Advanced Tachometer

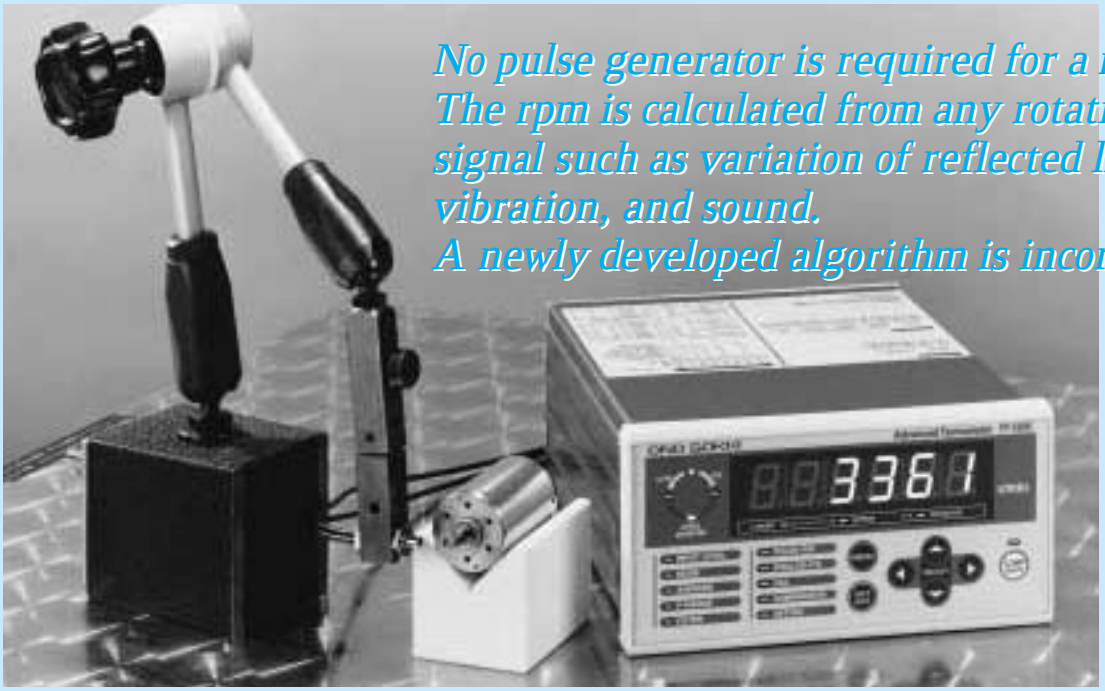
FT-1500

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

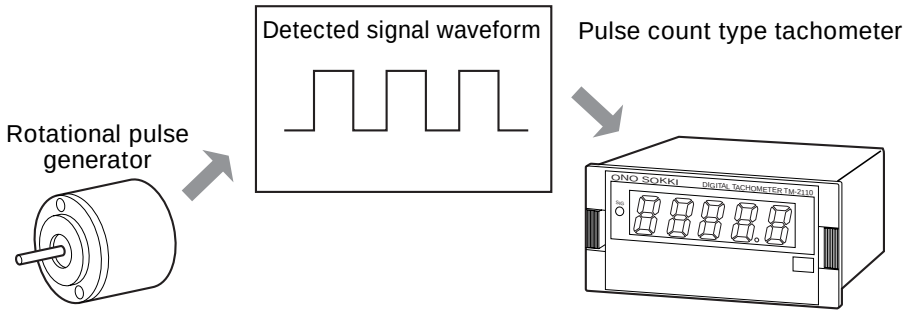
More and more customers in the world are adopting the FT-1500 for their inspection lines of motors, home appliances, car parts, etc.



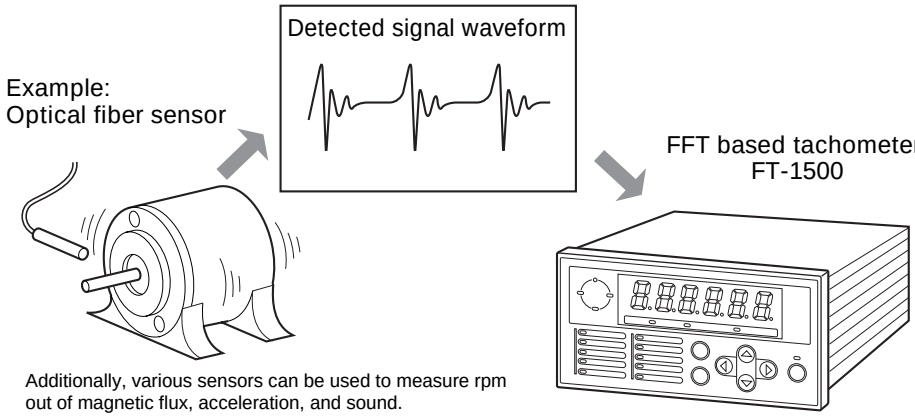
No pulse generator is required for a measurement.
The rpm is calculated from any rotation-dependent raw signal such as variation of reflected light, magnetism, vibration, and sound.
A newly developed algorithm is incorporated.

