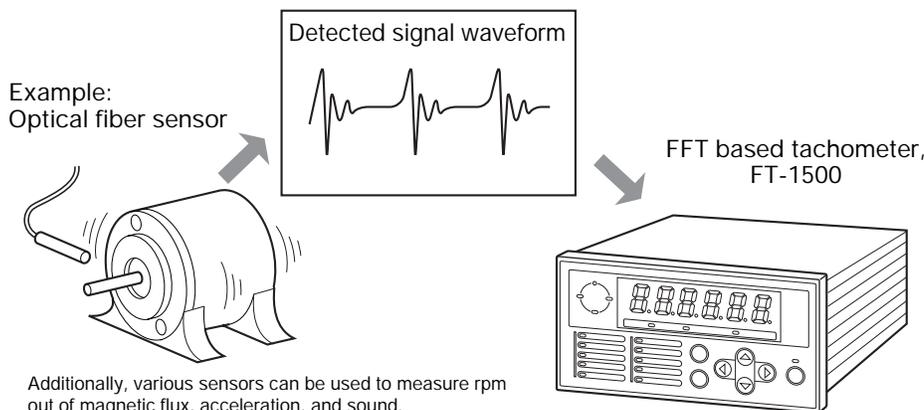
*No pulse generator is required for a measurement. The rpm is calculated from any rotation-dependent raw signal such as variation of reflected light, magnetism, vibration, and sound. A newly developed algorithm is incorporated.*

Use of advanced FFT technology makes the FT-1500 superior to any conventional tachometers.

## Conventional system



## FT-1500 system



## Features

- Does not require application of reflective markers or special machining to install a detector.
- Allows easy evaluation of home appliances or compressors, even when rotating shafts are not directly accessible.
- Added versatility when combined with a range of detectors, including a leakage flux detectors, optical fiber sensors, acceleration pickups, and sound-level meters.
- A simple, sturdy design for use on inspection lines. Two-stage, upper-/lower-limit comparator output or RS-232C interface, ideal for GO/NO GO determinations.
- Input of a two-phase signal enables determination of rotational direction (with the FT-0501).
- Provides multiple functions in an affordable package.

# Functional Descriptions

## CCW/CW indicator lamp

Indicates rotational direction.  
(Applicable when used with FT-0501.)

## LEVEL MONITOR indicator lamp

This indicates the voltage level of the signal from a sensor.  
(Excessive level: Red  
Proper level: Green  
Inadequate levels: No light)

## PULSE-P/R set function indicator lamp

Sets the number of pulses (poles) per rotation in the object to be measured. (0.5 P/R to 199.5 P/R)

## ANALOG-F.S. set function indicator lamp

Sets the rpm speed in the full-scale value (10 V) of an analog output signal.

## INPUT LEVEL selection function indicator lamp

Selects according to the voltage input from a sensor.  
(SIG1: Two ranges of  $\pm 12$  V and  $\pm 0.5$  V  
SIG2: Three ranges of  $\pm 5$  V,  $\pm 0.5$  V, and  $\pm 0.05$  V)

## MENU selector switch

Enables or disables the setting of each parameter.

## CAL selection function indicator lamp

Outputs analog output signals (ZERO (0 V) or FULL (10 V)).

## LOWER/UPPER/ROTATION indicator lamp

Indicates the comparator determination.

## COMP ON/OFF selector switch

Enables or disables operation of the comparator.

## SET NEXT selector switch

Allows selection of each function in sequence; used to set parameters.

## COMPARATOR set function indicator lamp

Sets the upper- or lower-limit value of rpm speed and the rotational direction (CW or CCW).

## OPTION set switch

Switch reserved for special use

## AVERAGE selection function indicator lamp

Performs exponential averages of a spectrum position following FFT calculation. (OFF or multiples of 2, 4, 8, or 16)

