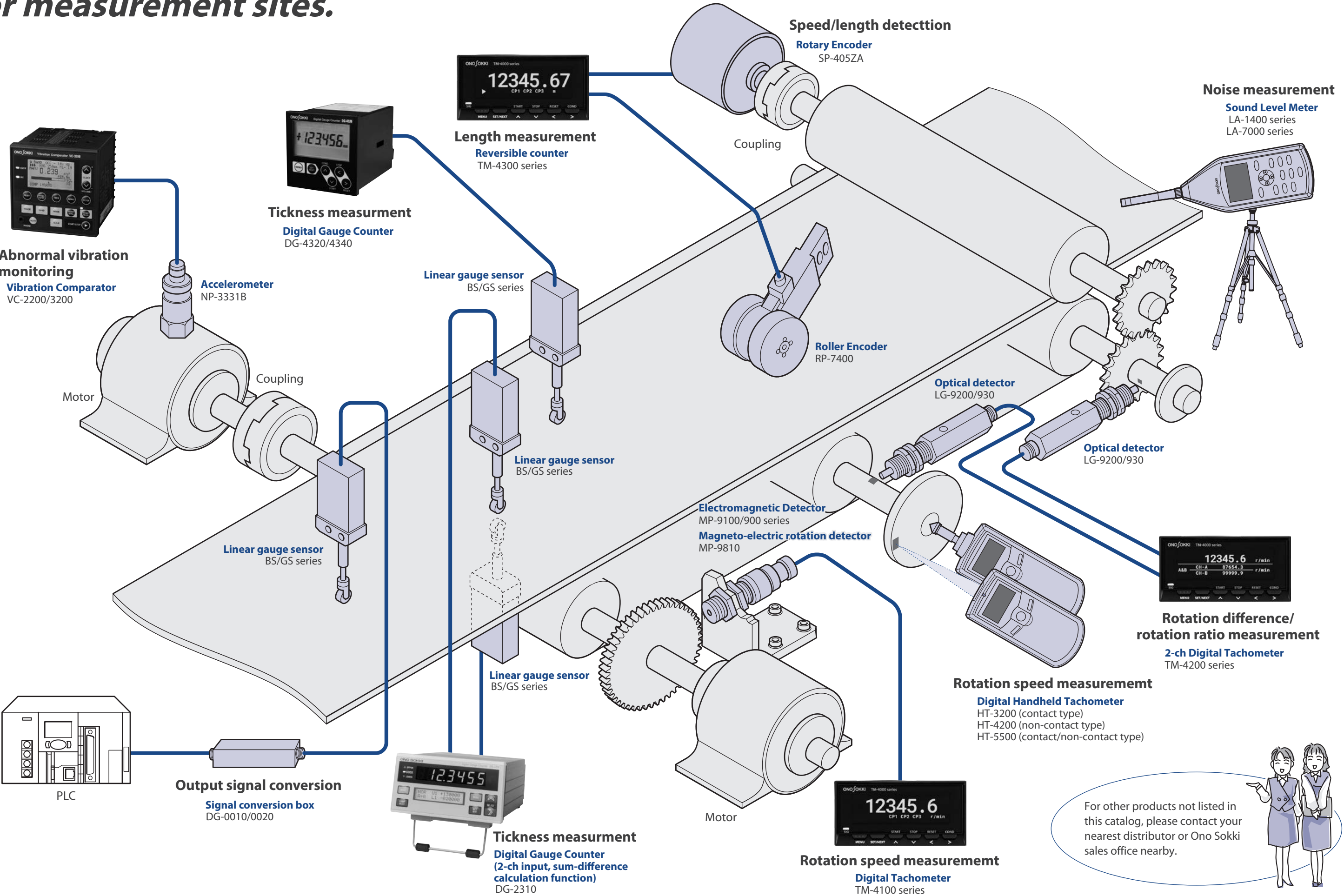


Application Note

Dimension / Rpm & Speed / Torque / Sound & Vibration



Ono Sokki provides optimal solutions for measurement sites.



For other products not listed in this catalog, please contact your nearest distributor or Ono Sokki sales office nearby.

We introduce various application examples using our products in this brochure. We would be pleased if we could help you solve your problem.

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Dimension & Displacement



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Gauges & Counters connection table

Liner Gauge Sensors

| Type | Resolution | Measurement range | | | | |
|--|------------|---|--|--|---|--|
| | | 10 mm | 13 mm | 30 mm | 50 mm | 100 mm |
| General Protection class IP64 | 10 μm | | GS-1713A  | GS-1730A  | | |
| | 1 μm | | GS-1813A  | GS-1830A  | | |
| Vibration resistant*1 Protection class IP64 | 10 μm | | GS-6713A  | GS-6730A  | | |
| | 1 μm | | GS-6813A  | GS-6830A  | | |
|  Vibration resistant, oil-proof Long life*2 Protection class IP66G | 10 μm | | GS-4713A  | GS-4730A  | | |
| | 1 μm | | GS-4813A  | GS-4830A  | | |
| Small Protection class IP66 | 10 μm | BS-1210  | | | | |
| | 1 μm | BS-1310  | | | | |
| Long stroke Protection class IP5X | 10 μm | | | | GS-5050A  | GS-5100A  |
| | 1 μm | | | | GS-5051A  | GS-5101A  |
| High resolution Protection class IP66G | 0.1 μm | | GS-3813B  | GS-3830B  | | |



*1:Vibration resistant type means that the sensor is not damaged even if prescribed shock vibration is added.It does not guarantee the normal measurement under vibration or shock.
*2:The number of sliding times has tripled compared with the existing model.

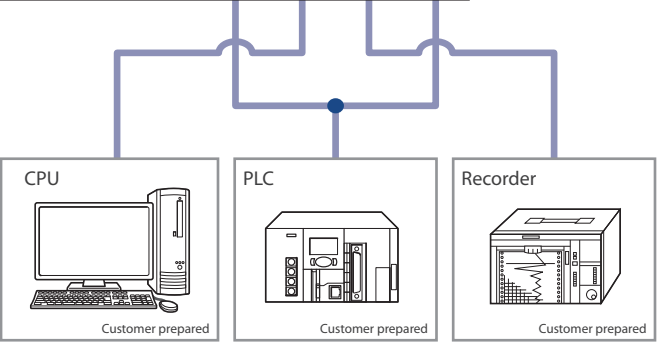
Digital Gauge Counter

| Model name | Display | | | DIN size | Function | | | | | | Output | | | |
|---|---------|-----|-------------|----------|-------------------|--------|----------|----------|-----------------|--------------------|--------|---------|--------|------------|
| | LCD | LED | Fluorescent | | 2ch add & sub cal | Offset | MAX hold | MIN hold | Range (MAX-MIN) | Multiplier setting | BCD | RS-232C | Analog | Comparator |
| DG-4320  | ○ | — | — | 72 X 72 | — | ○ | ○ | ○ | ○ | ○ | ○ | — | — | — |
| DG-4340  | ○ | — | — | 72 X 72 | — | ○ | ○ | ○ | ○ | ○ | ○ | — | — | ○ |
| DG-2310  | — | ○ | — | 144 X 72 | ○ | ○ | ○ | ○ | ○ | — | ○ | ○ | ○ | ○ |
| DG-5100  | — | — | ○ | 96 X 48 | — | ○ | ○ | ○ | ○ | ○ | △*3 | △*4 | △*5 | △*6 |

*3: BCD option DG-0522 is required
*4: RS-232C card option TM-0350 is required.
*5: Analog output option DG-0530 is required.
*6: Comparator output option TM-0340 is required.
*7: Connection conversion cable AA-8910 is required

Signal conversion box

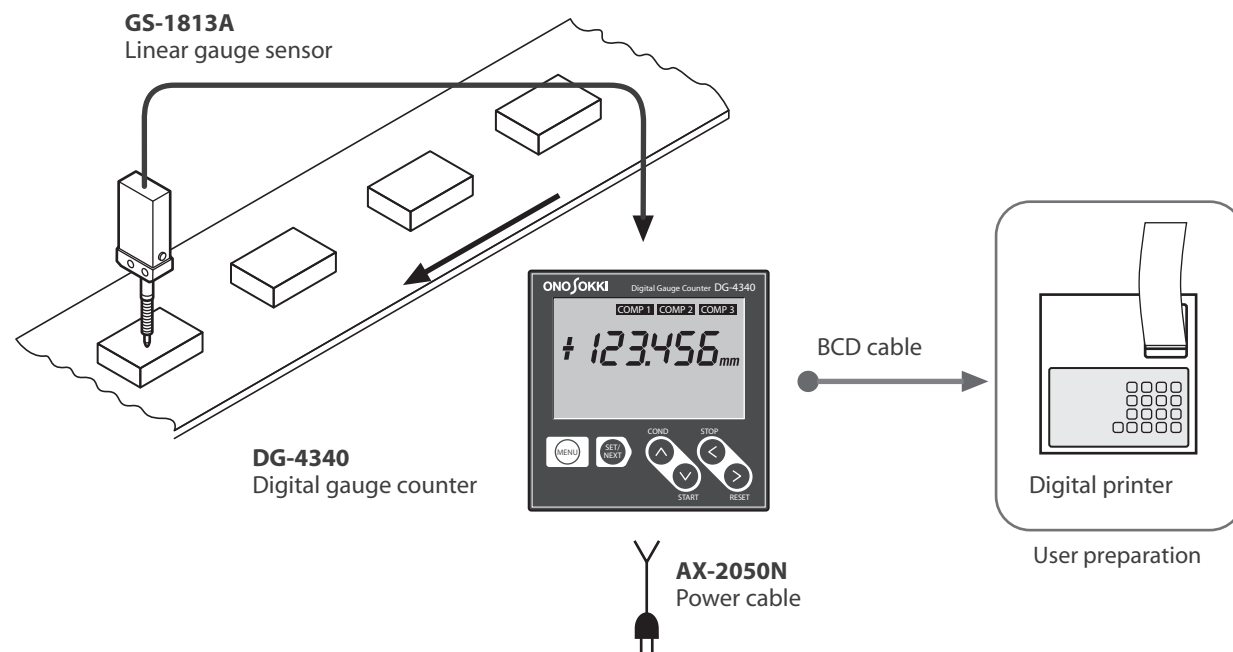
| Model name | Features | Output type | Output connector |
|---|----------|----------------|------------------|
| DG-0010  | | Open collector | R03-R6M |
| DG-0020  | | Line driver | R03-R6M |



Dimension measurement

Small component dimension measurement & printing out data

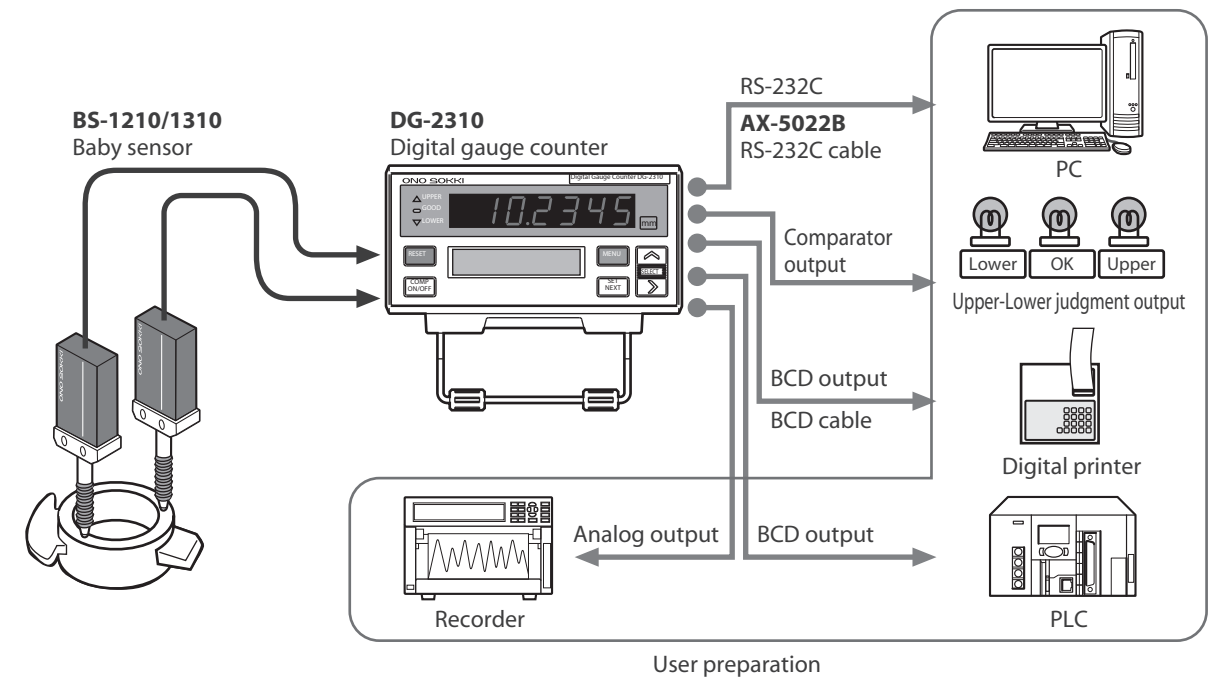
- Measure the dimension of processed parts and make the Pass/Fail judgement.
- The DG-4340 visually displays when the measured value is "Lower" or "Upper" to the set value by turning the LCD backlight "red".
- Measurement display values can be printed out.