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

Conventional system



FT-1500 system



Additionally, various sensors can be used to measure rpm out of magnetic flux, acceleration, and sound.

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

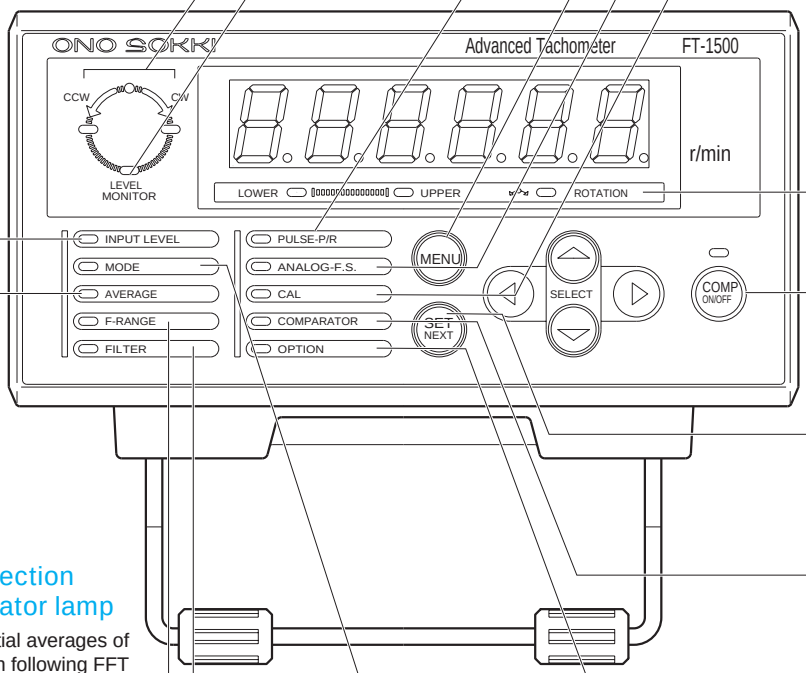
Sets the rpm speed in the full-scale value (10 V) of an analog output signal.

INPUT LEVEL selection function indicator lamp

Selects according to the voltage input from a sensor.
(SiG1: Two ranges of ±12 V and ±0.5 V
SiG2: Three ranges of ±5 V, ±0.5 V, and ±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.

AVERAGE selection function indicator lamp

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

COMPARATOR set function indicator lamp

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

F-RANGE selection function indicator lamp

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

OPTION set switch

Switch reserved for special use

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.

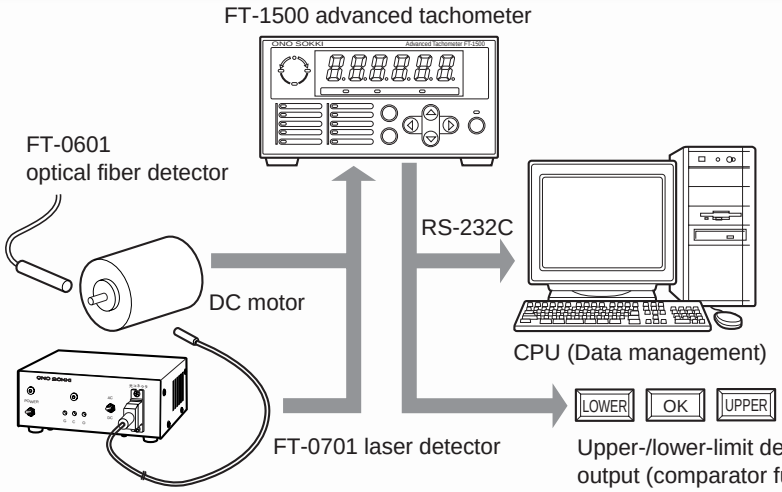
MODE	Major Object	Measurement Algorithm	Applicable Sensor
DC-M.1	DC motor	Maximum peak method	FT-0501
DC-M.2	4-pole DC motor, etc.	Maximum peak method	FT-0501
DC-M.3	3-pole DC motor	Maximum peak method	FT-0501
DC-M.3	DC motor	Peak-interval method	FT-0501
COMP	Compressor	Maximum peak method	Acceleration pickup
REVO	Rotor, fan, etc.	Peak-interval method	FT-0601
ENG	Engine	Peak-interval method	VP-202, etc. 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.