## F-RANGE selection function indicator lamp

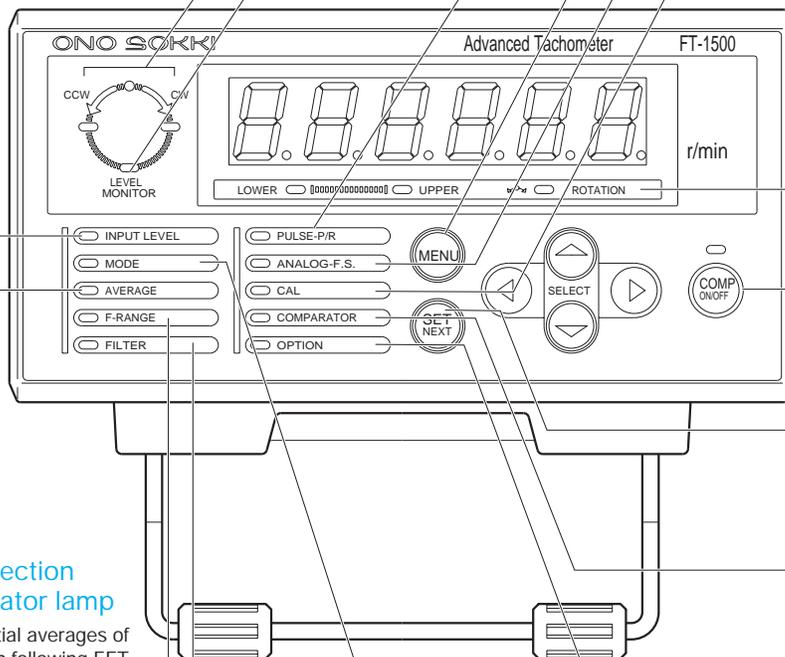
Selects the frequency range for the object to be measured. (500 Hz, 2 kHz, or 10 kHz)

## FILTER set function indicator lamp

Sets upper- and lower-limit frequency values to eliminate undesirable portions of the spectrum.

## MODE selection function indicator lamp

Selects a mode appropriate for the object to be measured. The measurement algorithm and drive current for a sensor is automatically switched according to mode.



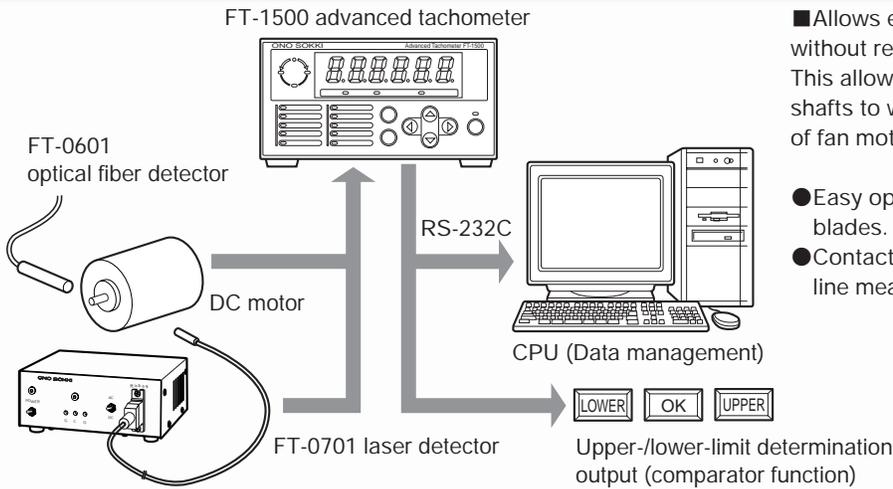
| MODE       | Major Object                                      | Measurement Algorithm | Applicable Sensor                          |
|------------|---|-----------------------|--|
| DC-M.1     | DC motor  | Maximum peak method   | FT-0501                                    |
| DC-M.2     | 4-pole DC motor, etc.                             | Maximum peak method   | FT-0501                                    |
| DC-M.3     | 3-pole DC motor                                   | Maximum peak method   | FT-0501                                    |
| DC-M.3     | DC motor  | Peak-interval method  | FT-0501                                    |
| COMP       | Compressor  | Maximum peak method   | Acceleration pickup                        |
| REVO       | Rotor, fan, etc.                                  | Peak-interval method  | FT-0601                                    |
| ENG        | Engine  | Peak-interval method  | VP-202, etc.<br>Engine Revolution Detector |
| USER-1,2,3 | Any algorithm selectable according to the object. |                       | FT-0701, etc.                              |

# Several FT-1500 applications are given below as examples.

● The applications described below are provided as examples only.

When combined with an optimal detector, the FT-1500 gives you the capability to measure the rpm speed for a device that previously could not be evaluated. For more information, please contact your nearest service facility.