Dimension measurement

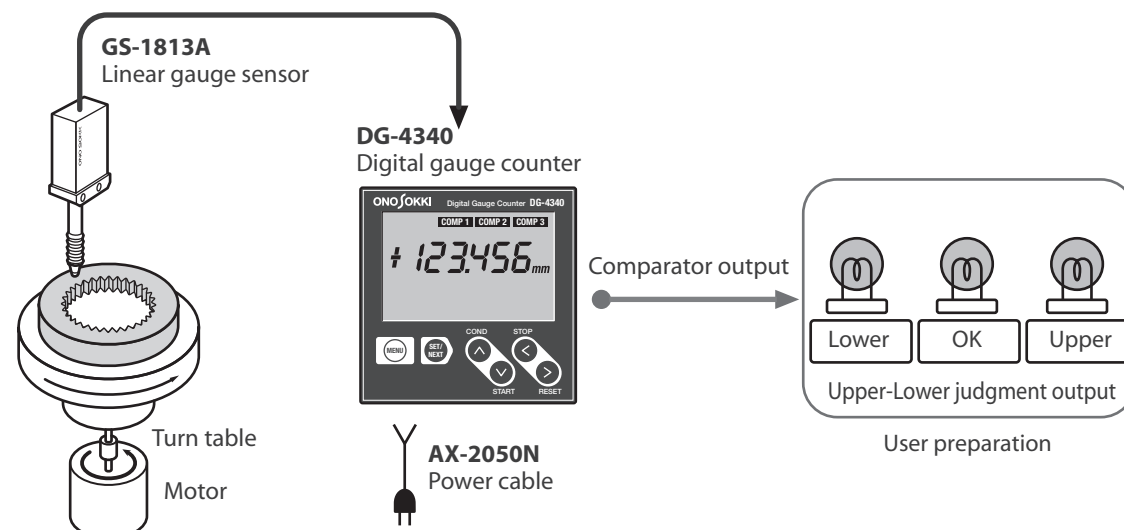
Parallelism measurement and sorting of metal parts

- Measure the parallelism between two points on micro parts.
- Since the distance between two points is short, small type sensors are used to measure parallelism (= difference in level between surfaces).



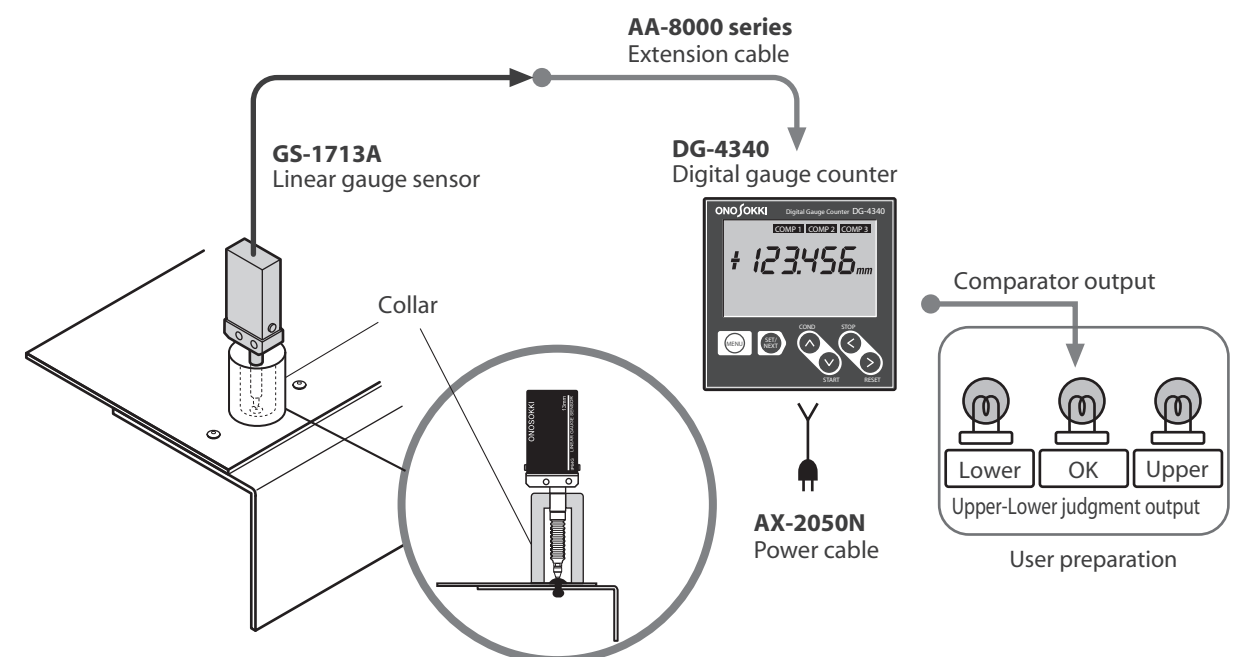
Measurement of flatness of metal parts (precision gears, etc.)

- Point the sensor head at the gear surface and input the reset signal to make the display zero.
- After inputting the peak hold start signal, rotate the side of the gear on the turntable and input the peak hold stop signal. Measure the maximum value of surface runout during one rotation and judge the Pass/Fail.
- Measure the maximum height deviation within one rotation and outputs the Pass/Fail.
- The DG-4340 visually displays when the measured value is "Lower" or "Upper" to the set value by turning the LCD backlight "red".
- If lateral stress is applied to the linear gauge sensor, we recommend measuring it indirectly using a jig. However, please note that in the case of indirect measurement, accuracy may deteriorate depending on the jig.



Measuring the height of rivet/screw

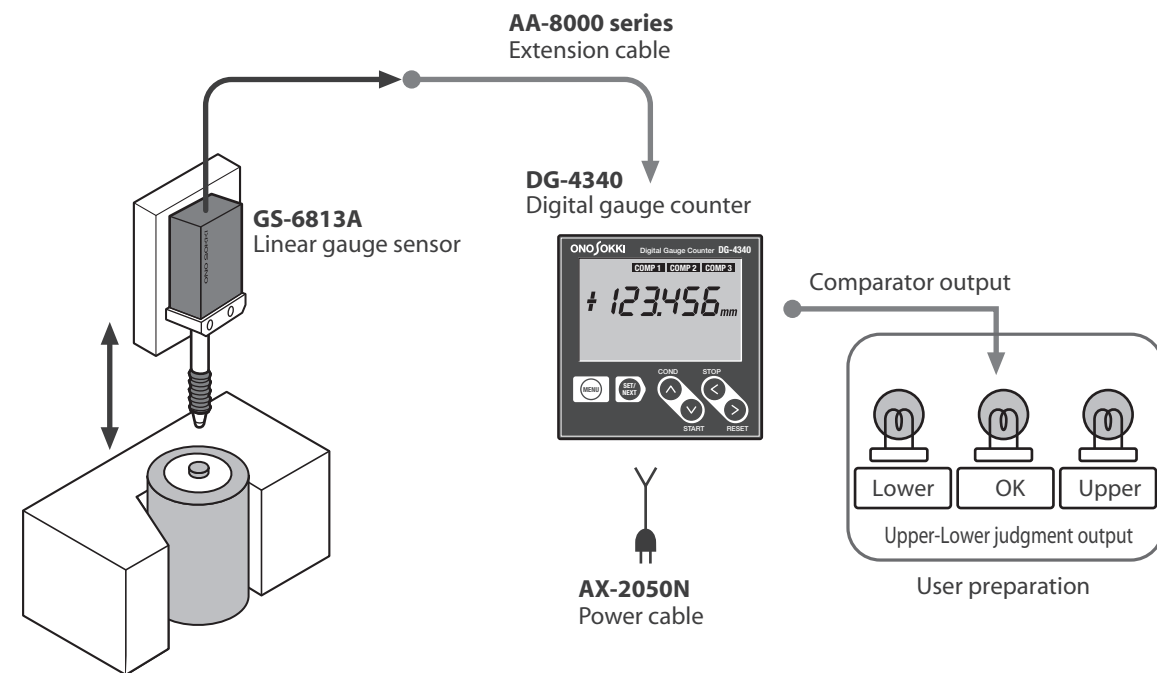
- Measure the height of rivet or screw from mounting surface by means of equipping a collar for checking zero-point with the tip of linear gauge sensor.
- The DG-4340 visually displays when the measured value is "Lower" or "Upper" to the set value by turning the LCD backlight "red".
- The collar in below figure is user-preparation.



Dimension measurement

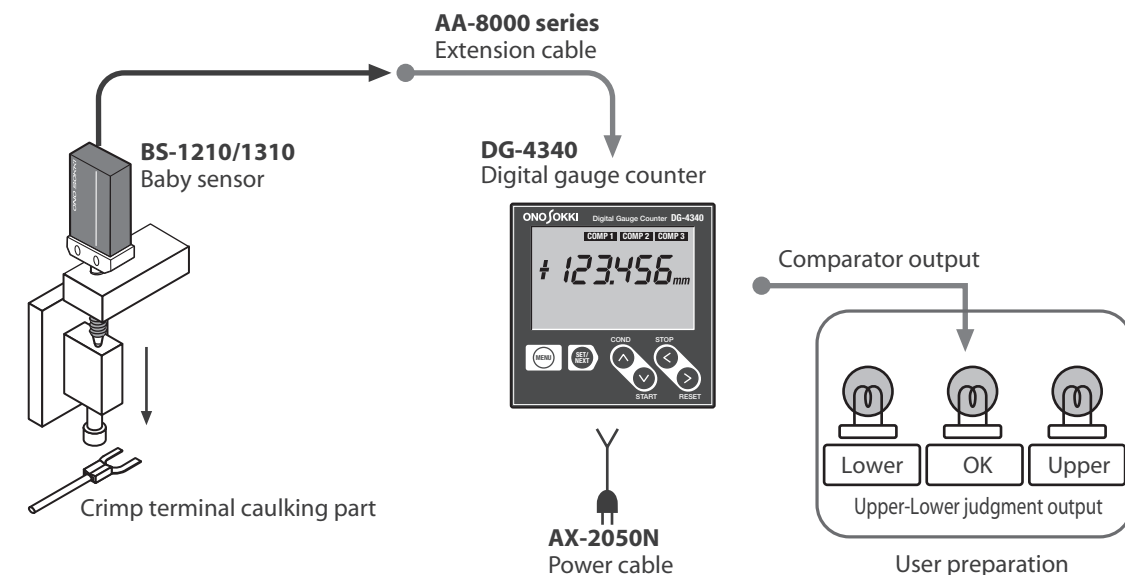
Measuring the height of battery

- Measure the height of battery (battery cell, button battery, rechargeable battery etc.). The height of electrode is measured and the Pass/Fail judgment is made by attaching a linear gauge sensor to an automatic device.
- The DG-4340 visually displays when the measured value is "Lower" or "Upper" to the set value by turning the LCD backlight "red".