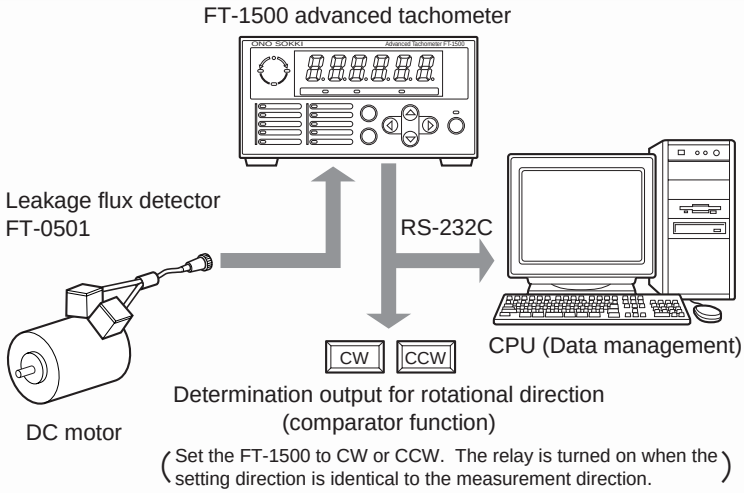
Application 1 Rotational measurement of a micro DC motor rotational shaft



■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.

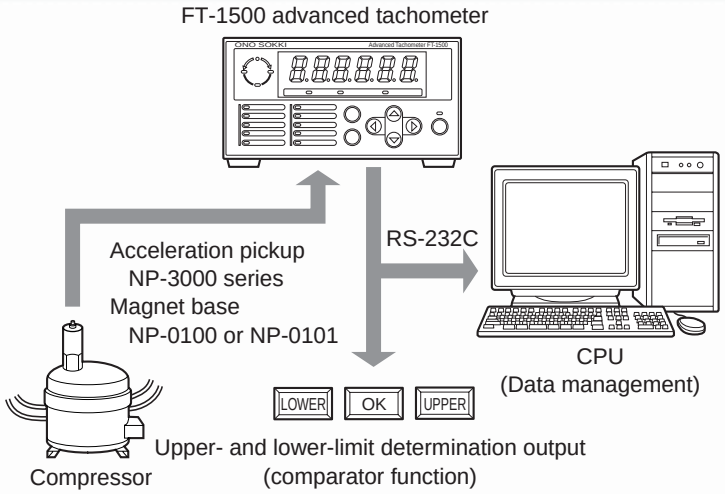
Application 2 Determination of rotational direction and revolution measurement of a DC motor



■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.

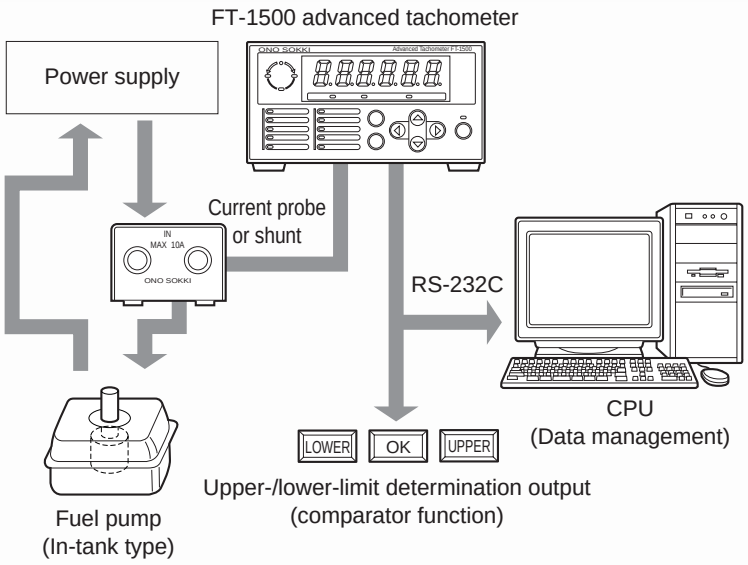
Application 3 Measurement of compressor revolution using an acceleration pickup



■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.