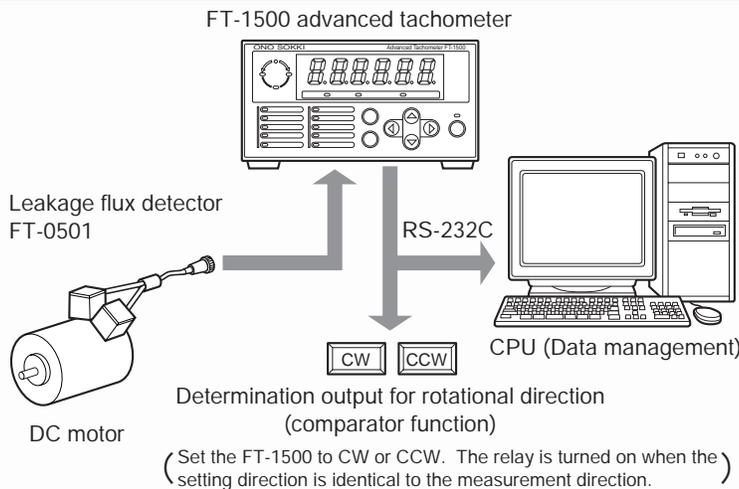
## Application 1 Rotational measurement of a micro DC motor rotational shaft



■ Allows easy measurement of motor shaft rotations, without requiring reflective marks. This allows measurement of the revolutions of thin shafts to which reflective marks can't be attached, or of fan motors from which light can't be reflected.

- Easy operation - just enter the number of fan blades.
- Contact-free measurement - ideal for inspection line measurement needs.

## Application 2 Determination of rotational direction and revolution measurement of a DC motor

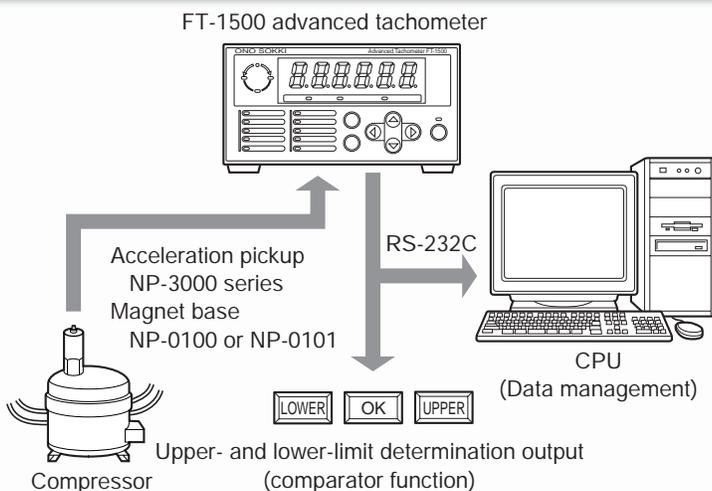


■ Given below is an example of rotational direction determination and revolution measurement of a DC motor made using the advanced tachometer FT-1500 and leakage flux detector FT-0501.

The FT-0501, which was developed as a detector specially for use with the FT-1500, detects the leakage flux of a DC motor and extracts a frequency signal proportional to the rpm speed. Since the FT-0501 has two internal coils, a phase shift occurs between the two detected signals. The rotational direction is then indicated by the phase relation. This function is very convenient in quality control operations involving small DC motors, whose rotational direction may be difficult to be determined visually. The function also allows measurement of the rpm speed.

- Rotational direction is determined by the output of a two-phase signal.
- The output function (semiconductor relay) that determines rotational direction is useful for CW/CCW determination on inspection lines.