Measuring the height of the crimp terminal caulking part

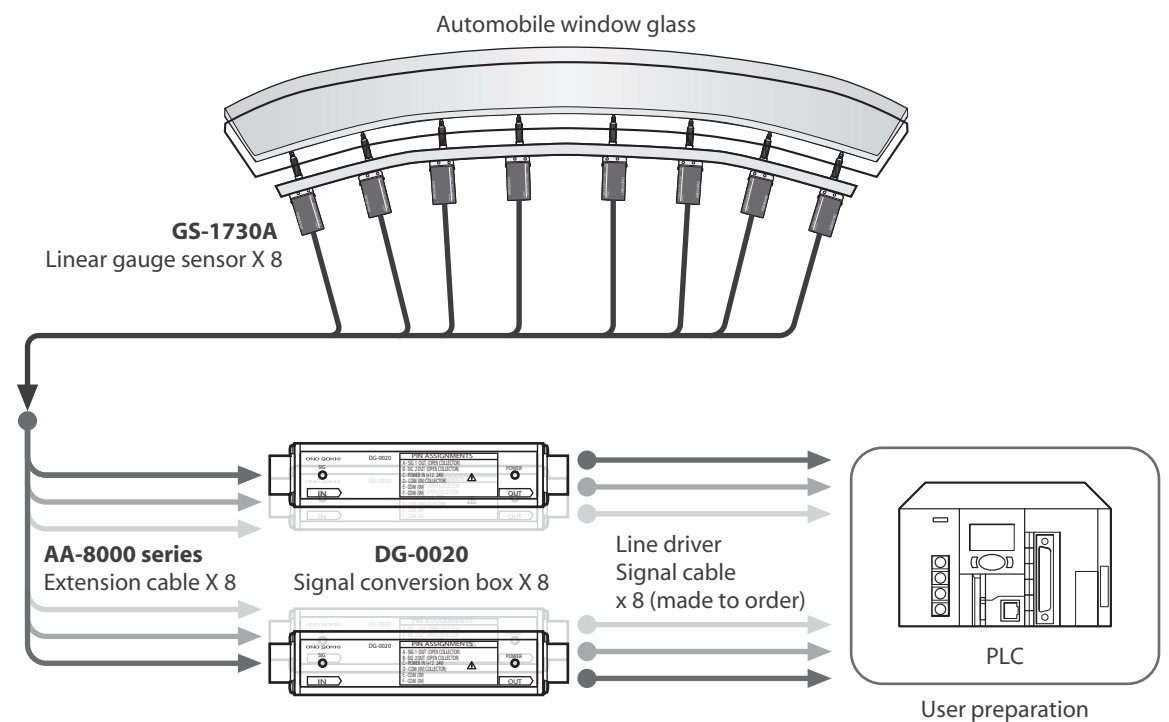
- A sensor is installed in an automatic machine to measure the height of caulking parts such as crimp terminals. The BS-1210/1310 small type sensors are suitable for narrow spaces as shown in the figure.
- The DG-4340 visually displays when the measured value is "Lower" or "Upper" to the set value by turning the LCD backlight "red".
- Recommend the GS-6700A/6800A series, which has excellent vibration and shock resistance, for installation in automatic machines that generate a lot of vibration.
- If lateral stress is applied to the linear gauge sensor, we recommend measuring it indirectly using a jig. However, please note that in the case of indirect measurement, accuracy may deteriorate depending on the jig.



Shape measurement

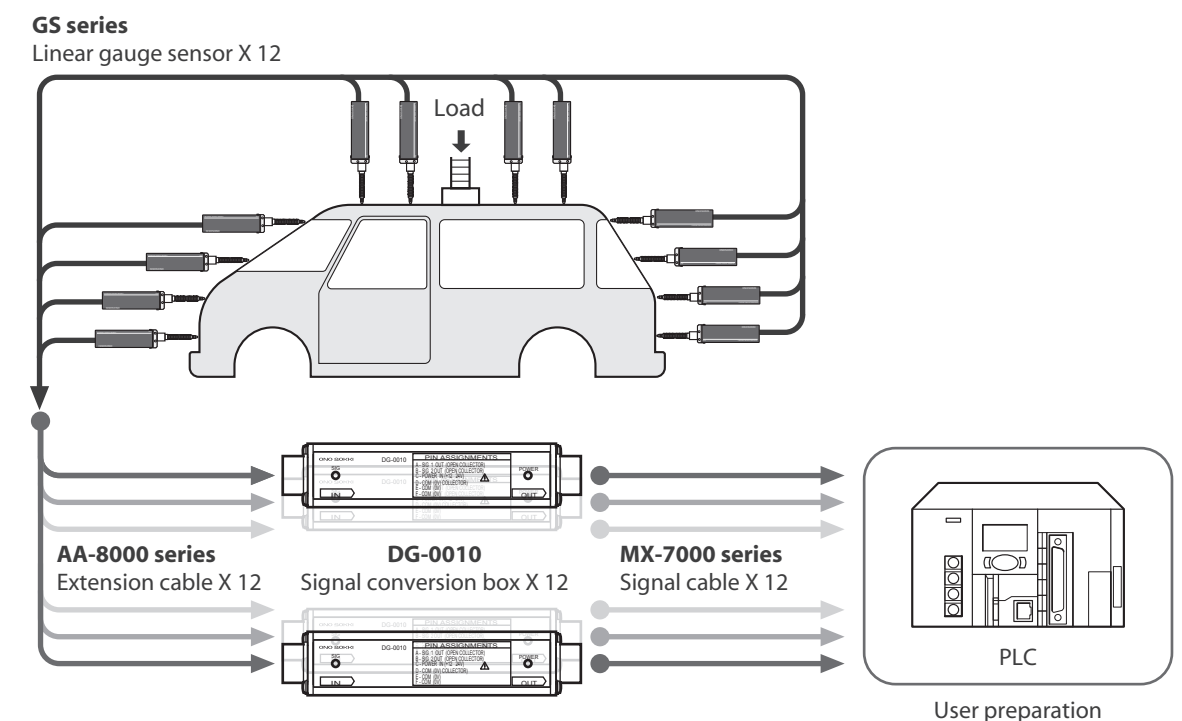
Measuring the curved surface of automobile window glass/liquid crystal panel

- Bending stress or twisting is applied to the walls and doors of modular bathrooms, apartment buildings, and the bodies of automobiles and trains, and the displacement at each measurement point is measured.



Vehicle body shape measurement

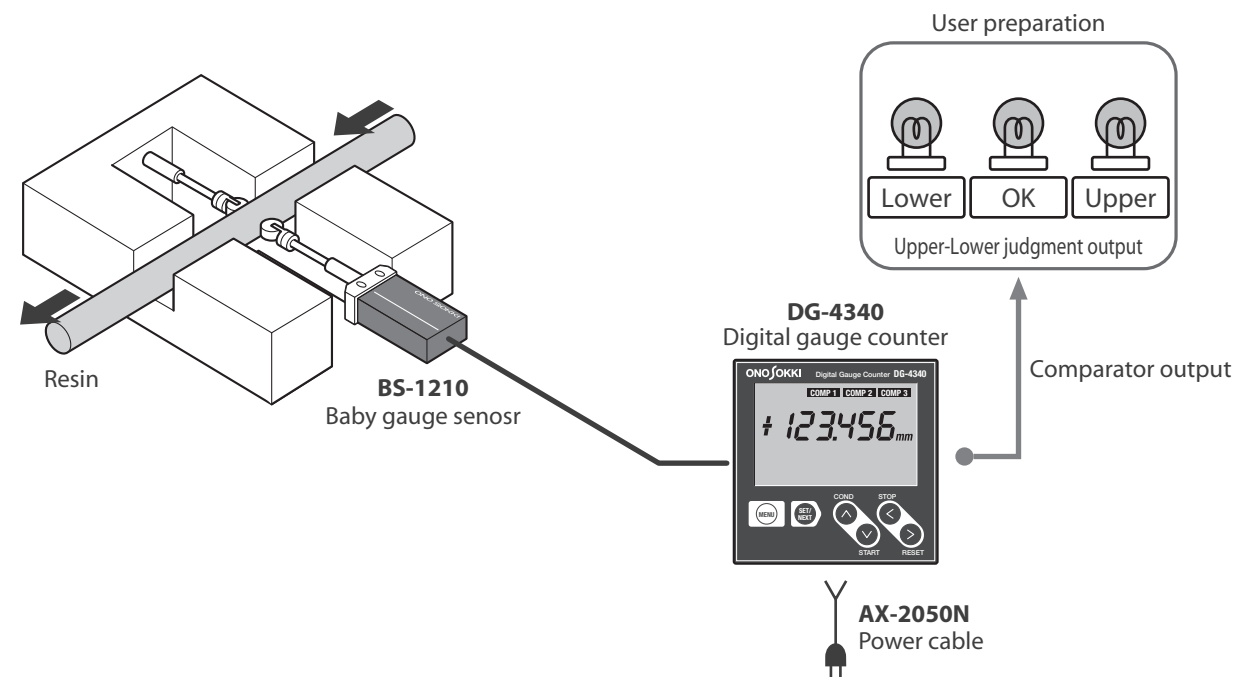
- A constant load is gradually applied to the vehicle body, and the displacement at the measurement points is measured with multiple channels. The body strength can be measured from the relationship between load and displacement.



Shape measurement

Shape measurement of resin products

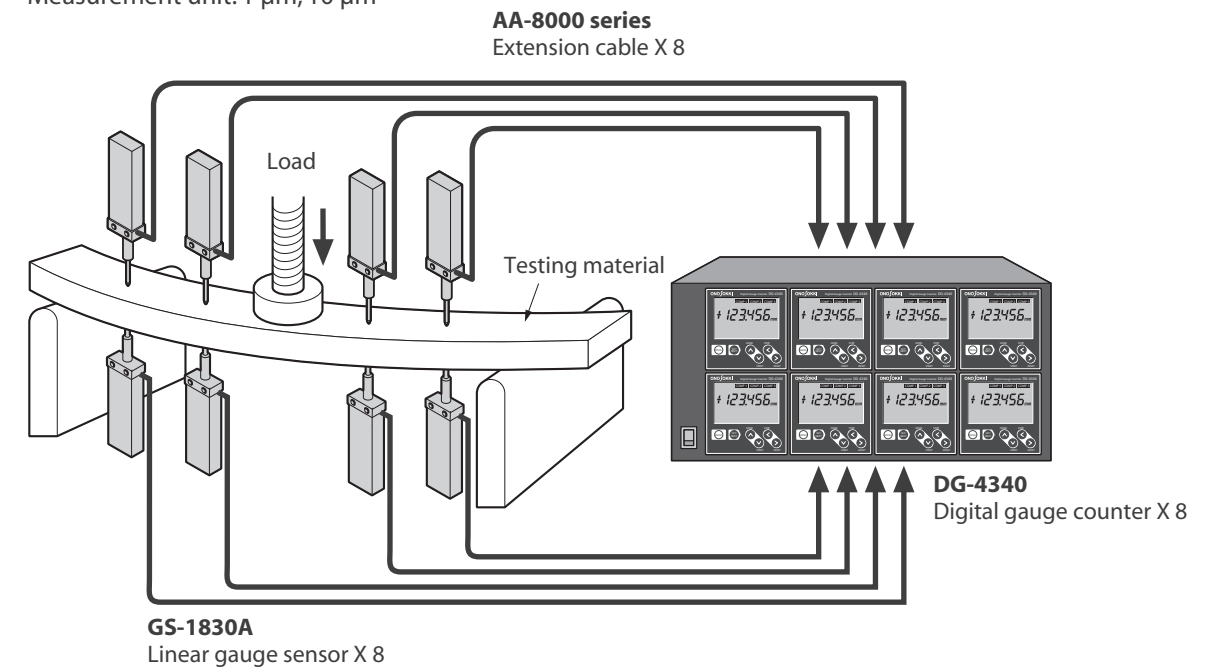
- Continuously measure whether the outer shape of resin product is finished according to specifications and perform the Pass/Fail judgment.
- The DG-4340 visually displays when the measured value is "Lower" or "Upper" to the set value by turning the LCD backlight "red".



Displacement measurement

Strength testing of architectural and civil engineering materials

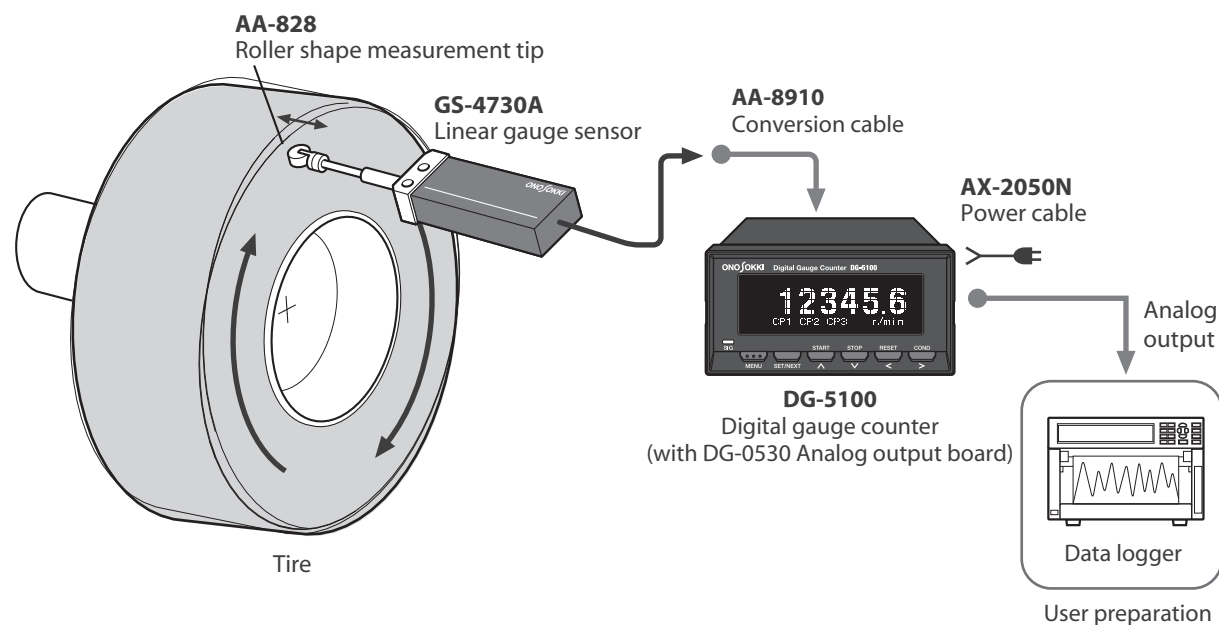
- When a load is applied to the material being tested, the material deforms due to the load. By measuring the amount of displacement, the strength characteristics of the material can be determined from the relationship between load and displacement. This application example can be applied to various testing machines.
- Measurement unit: 1 μ m, 10 μ m