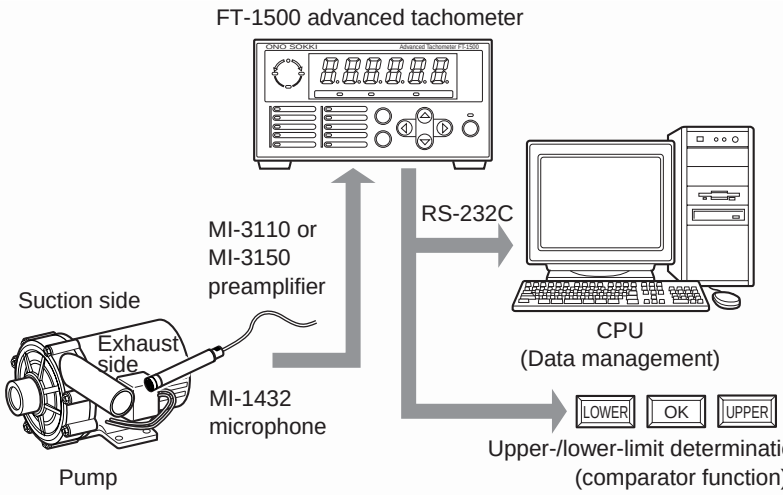
Application 4 Measuring revolutions of a fuel pump DC motor, using a current probe sensor



■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 Ω or less in DC resistance
Maximum input frequency: 2 kHz (3-dB down point)
Minimum passing frequency: 20 Hz
(Fundamental wave)

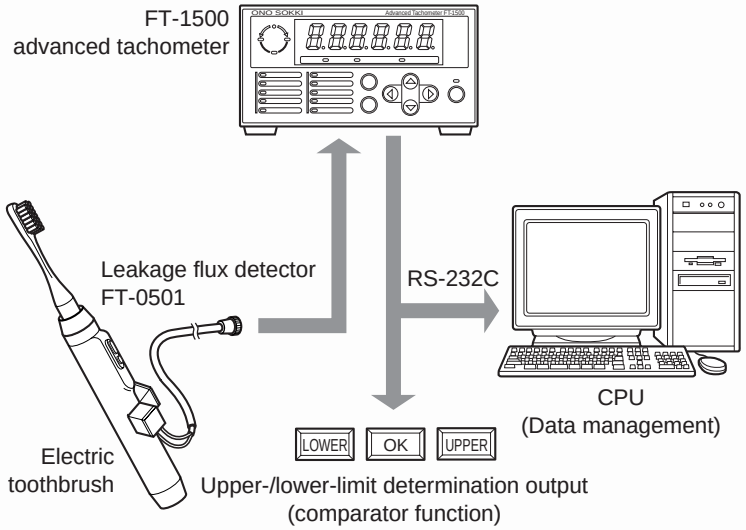
Application 5 Measuring pump revolutions through sound pressure sensing