## Application 3 Measurement of compressor revolution using an acceleration pickup

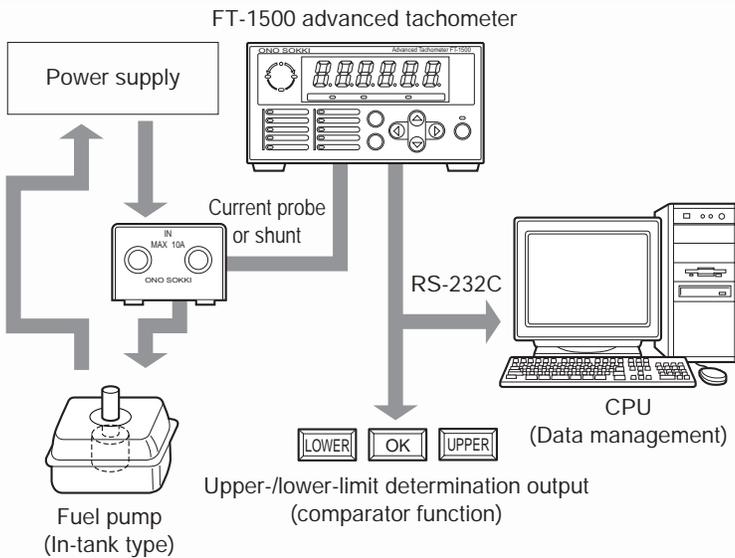


■ This is used for compressors that function as essential components of household refrigerators, vending machines, display cases, and air conditioning units. The number of revolutions of a compressor whose rotational shaft is not directly accessible is easily measured by combining the FT-1500 with an acceleration pickup.

An acceleration pickup (NP-3000 series) is installed on an optional magnet base (NP-0100 or NP-0101) and placed at an optimum position after a signal check at various locations.

- Permits easy measurement of compressor shaft revolutions when a shaft is difficult to access.
- Permits measurement of revolutions of the compressor incorporated in products and of stand-alone compressors.
- Ideal for lock determination during lock-testing of a refrigerator.

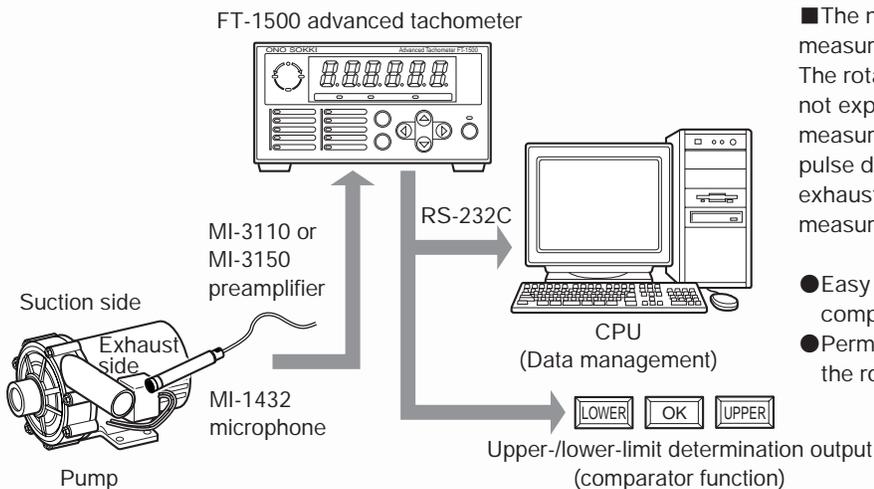
## Application 4 Measuring revolutions of a fuel pump DC motor, using a current probe sensor



■ For DC motors found in automobile electronics. The current consumption of the DC motor pulses in proportion to the number of poles in the motor. A current probe or shunt is inserted into one side of the power line connected to the DC motor. The resulting signal is output from the current pulsation of the DC motor as a frequency signal corresponding to the input current. The revolution of the DC motor can be accurately measured by inputting the signal to the FT-1500 and performing a FFT. This function is ideal for measuring the revolution of a stand-alone DC motor or products (parts) that incorporate motors whose lead wires are accessible, such as those found in automobile electrical equipment.

- Shunt box specifications (One example)
  - Input current: 1 to 10A (maximum)
  - Withstand voltage: 30 VDC
  - Input loss: 0.2  $\Omega$  or less in DC resistance
  - Maximum input frequency: 2 kHz (3-dB down point)
  - Minimum passing frequency: 20 Hz (Fundamental wave)

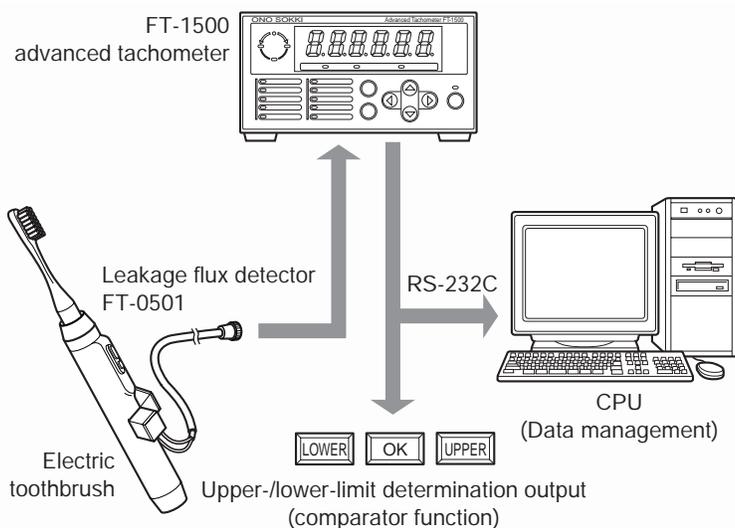
## Application 5 Measuring pump revolutions through sound pressure sensing