Displacement measurement

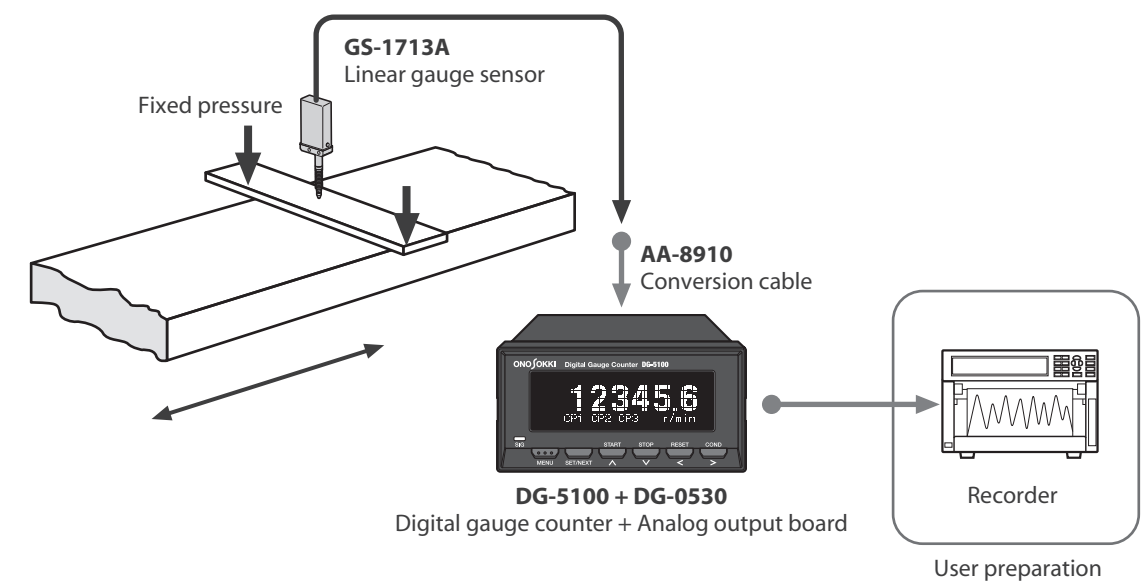
Measuring the rotational deflection of tires

- Measure the rotational deflection of tires. Since measurements are expected to be made in environments with large vibrations, we recommend using a vibration-resistant linear gauge.
- If lateral stress is applied to the linear gauge sensor, we recommend measuring it indirectly using a jig. However, please note that in the case of indirect measurement, accuracy may deteriorate depending on the jig. This figure shows an example of the GS-4730A, which uses a carbon shaft that is resistant to lateral stress.



Measuring the thickness of material such as glass wool, felt, cloth etc.

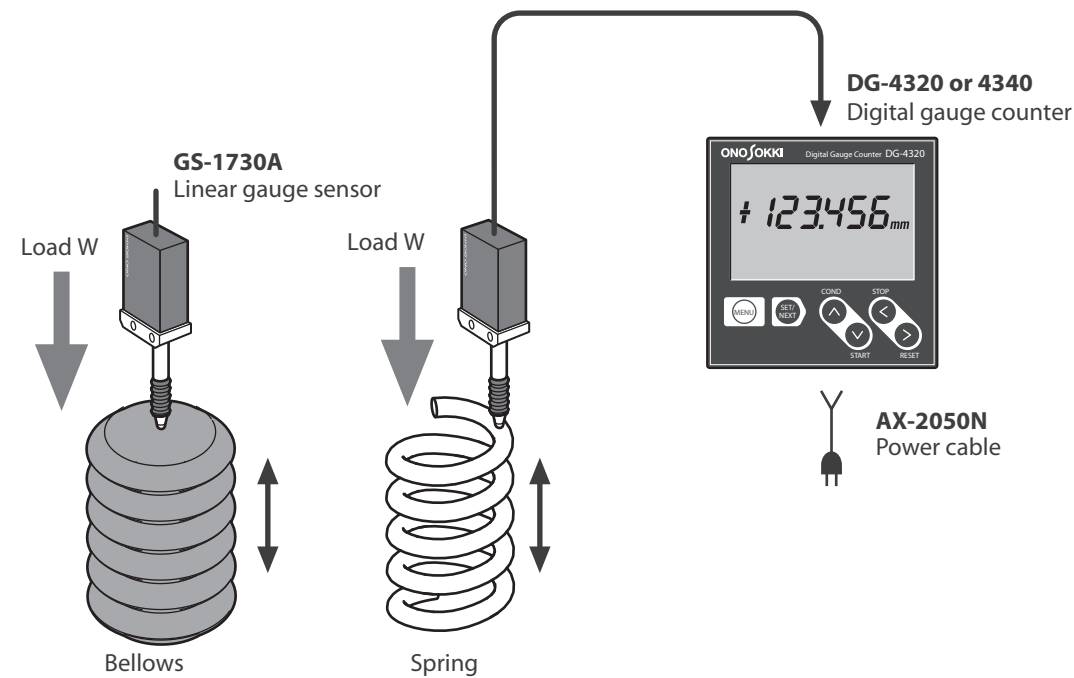
- Thickness measurement of soft material such as glass wool or felt under the condition at applying constant pressure. Conveying material such as glass wool or felt at low speed, the amount of thickness change can be recorded continuously.
- Analog output can be made by combining the DG-5100 and DG-0530. Analog voltage output specifications as follow:
Analog voltage output: 0 to ± 10 V
Update time: 10ms Please select a recorder to be compatible with the above specifications.



■ Displacement measurement

Measuring the displacement of bellows/springs

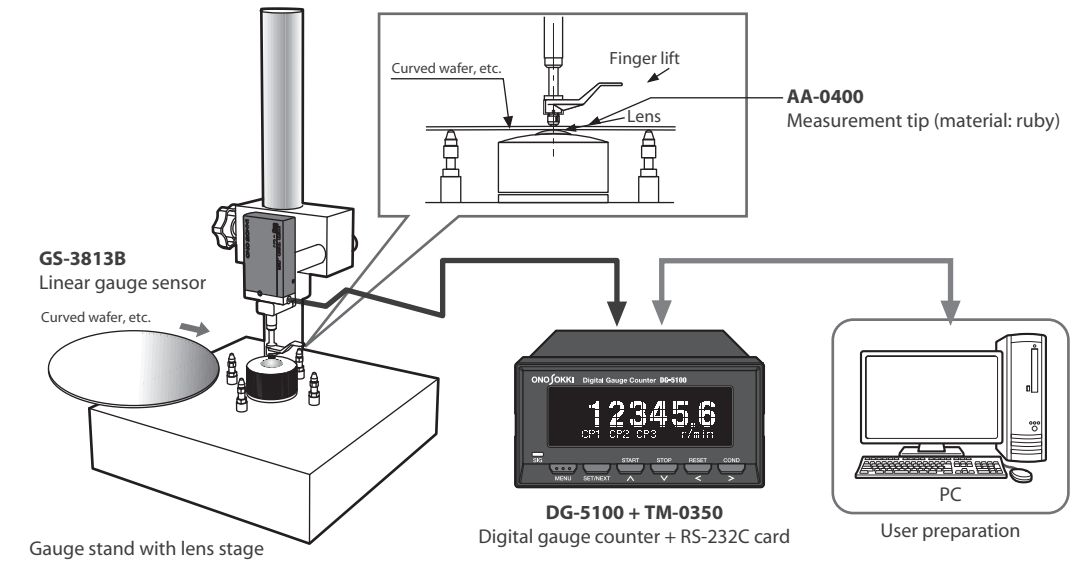
- Put the spindle on bellows or springs, and then reset to zero at that point. Measure the amount of compressed displacement when a fixed load is applied. (load-displacement measurement)
- Applications: Screening of plywood or construction mold by measuring load-displacement, etc.



■ Dimension measurement with high resolution type linear gauge

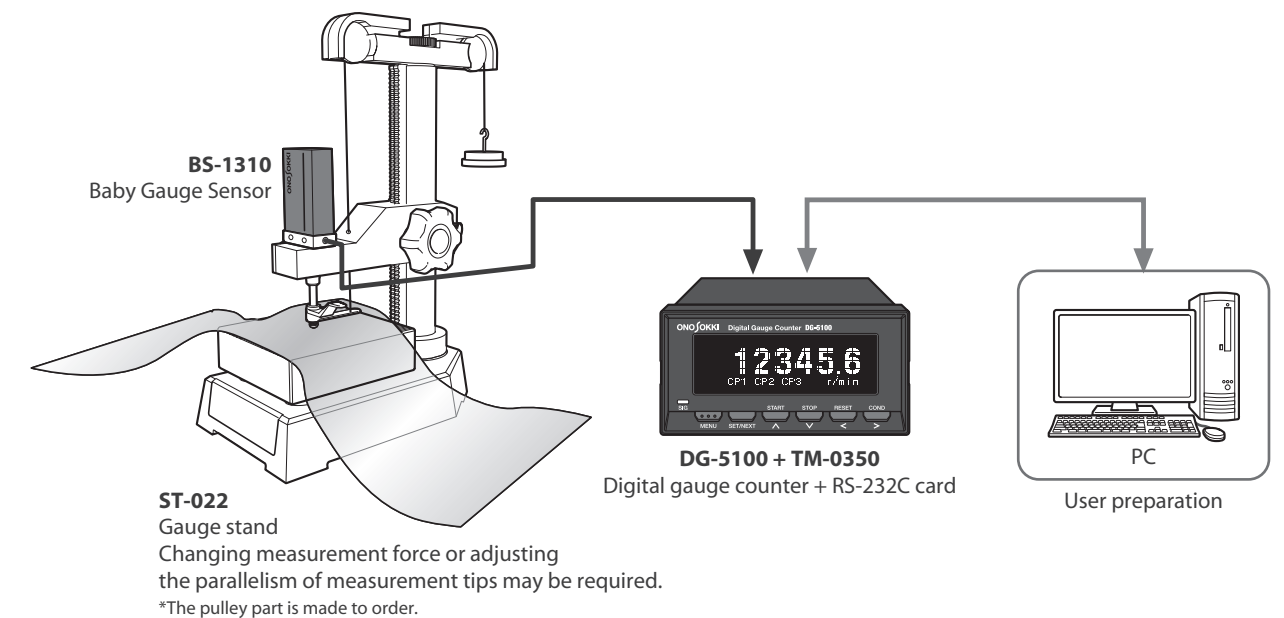
High-precision dimensional measurement of electronic materials such as silicon wafers

- Measure the thickness of curved plate material including silicon wafer with high accuracy. Specialized stand is used to prevent an influence of curve, which is designed to have convex lens where the measurement tip is hit, and four pins around the lens in order to hold up the curved plate material stably. Adjusting to fit the center of measurement tip for GS-3813B gauge sensor and convex lens, the thickness can be measured with less influence of curve.
- The second processing including statistical processing can be performed by transferring the measured data to PC via RS-232C interface.



Contact thickness measurement of film for electronic industry with high accuracy

- When measuring the thickness of polymer films for the electronic industry, there are cases in which the standard measurement pressure is used, and the measurement pressure is reduced as "distortion" occurs and affects the measurement results. To suppress "distortion", pressure can be dispersed using a flat probe.