■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

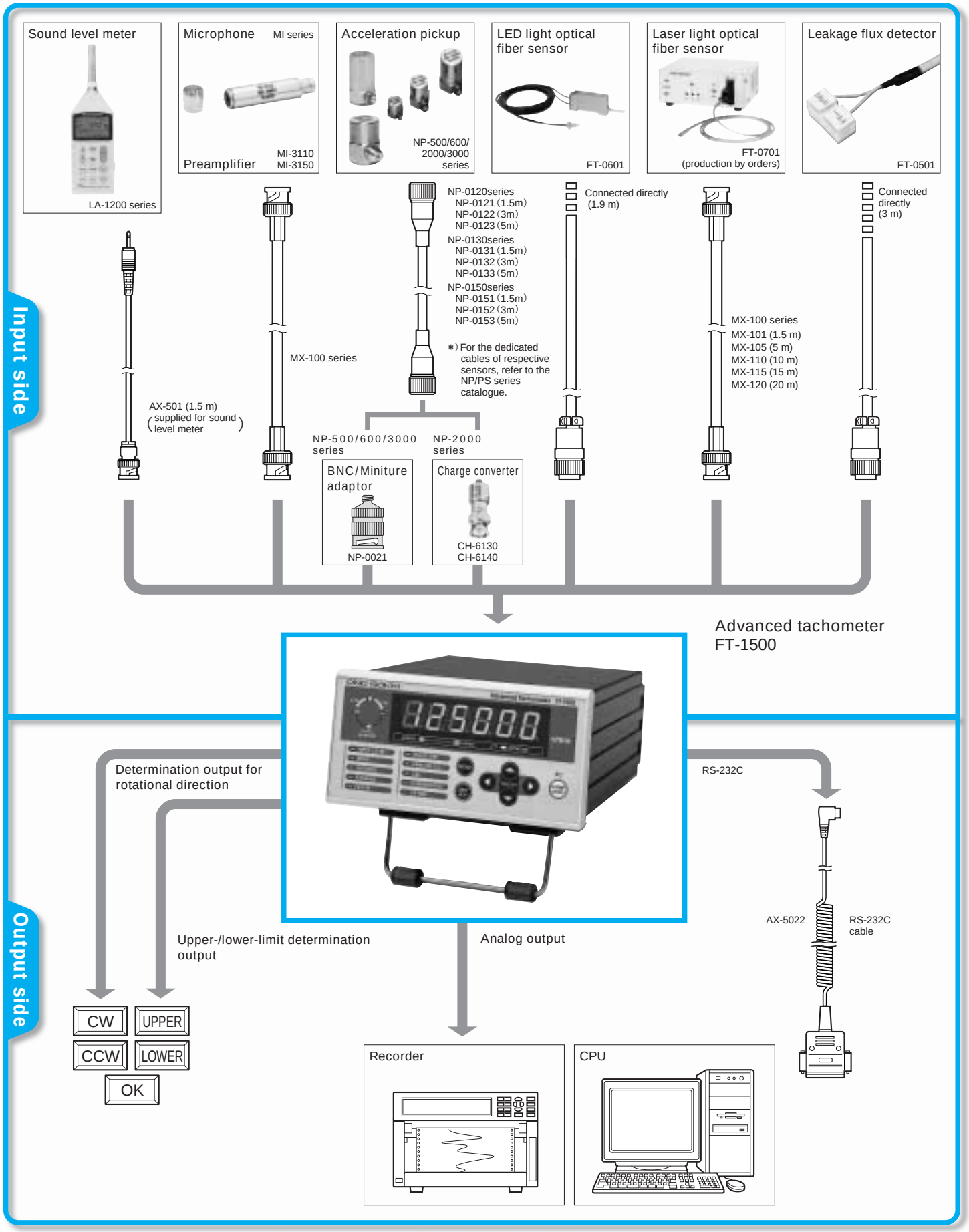


■For inspection line work, the following is an easy way to measure the revolution rates of finished products such as household electrical products.
As an example, we'll use a popular electric toothbrush. The quality control of these finished products is crucial, since revolving parts directly contact 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 configurated 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 tim 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.) Measurement range (r/min) = Measurement frequency range (Hz) x 60 / number of pulses set (P/R) Measurement frequency range 500Hz range: 3.75 Hz to 500 Hz 2 kHz range: 15 Hz to 2 kHz 10kHz range: 75Hz to 10 kHz ex.) When 500 Hz range and 1 P/R are set, measurement range can be calculated as below: (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.) Resolution (r/min) = Frequency range (Hz) / 12800 x 60 / number of pulses set (P/R) ex.) When 2 kHz range and 12 P/R are set, resolution can be calculated as below: 2000 / 12800 × 60 / 12 ≒ 1 (r/min)
Measurement accuracy	Accuracy (r/min) = ±2 x rpm resolution (r/min) ±1 ex.) When 2 kHz range and 12 P/R are set, accuracy can be calculated as below: ±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 Setting error ±0.5% of F.S (FULL) ±0.3% of F.S. (ZERO)
Temperature coefficient	0.05% of F.S./℃
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) 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℃ to 40℃
Storage temperature range	-10℃ to 55℃
External dimensions	144 (W) × 72 (H) x 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	