■ The number of pump revolutions is easily measured by monitoring exhaust noise. The rotational shaft in pump equipment is generally not exposed externally, making it difficult to perform measurement of revolutions based on the ordinary pulse detection system. In this example, changes in exhaust pressure are detected for revolution measurement with a microphone.

- Easy operation - just enter the number of compressor blades.
- Permits measurement of pump revolutions when the rotational shaft is not directly accessible.

## Application 6 Measuring the revolution of DC motors found in home appliances

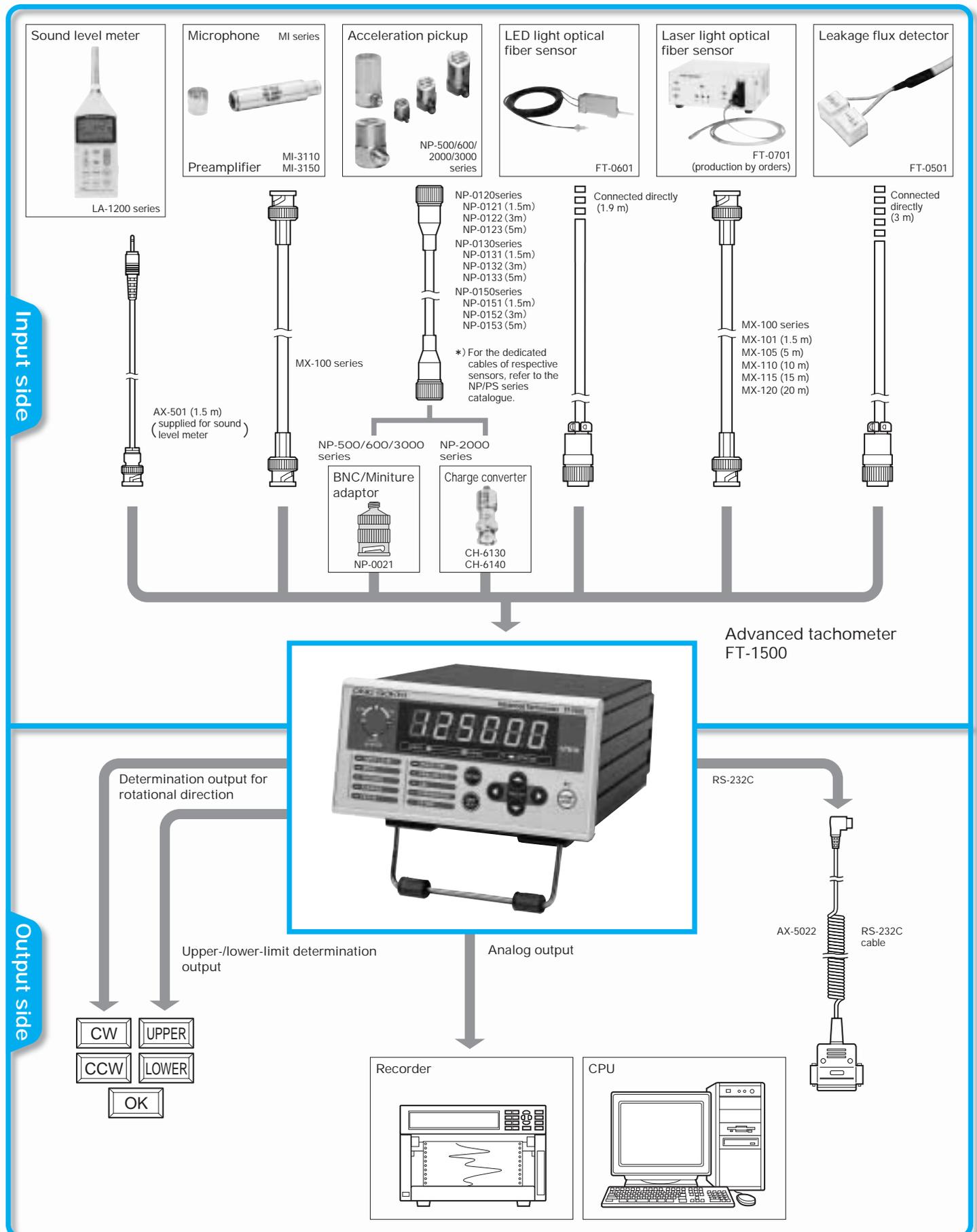


■ For inspection line work, the following is an easy way to measure the revolution rates of finished products such as household electrical products. As an example, we'll use a popular electric toothbrush. The quality control of these finished products is crucial, since revolving parts directly contact the teeth and gums. The FT-1500 detects the magnetic flux leaking from the DC motor found in such products. The number of poles is then input to the FT-1500. Various adaptive detectors are provided in the application using the FT-1500.

- The FT-1500 detects the pulsation of the leakage flux proportional to the number of poles of the DC motor in the finished product.
- Provides two-stage, upper-/lower-limit comparator output ideal for OK, LOWER, or UPPER determination on inspection lines
- Permits data management through an RS-232C interface.
- Measurement system configured at an affordable cost.

Note: The applications described in this brochure are real-world examples. However, the capacity to provide accurate measurement may vary depending on the state of the object to be measured or suitability of the detector for a particular task. We recommend confirming compatibility by product demonstration before purchasing.

# The FT-1500 system is illustrated below.



# FT-1500 Specifications

| Signal input section   |  |
|--|--|
| Sensor input section SIG1 (For FT-0501 and FT-0601)            |  |
| Input impedance  | Approx. 1MΩ (at 10 kHz)  |
| Input voltage ranges   | ±12 V and ±0.5 V   |
| Input coupling system  | AC coupling  |
| Input connector  | Adaptive plug R03-PB6M (TAJIMI)  |
| Power supply for detector                                      | 12 ±0.6 V 100 mA   |
| Sensor input section SIG2 (for NP series, FT-0701, and others) |  |
