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.
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

- Rotational pulse generator
- Detected signal waveform
- Pulse count type tachometer

### FT-1500 system

- Example: Optical fiber sensor
- Detected signal waveform
- FFT based tachometer, FT-1500

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.
**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.

**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

**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.

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<tr>
<th>MODE</th>
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<th>Measurement Algorithm</th>
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<td>4-pole DC motor, etc.</td>
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<td>3-pole DC motor</td>
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<tr>
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<td>REVO</td>
<td>Rotor, fan, etc.</td>
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</tr>
<tr>
<td>ENG</td>
<td>Engine</td>
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<td>VP-202, etc. Engine Revolution Detector</td>
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<tr>
<td>USER-1,2,3</td>
<td>Any algorithm selectable according to the object.</td>
<td></td>
<td>FT-0701, etc.</td>
</tr>
</tbody>
</table>
Several FT-1500 applications are given below as examples.

- **Application 1** Rotational measurement of a micro DC motor rotational shaft
  - **FT-1500 advanced tachometer**
  - **FT-0601 optical fiber detector**
  - **FT-0701 laser detector**
  - **DC motor**
  - **RS-232C**
  - **CPU (Data management)**
  - **Upper/lower-limit determination output (comparator function)**

- **Application 2** Determination of rotational direction and revolution measurement of a DC motor
  - **FT-1500 advanced tachometer**
  - **Leakage flux detector FT-0501**
  - **DC motor**
  - **RS-232C**
  - **CPU (Data management)**
  - **Determination output for rotational direction (comparator function)**

- **Application 3** Measurement of compressor revolution using an acceleration pickup
  - **FT-1500 advanced tachometer**
  - **Acceleration pickup NP-3000 series**
  - **Magnet base NP-0100 or NP-0101**
  - **Compressor**
  - **RS-232C**
  - **CPU (Data management)**

- **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 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.

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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.

Sound level meter
- LA-1200 series

Microphone
- MI series
  - LA-3110
  - LA-3150

Accelerometer
- NP-500/600/2000/3000 series
  - NP-0120 series
    - NP-0121 (1.5m)
    - NP-0122 (3m)
    - NP-0123 (5m)

- NP-0130 series
  - NP-0131 (1.5m)
  - NP-0132 (3m)
  - NP-0133 (5m)

- NP-0150 series
  - NP-0151 (1.5m)
  - NP-0152 (3m)
  - NP-0153 (5m)

- For the dedicated cables of respective sensors, refer to the NP/PS series catalogue.

Charge converter
- CH-6130
  - CH-6140

LED light optical fiber sensor
- FT-0601

Laser light optical fiber sensor
- FT-0701
  - (production by orders)

Leakage flux detector
- FT-0501

Advanced tachometer
- FT-1500

Input side

- AX-501 (1.5 m)
  - (supplied for sound level meter)

- AX-501 (1.5 m)

Output side

Analog output

Determination output for rotational direction

- CW
- UPPER
- CCW
- LOWER
- OK

Recorder

CPU
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 ±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.)
  - 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
    - 10 kHz range: 75 Hz to 10 kHz
  - Resolution (r/min) = Frequency range (Hz) / 12800 x 60 / number of pulses set (P/R)
  - Accuracy (r/min) = ±0.5% of F.S.
    - Setting error: ±0.5% of F.S. (FULL)
    - ±0.3% of F.S. (ZERO)
- 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 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
- 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 when "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°C to 40°C
- Storage temperature range: -10°C to 55°C
- External dimensions: 144 (W) x 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: DC motor
- FT-0601: Rotating shaft
- FT-0701 (manufactured when ordered): 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°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**

Rear view Panel cut dimensions

**FT-0501**

Rear view

**FT-0601**

Screw-tightening surface

**FT-0701**

Rear view

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

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