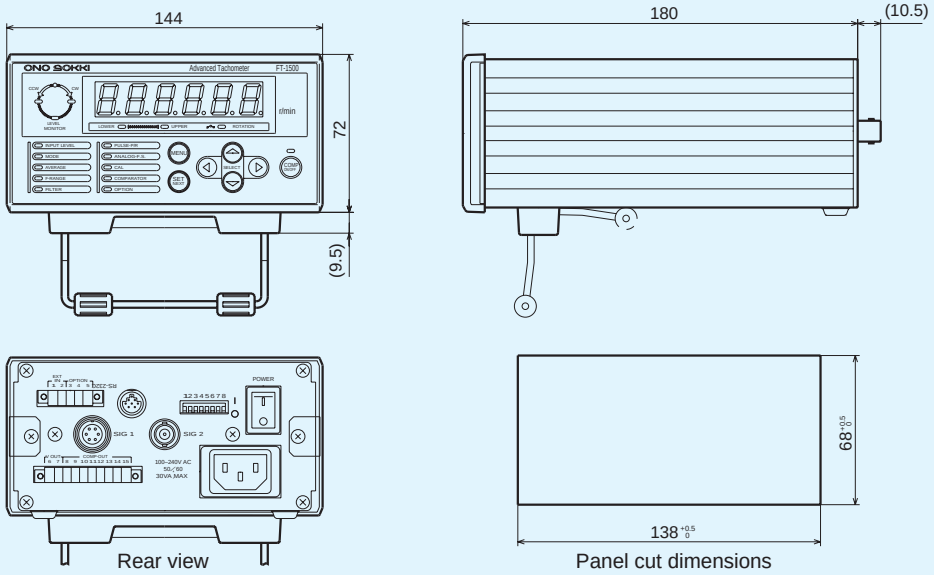
Option	
AX-5022	RS-232C signal cable (2 m for PC)

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* Fiber length: 2 m Fixed to a signal cable of 1.9 m with a connector (R03-PB6M)	Visible light semiconductor laser 680 nm, class 2 Detection distance: 30 to 100 mm* Fiber length: 1 m Requires a signal cable MX-100 series : Optional
Operating temperature range	-10℃ to + 60℃	-10℃ to +50℃	5℃ to +40℃

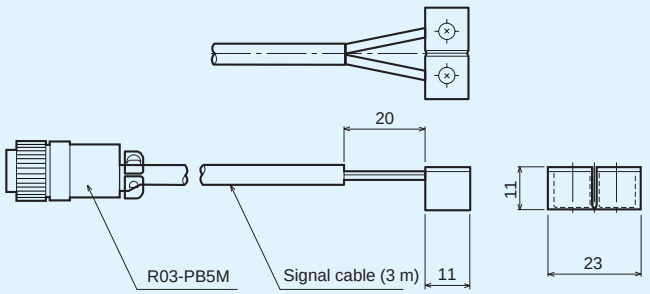
* The detection distance is a rough standard and varies depending on shaft diameter and optical conditions of the surface.

■External Dimensions

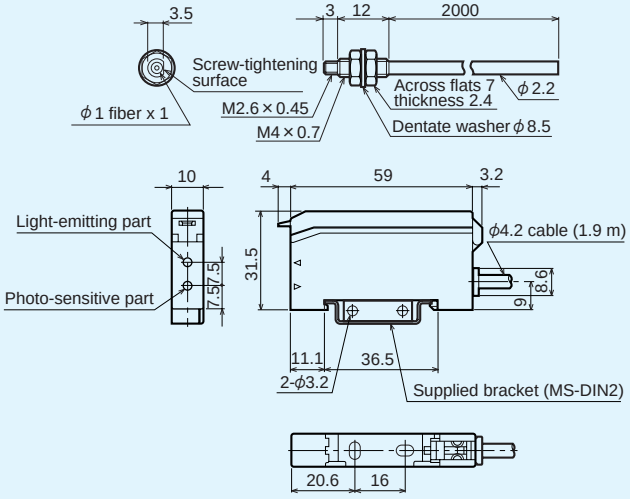
●FT-1500



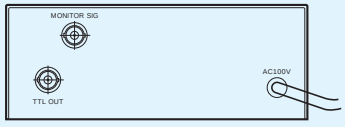
●FT-0501



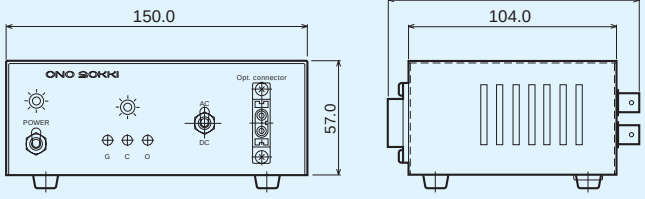
●FT-0601

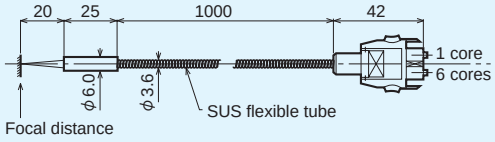


●FT-0701



Rear view





※The supplied flexible tubing may be thicker.

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

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