| Input impedance  | 100kΩ or greater   |
| Input voltage ranges   | ±5 V, ±0.5 V, and ±0.05 V  |
| Input coupling system  | AC coupling  |
| Input connector  | C02 (BNC)  |
| Power supply for detector                                      | 2.4 mA ±0.5 mA constant current drive (with adaptive load of 5kΩ or less)  |
| External control signal input section                          |  |
| Contact input ON   | Measurement begins. The display is updated and the comparator operates every time the measurement period elapses.  |
| Contact input OFF  | Measurement stops. The display and comparator status are retained.   |
| Input connector  | One-touch terminal board (adaptive wire diameter AWG28-16)   |
| Input signal type  | Non-voltage contact signal   |
| Open voltage   | 5 V ±0.25 V  |
| Short-circuit current  | 1 mA or less   |
| Contact resistance   | 50 Ω or less   |
| Pulse width  | 500 ms or more   |
| Measurement display section                                    |  |
| Computing system   | 1024-point FFT calculation system  |
| Measurement rpm range (r/min)                                  | Depends on frequency range and number of pulses set. (See below.)<br>Measurement range (r/min) = Measurement frequency range (Hz) × 60 / number of pulses set (P/R)<br>Measurement frequency range<br>500Hz range: 3.75 Hz to 500 Hz<br>2 kHz range: 15 Hz to 2 kHz<br>10kHz range: 75Hz to 10 kHz<br>ex.) When 500 Hz range and 1 P/R are set, measurement range can be calculated as below:<br>(3.75 to 500) × 60 / 1 = 225 to 30000 (r/min) |
| Rpm resolution (r/min)   | Depends on frequency range and number of pulses set. (See below.)<br>Resolution (r/min) = Frequency range (Hz) / 12800 × 60 / number of pulses set (P/R)<br>ex.) When 2 kHz range and 12 P/R are set, resolution can be calculated as below:<br>2000 / 12800 × 60 / 12 ≈ 1 (r/min)   |
| Measurement accuracy   | Accuracy (r/min) = ±2 × rpm resolution (r/min) ± 1<br>ex.) When 2 kHz range and 12 P/R are set, accuracy can be calculated as below:<br>±2 × 1 ± 1 = ±3 (r/min)  |
| Measurement time   | 500 ms or less   |
| Display  | 7-segment green LED, 6 digits, 14.2 mm of character height   |
| Pulse count set range  | 0.5 to 199.5 P/R in 0.5 steps  |
| Rotational direction determination function                    | Displays CW or CCW (when used with FT-0501)  |
| Exponential averaging  | Selects one of 2, 4, 8 or 16 times.  |