Rotation & Speed

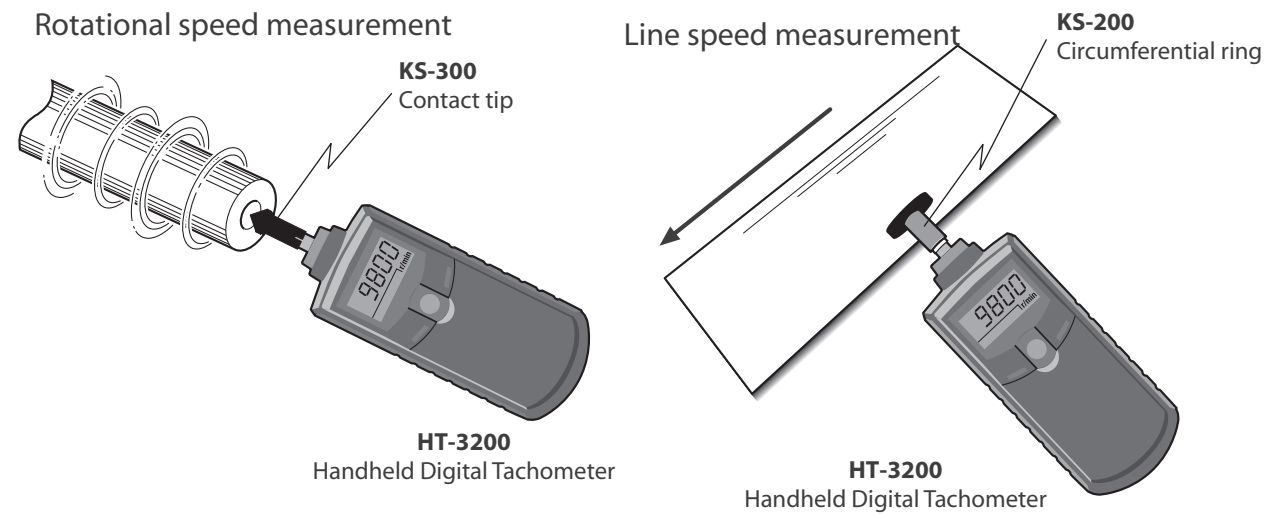


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Measurement of rotational speed by rotating shaft

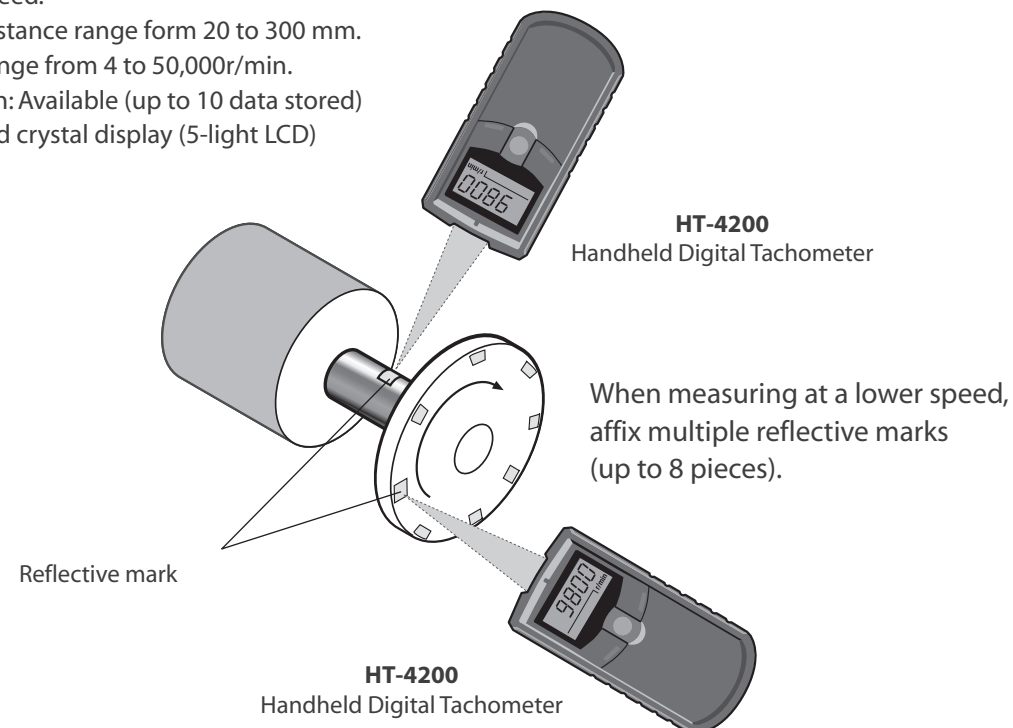
Rotational and line speed measurement with Contact type Handheld Digital Tachometer

- The rotational speed of the shaft can be measured by pressing the KS-300 Contact tip against the center hole at the end of the rotating shaft.
- The line speed can be measured by pressing the KS-200 Circumferential ring onto the conveyor surface.
- Measurement range: 0.5 to 10,000 r/min (rotational speed), 0.05 to 1000 m/min (line speed)
- Memory function: Available (up to 10 data stored)
- Large-sized liquid crystal display (5-light LCD)



Rotational speed measurement with Non-contact type Handheld Digital Tachometer

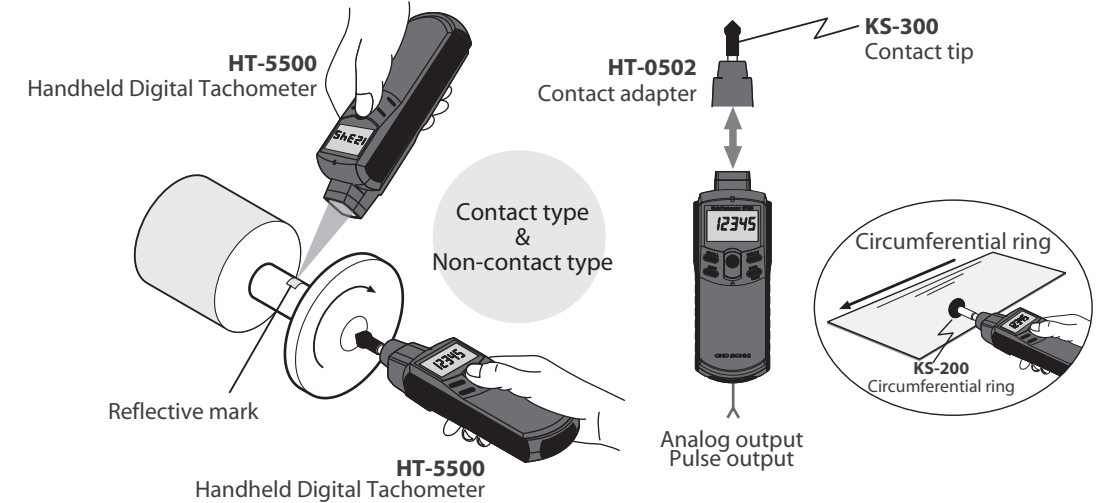
- It can measure rotational speed simply by affixing 12mm-square reflective mark on the surface or edge of rotating shaft. It detects the reflective mark on the rotating body from the visible red light reflected and displays the rotational speed.
- Measurement distance range from 20 to 300 mm.
- Measurement range from 4 to 50,000r/min.
- Memory function: Available (up to 10 data stored)
- Large-sized liquid crystal display (5-light LCD)



Measurement of rotational speed by rotating shaft

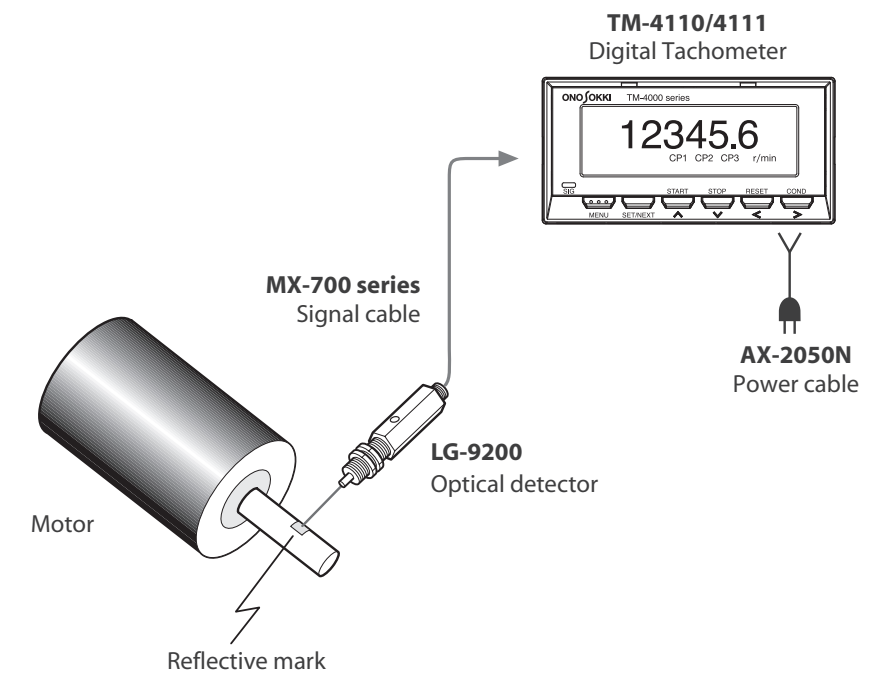
Rotational speed measurement with Contact/Non-contact type Handheld Digital Tachometer

- Capable of both contact and non-contact measurement in one unit.
- The non-contact type tachometer can measure rotational speed simply by affixing 12mm-square reflective mark on the surface or edge of rotating shaft, and detects the reflective mark on the rotating body from the visible red light reflected and displays the rotational speed.
- The rotational speed of the shaft can be measured by using the Contact adapter HT-0502 and pressing the KS-300 Contact tip against the center hole at the end of the rotation shaft. The line speed can be measured by pressing the KS-200 Circumferential ring onto the conveyor surface.
- Both analog and pulse signal output are provided as standard function. Analog output is used for recording the fluctuation of rotational speed by pen-recorder etc.
- Maximum 20 data can be saved with built-in memory function.



Rotational speed measurement with Non-contact type Optical detector

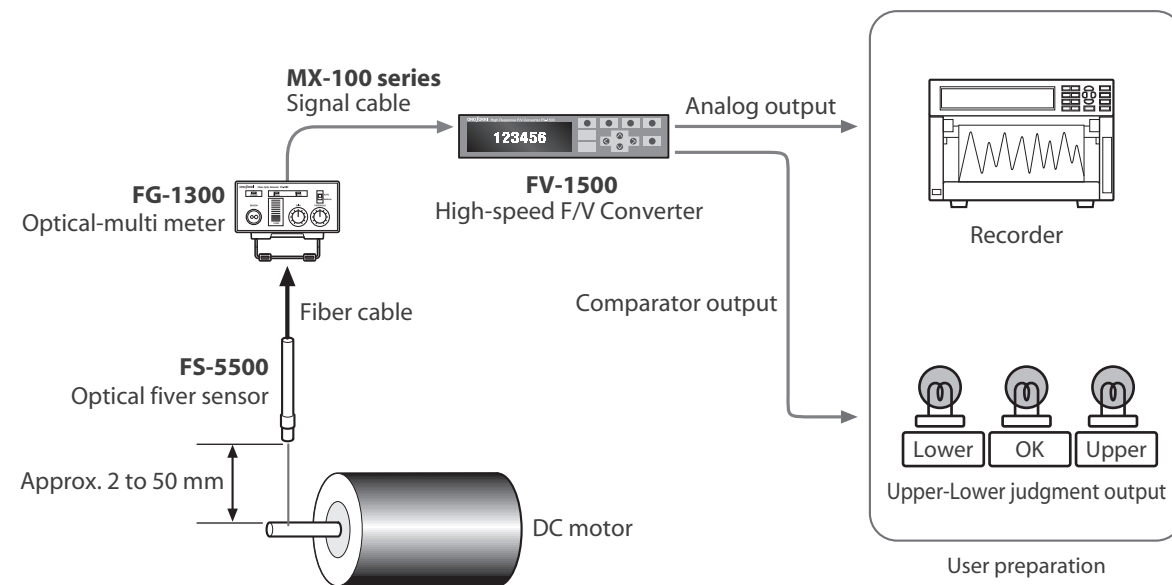
- The non-contact type optical detector, can measure the rotational speed simply by affixing a 12mm-square reflective mark to rotating shaft of the object such as motor.
- Detection distance (LG-9200): max. 40 mm (using 12mm-square reflective mark)
- Detection distance (LG-930): max. 70 to 200 mm (using 12mm-square reflective mark)



Measurement of rotational speed by rotating shaft

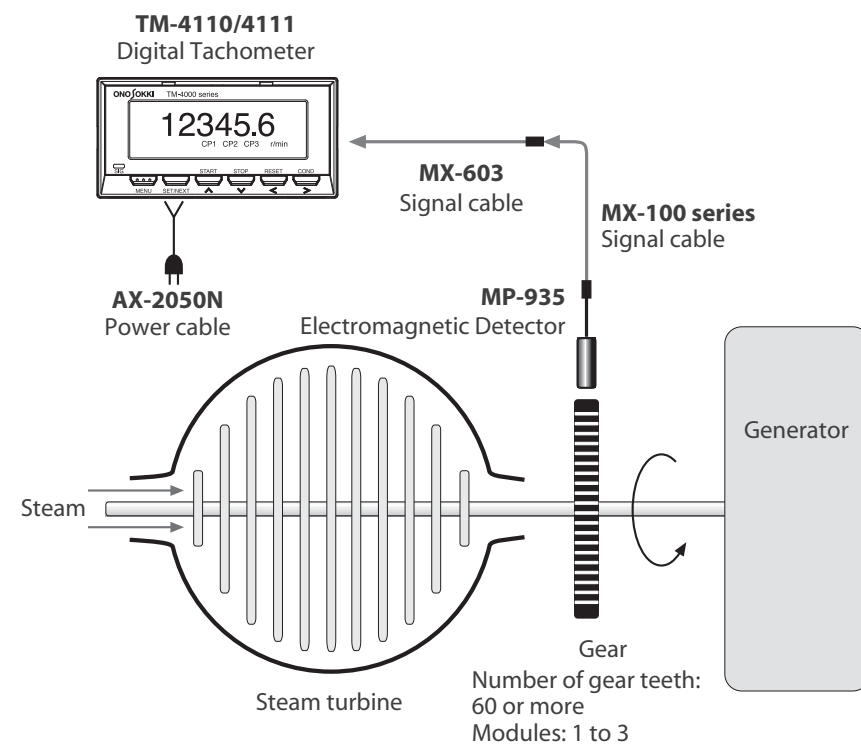
Measuring the rotational speed of thin shaft with 5 mm diameter with Non-contact type detector

- The rotation speed is measured by periodically changing the amount of reflected light from the optical fiber sensor due to the irregularities of the rotating shaft and changes of the black line.
- Applicable rotational shaft of diameter: approx. 5 mm or more
- Detection distance: approx. 2 to 50 mm
- The comparator output with two levels function is provided as standard which is useful to make OK, LOWER, or UPPER judgment.