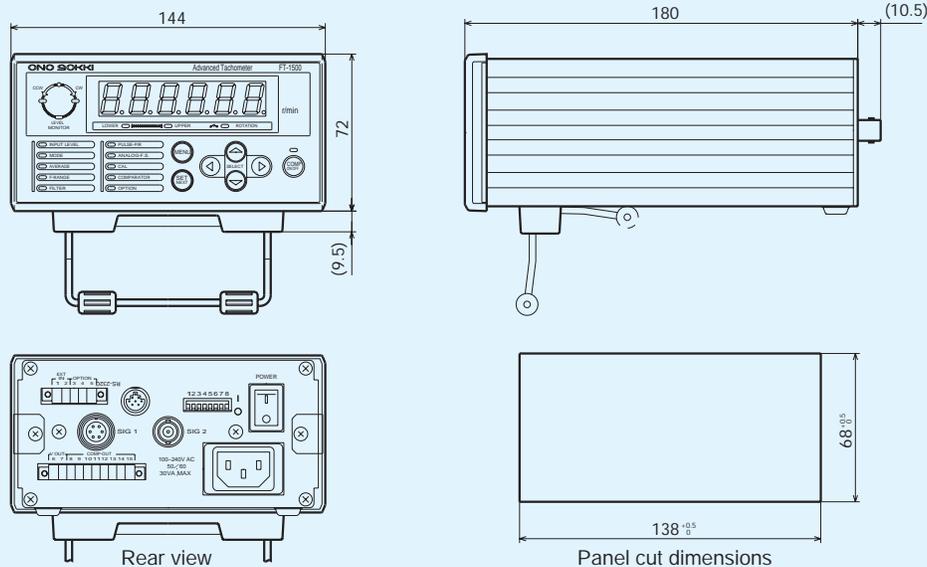
| Signal output section   |  |
|---|--|
| Analog signal output  |  |
| Output voltage range  | 0 to 10 V. Set any rpm for 10 V output.  |
| Load resistance   | 1k ohm or more   |
| Output connector  | One-touch terminal board (adaptive wire diameter AWG28-16)   |
| Accuracy  | Linearity ±0.3% of F.S<br>Setting error ±0.5% of F.S (FULL)<br>±0.3% of F.S. (ZERO)  |
| Temperature coefficient   | 0.05% of F.S./°C   |
| Calibration function  | Outputs a ZERO (0 V) or FULL (10 V) output voltage.  |
| Comparator output   |  |
| Output system   | Semiconductor relay (Photo MOS)  |
| Upper-limit determination   | Set to ON with "set value =< display value."   |
| Lower-limit determination   | Set to ON with "set value > display value."  |
| Determination of rotational direction   | Sets CW or CCW. Set to ON with "set direction = display."  |
| OK determination  | Set to ON when determination for the three items above are all OFF.  |
| Output connector  | One-touch terminal board (adaptive wire diameter AWG28-16)   |
| Contact capacity  | 30 VDC, 0.1 A (Resistance load)  |
| Monitor output  |  |
| Output connector  | One-touch terminal board (adaptive wire diameter AWG28-16)<br>Shared with the analog output terminal and selected using a BIT switch |
| Interface   |  |
| RS-232C   |  |
| Interface function  | Reads parameters and measured data, and sets parameters.   |
| Baud rate   | 2400, 4800, 9600, 19200 bps  |
| Connector   | HR 12 - 10 R - 8 SDL   |
| General specifications  |  |
| Power supply  | 100 to 240 VAC (50/60 Hz)  |
| Power consumption   | 30 VA or less  |
| Operating temperature range   | 0°C to 40°C  |
| Storage temperature range   | -10°C to 55°C  |
| External dimensions   | 144 (W) × 72 (H) × 210 (D) mm  |
| Weight  | 1500 g or less   |
| Supplied accessories  |  |
| Panel bracket, stand, Operating Manual, terminal board connectors (10-pin and 5-pin, each), and power cable |  |
| Option  |  |
| AX-5022   | RS-232C signal cable (2 m for PC)  |

| Dedicated sensors           | FT-0501   | FT-0601  | FT-0701 (manufactured when ordered)   |
|-----------------------------|---|--|---|
| Object to be measured       | DC motor  | Rotating shaft   | Rotating shaft and fan  |
| Detection system            | Leakage flux detection                                      | LED reflected-light optical fiber detection  | Laser reflected-light optical fiber detection   |
| Main specifications         | Fixed with a signal cable (3 m) with a connector (R03-PB6M) | Detection distance: Approx. 5 mm*<br>Fiber length: 2 m<br>Fixed to a signal cable of 1.9 m with a connector (R03-PB6M) | Visible light semiconductor laser 680 nm, class 2<br>Detection distance: 30 to 100 mm*<br>Fiber length: 1 m<br>Requires a signal cable MX-100 series : Optional |
| Operating temperature range | -10°C to +60°C  | -10°C to +50°C   | 5°C to +40°C  |

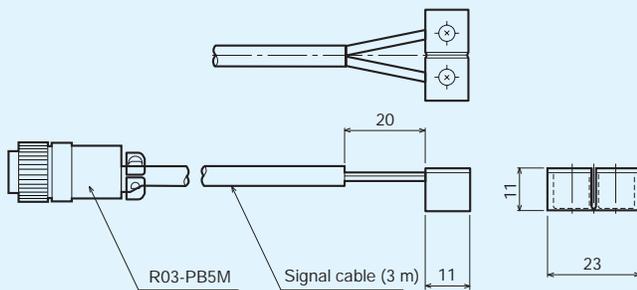
\* The detection distance is a rough standard and varies depending on shaft diameter and optical conditions of the surface.

## External Dimensions

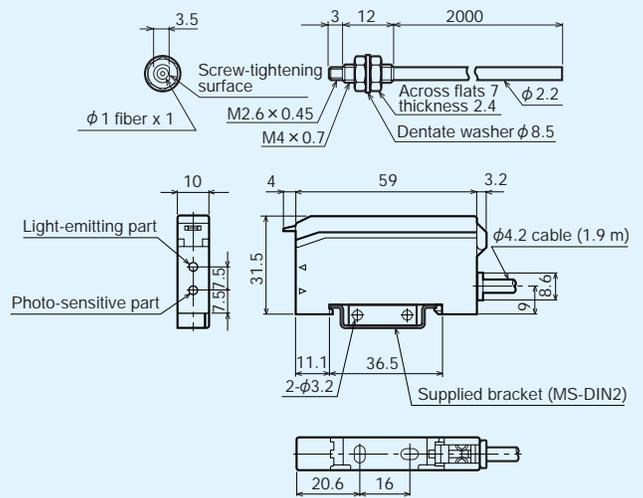
### ● FT-1500



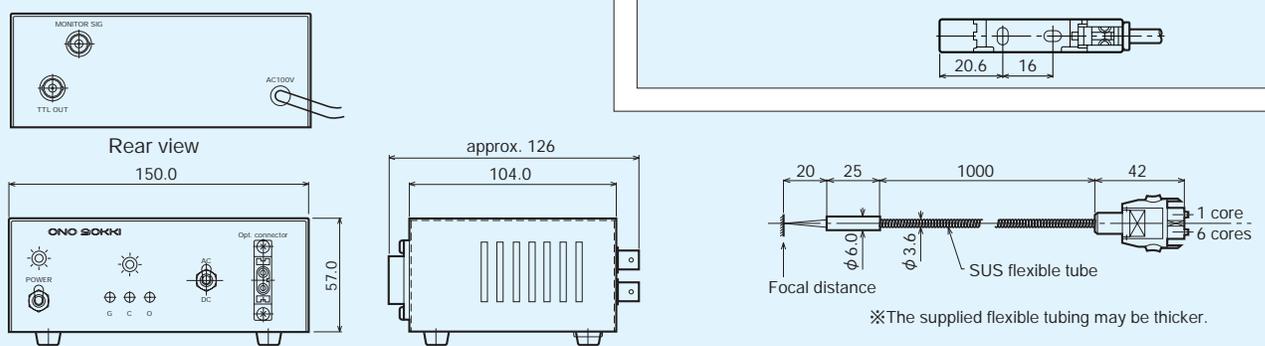
### ● FT-0501



### ● FT-0601



### ● FT-0701



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\*Outer appearance and specifications are subject to change without prior notice.  
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