Non-contact measurement of rotational speed using oil and heat proof detector

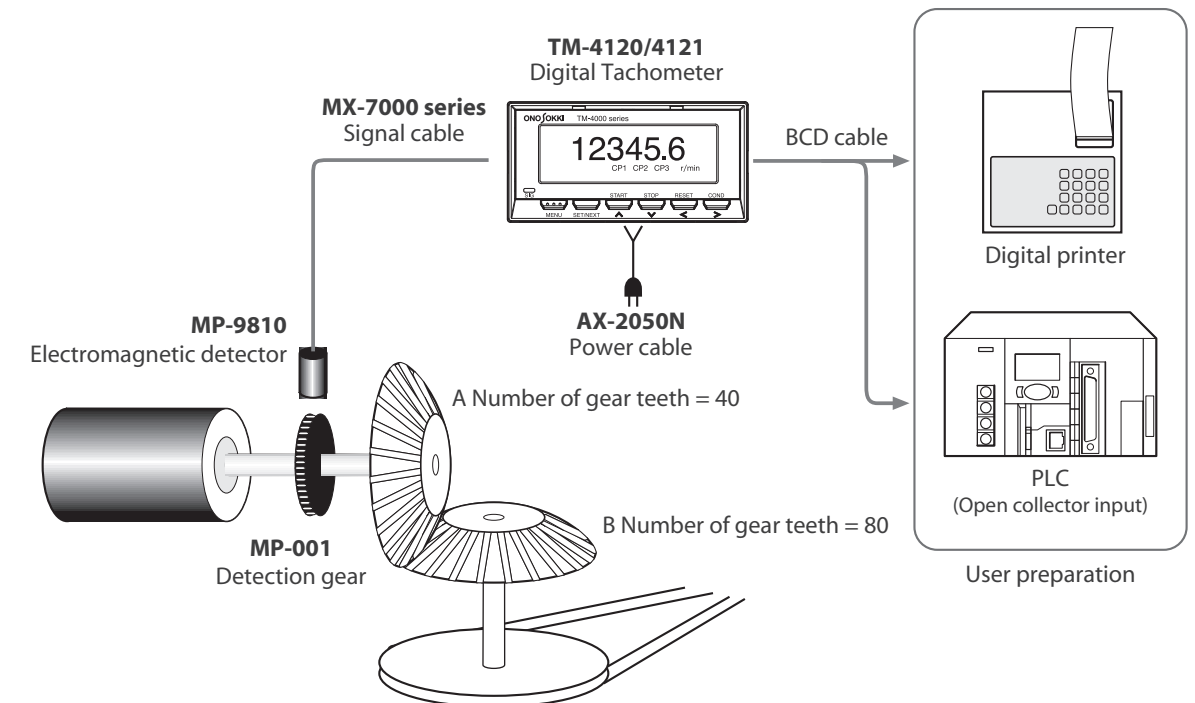
- Measurement range: approx. 300 r/min to 3500 r/min
- Operating temperature range: -10 to +150°C
- Please prepare gear teeth for rotational detection and its attachment.



Measurement of rotational speed by rotating shaft

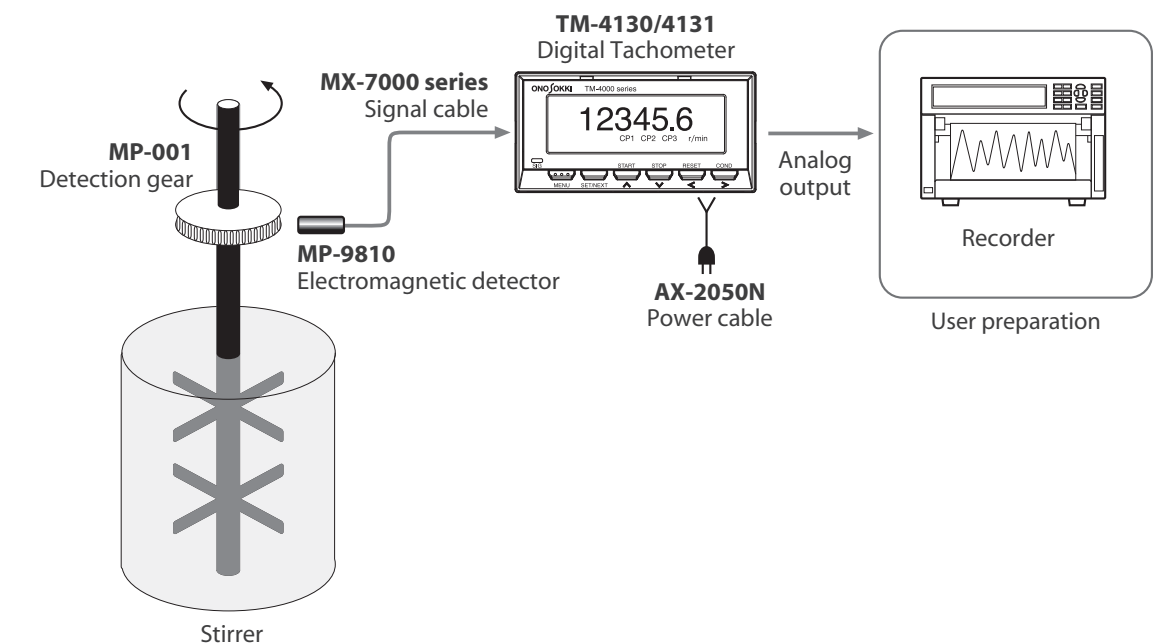
Measuring, displaying rotational speed of shaft, and outputting the measurement results to printer or PLC

- The TM-4120/4121 can print measured results out and export data to a PLC with BCD output, as well as measuring and displaying rotational speed of motor shaft. They can also calculate the rotational speed of gear shaft B by setting the number of detection gear A/ the number of detection gear B = 40/80=0.500.
- Measurement range: approx. 1r/min to 10000 r/min



Measuring, displaying rotational speed of shaft, and recording its rotational fluctuation

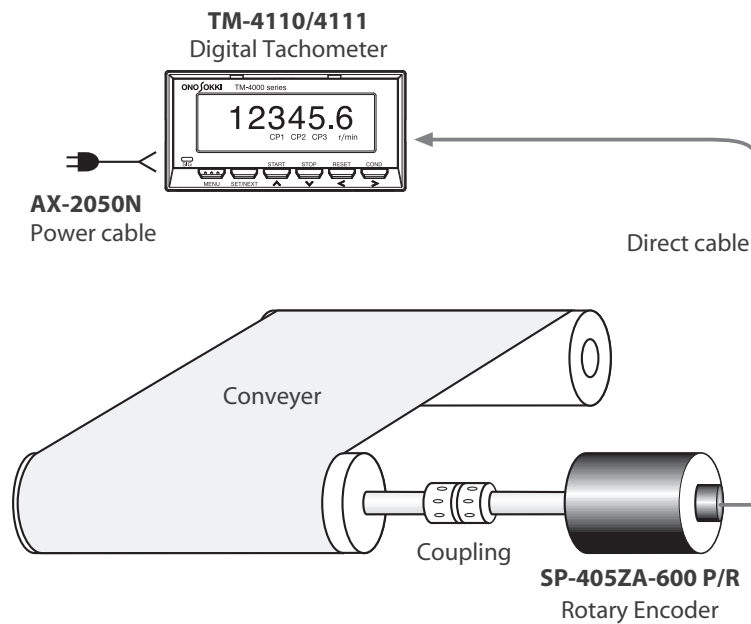
- By attaching a rotational detector to gear on a main rotational shaft of stirrer, blender, centrifuge and so on, it can output an analog signal to a recorder to monitor the rotational fluctuation as well as measuring and displaying rotational speed of shaft.
- Measurement range: approx. 1 to 20,000 r/min
- Rotation from low-speed at 0.05 r/min or less can be measured with the Rotary encoder.



Measurement of rotational speed by rotating shaft

Measuring the rotational speed at low-speed

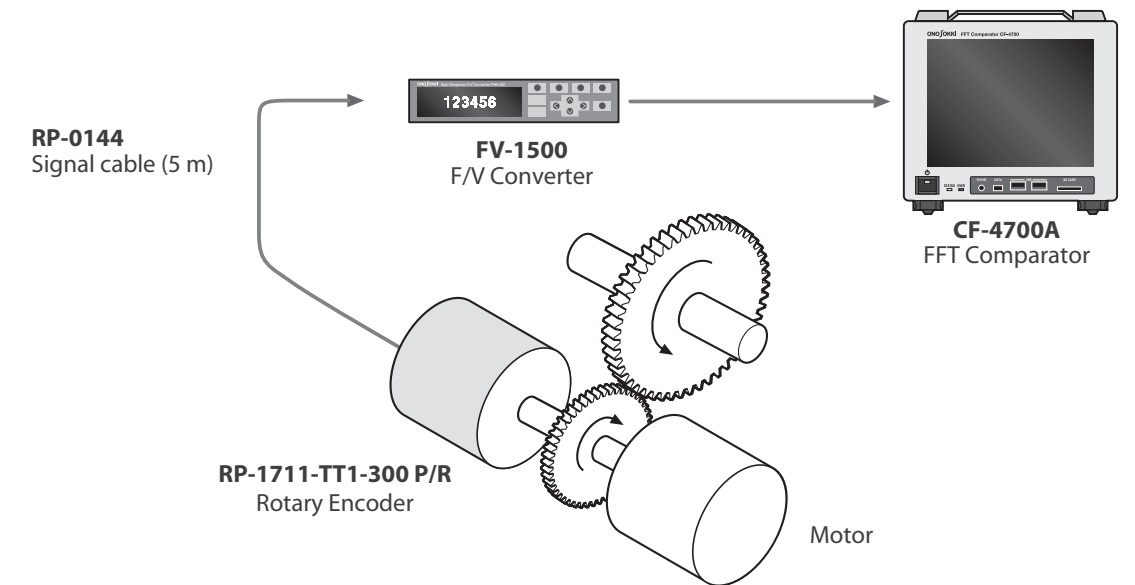
- It displays the rotational speed of shaft with 5 digits of 0000.0 or 000.00 by attaching the Rotary Encoder to a roll shaft of conveyer.
- Measurement range : approx. 0.1 to 5,000 r/min
- The coupling to fit with connection shaft is prepared by user.
- We have several types of Rotary Encoder to meet various requirements.



Measurement of rotational speed by rotating shaft

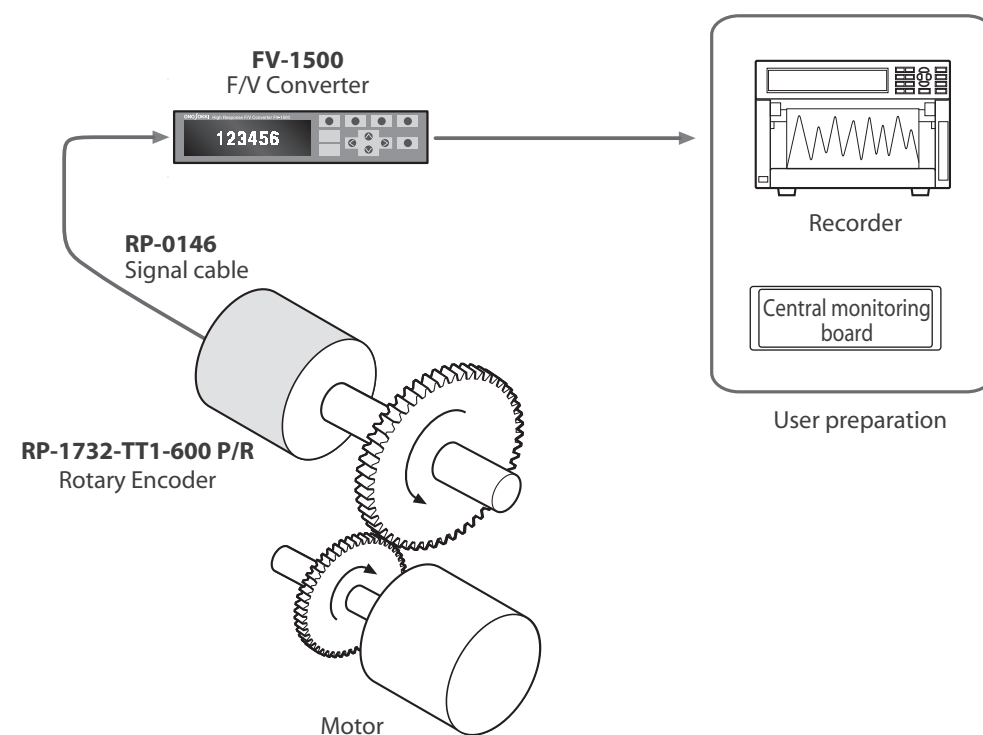
Analyzing the fluctuation of rotational speed (High response type)

- The rotational speed and velocity are calculated from one cycle time of the rotary encoder pulse signal, and the FV-1500 High-speed F/V converter performs DA conversion to generate 10 V/full scale (full scale can be set arbitrarily) output. The FV-1500 outputs voltage and current with a high response time of 1 cycle time of the input signal + 3.5 μ s, allowing for highly accurate analysis of transient fluctuations such as when a motor starts up. The FV-1500 has a deviation output function with a center frequency of ± 5 V and can determine rotation direction recognition by using a 2-phase output encoder.
- Measurement range : 0.2 Hz to 320 kHz



Recording the fluctuation of rotational speed

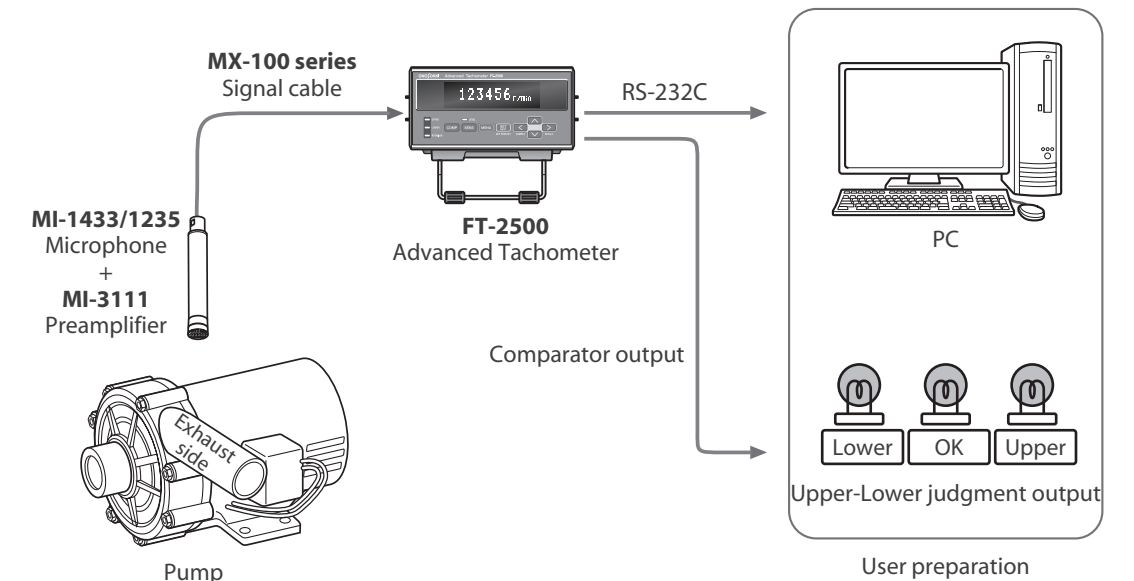
- This example shows how to detect circumferential or rotational speed of roller in order to convert frequency to voltage/current, and then output those signals.



Measurement of rotational speed by other than rotating shaft

Measuring the rotational speed of a pump from sounds (noises)

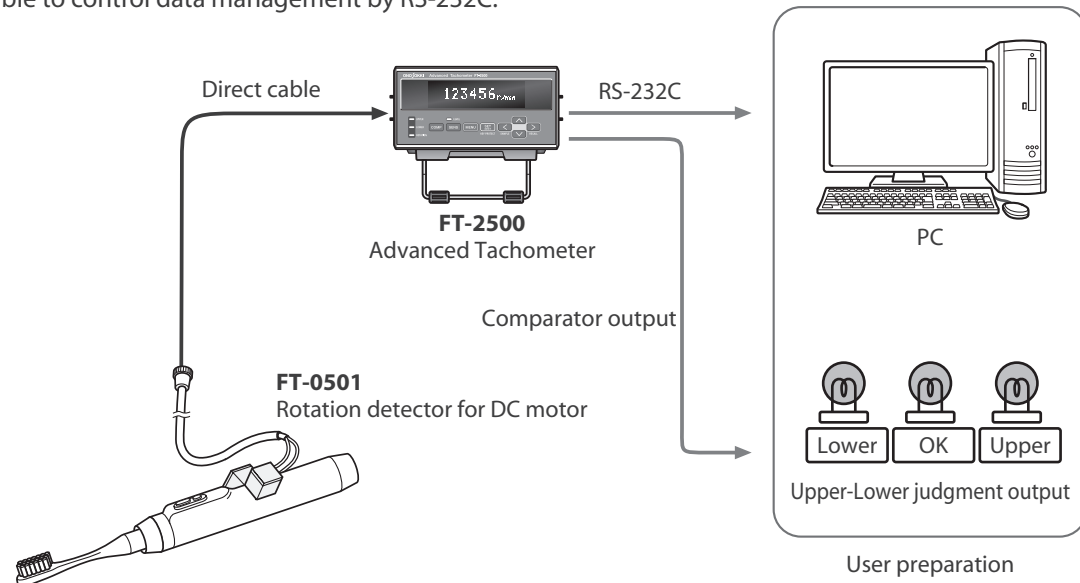
- It is difficult to measure the rotational speed of built-in pumps and so on which shafts are not exposed. It can be measured by capturing the exhaust sounds with a microphone, and performing frequency calculation in the periodic change of sound pressure.
- The comparator output with two levels function is provided as standard which is useful to make OK, LOWER, or UPPER judgment.
- Enable to control data management by RS-232C.



Measurement of rotational speed by other than rotating shaft

Measuring the rotational speed of built-in DC motors

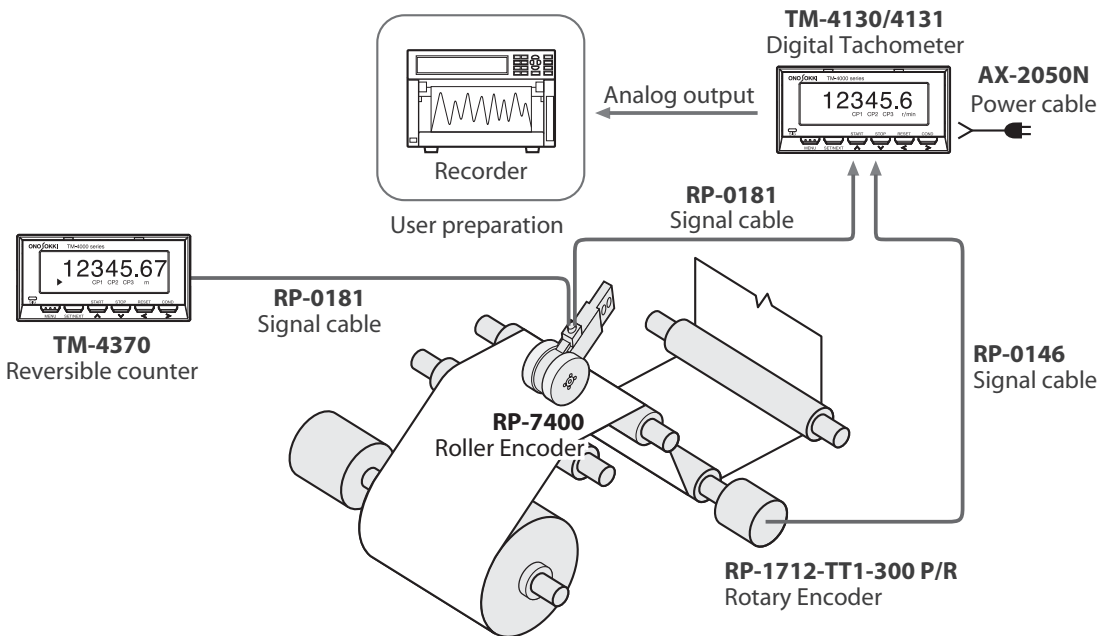
- This example shows how to measure the rotational speed of DC motors that are built in an electric toothbrush. The rotational speed and direction of rotation can be measured by detecting the magnetic flux leakage from the built-in DC motor, and performing frequency calculation in periodic change of magnetic flux.
- The comparator output with two levels function is provided as standard which is useful to make OK, LOWER, or UPPER judgment.
- Enable to control data management by RS-232C.



Measurement of rotational speed on production line

Line speed measurement and length measurement

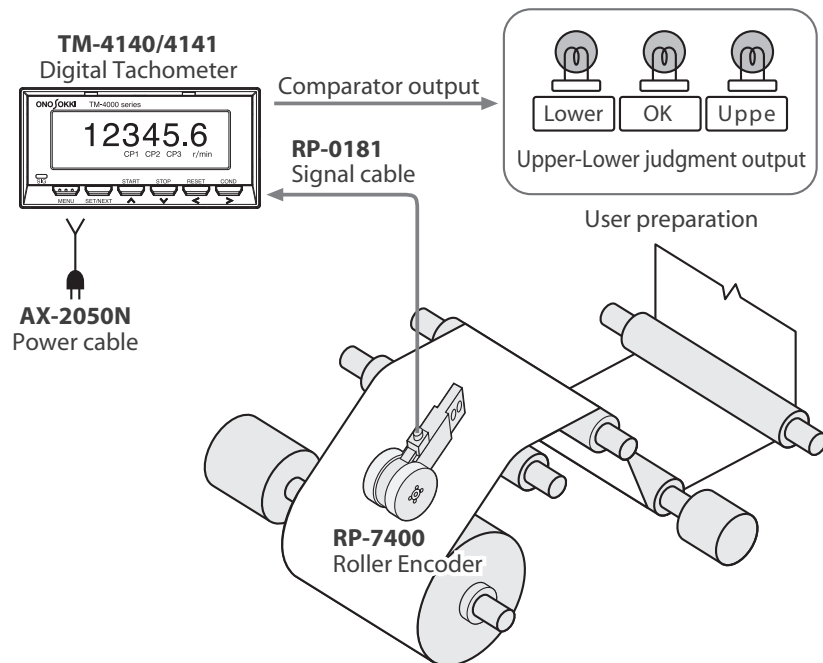
- By using the analog output of the TM-4130/4131 Digital Tachometer, the changes of line speed can be recorded on the recorder as well as measuring and displaying the line speed of belt conveyors, etc. in m/min. (RP-7400, Rotary Encoder RP series)
- By combining with 2-phase signal output type the RP-7400 and TM-4370 Reversible counter, it measures the length of lms, steel plates, papers, etc. in units of 1 mm* without missing even the minute rewinding amount at startup or just before stopping.



Measurement of rotational speed on production line

Measuring the line speed and alarming when the line speed exceeds the set range

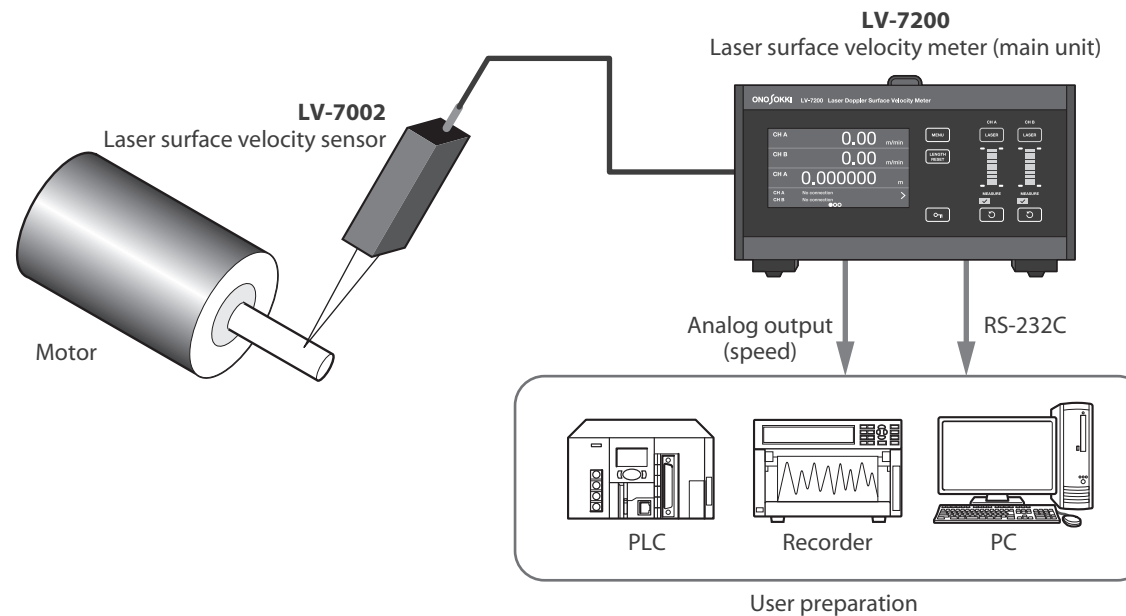
- In addition to measuring and displaying the line speed of belt conveyors, etc. in m/min, this system can sound the alarm with the comparator output function to stop the moving machine if the set speed is exceeded. By using the pulse factor of the TM-4140/4141 Digital Tachometer, it can be displayed in 6 digits of 00000.0 or 000.000.
- Measurement range: 0.01 to 999,999 m/min



No-load / non-contact velocity measurement by laser

Measurement of motor rotational speed

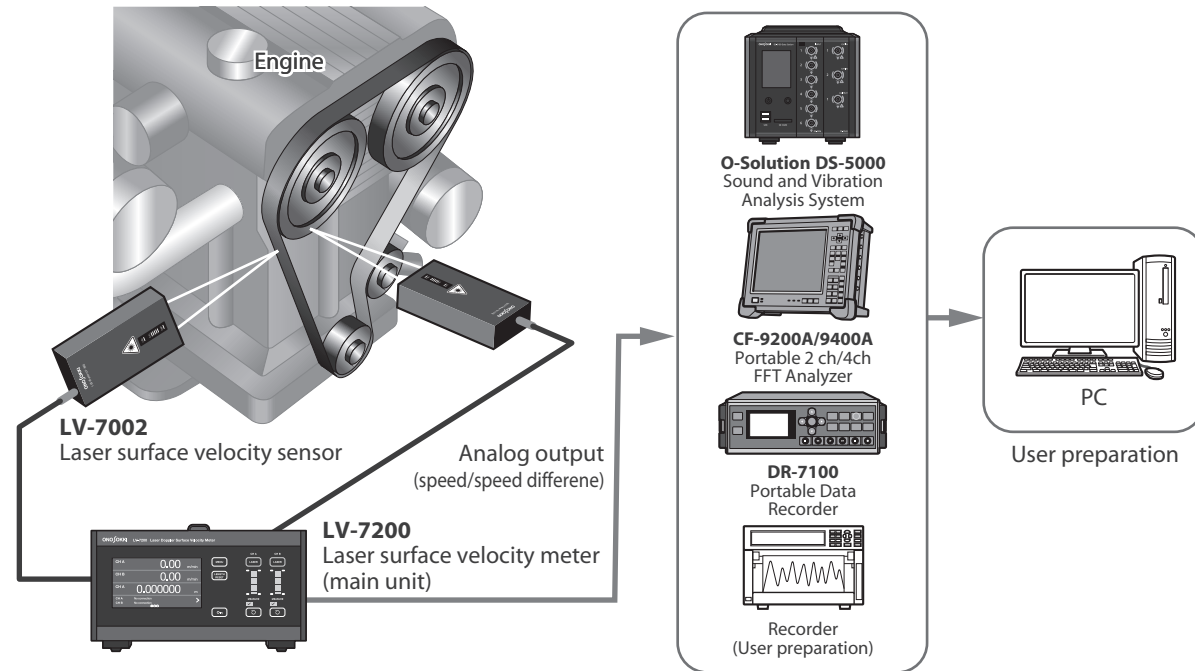
- Motor rotation speed and its fluctuation can be measured. No need to touch the sensor to the object or affix a reflective mark. This non-contact measurement is suitable for inspection of finished products. You can check and evaluate the controlling performance by measuring directly the behavior at the driven side even with the motor to which the encoder is attached at the driving side.
- Forward/reverse rotation of the motor can also be determined.
- Measurement range: 0 to $\pm 1,800$ m/min



No-load / non-contact velocity measurement by laser

Measurement of behavior, speed fluctuation, and slip for crank pulley/belt

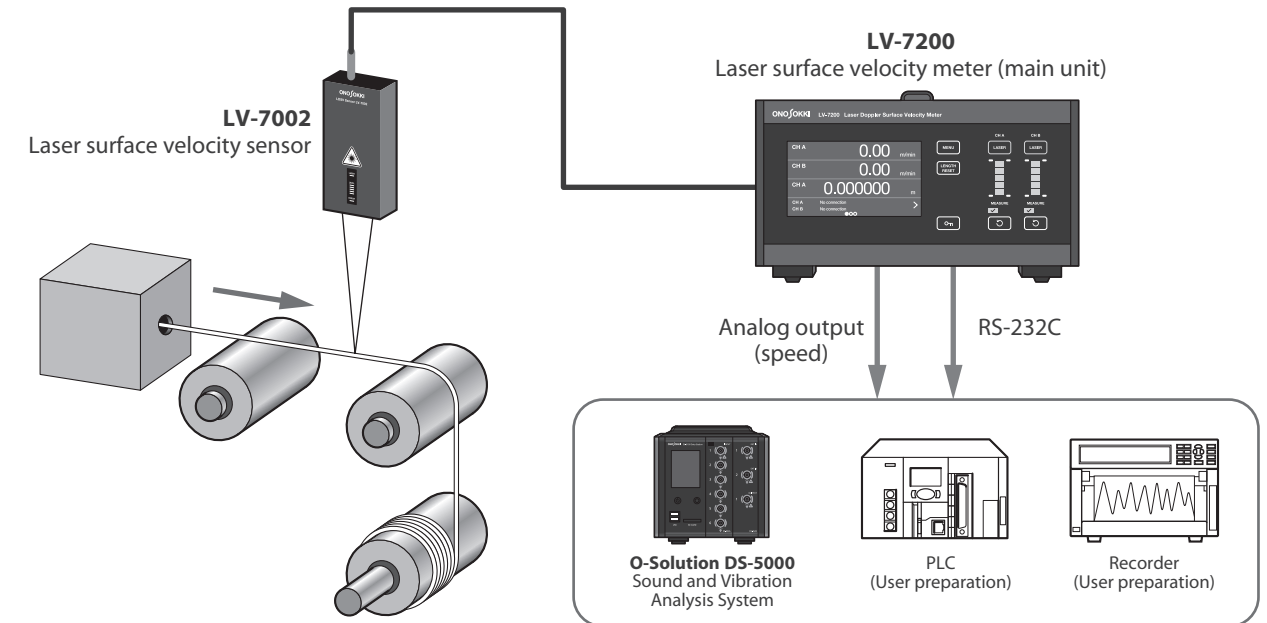
- Speed, its fluctuation, and slip (speed difference) of crank pulley/belt in an engine can be measured. Since it can be measured from zero speed, this system can detect the behavior of forward and reverse rotation occurring at start/stop, fine speed irregularity, and rotation resonance without contact.
- By using two sensors, it can measure the speed difference (slip) between a crank pulley and a belt.



No-load / non-contact velocity measurement by laser

Measurement of speed and length of wire/wire rod

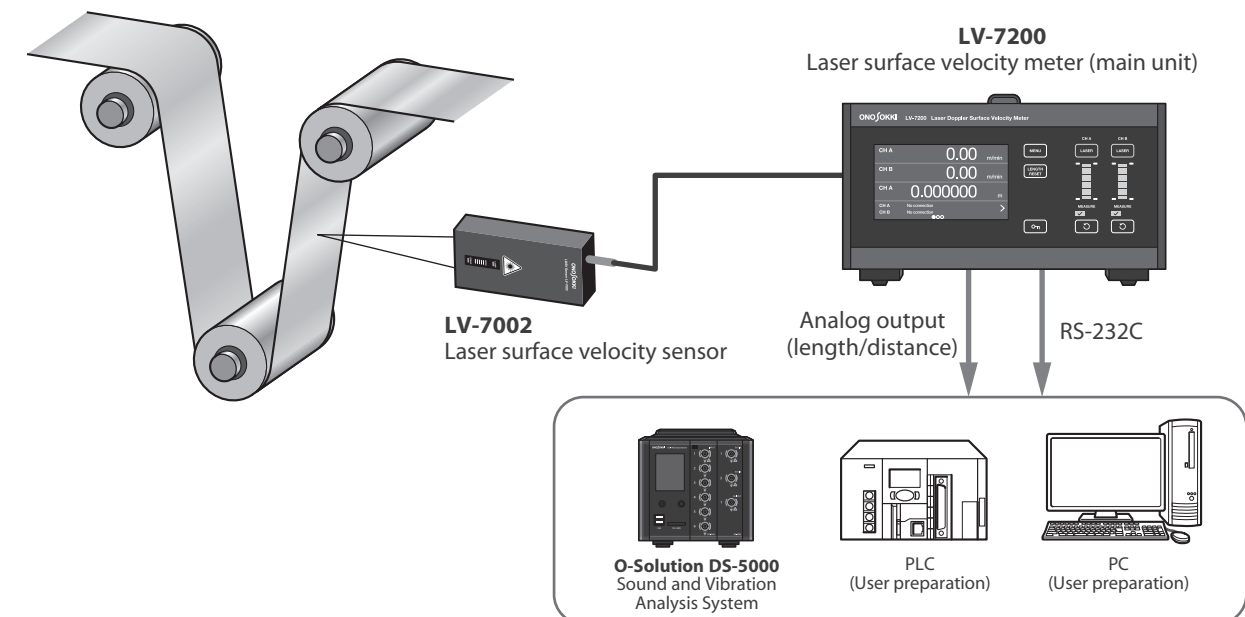
- This example shows how to measure the speed and length when winding thin objects such as wires and wire rods. Even objects that cannot be touched or marked with a sensor, such as wire rods, can be measured without contact, making it possible to directly measure the actual speed of the object.
- Spot diameter of the laser: an ellipse of 2 mm × 1 mm (The object with less than the spot diameter can be measured.)



Length and distance measurement on production line

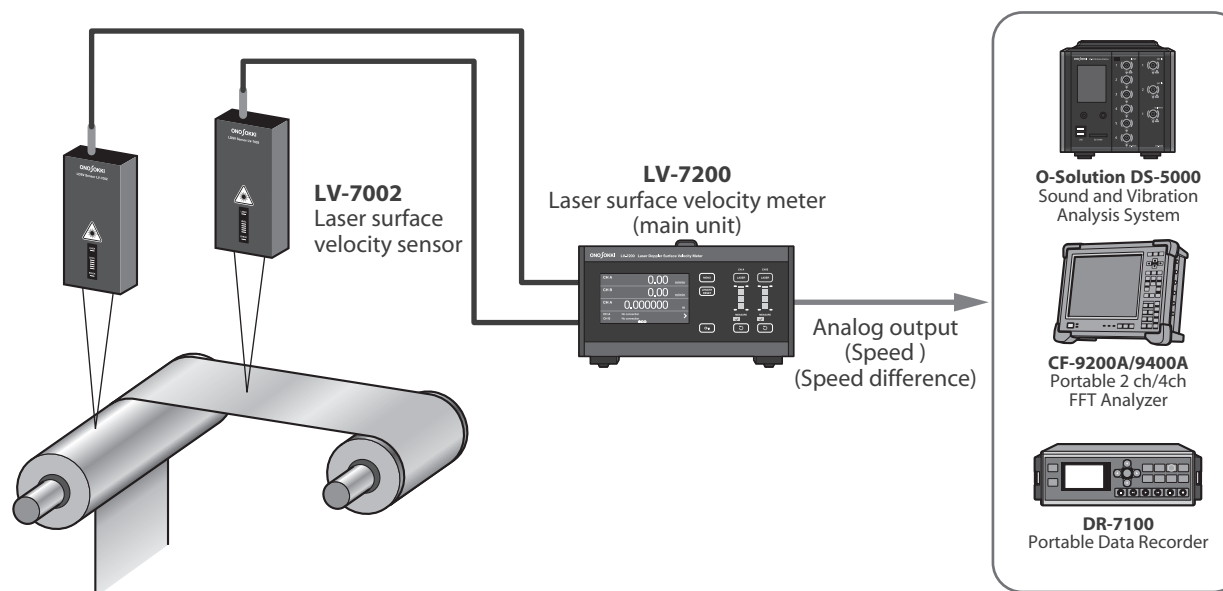
Measurement of length and distance of material/ finished product

- It can measure the length and moving distance of materials or finished products such as film, paper, rubber flowing on production line without contact. There is no need to touch or mark the object, so it can measure without worrying about scratches or defects.
- Since the feed distance of the object can be directly measured, excess length that occurs during manufacturing can be minimized.



Measurement of conveyance slip with delivery roll

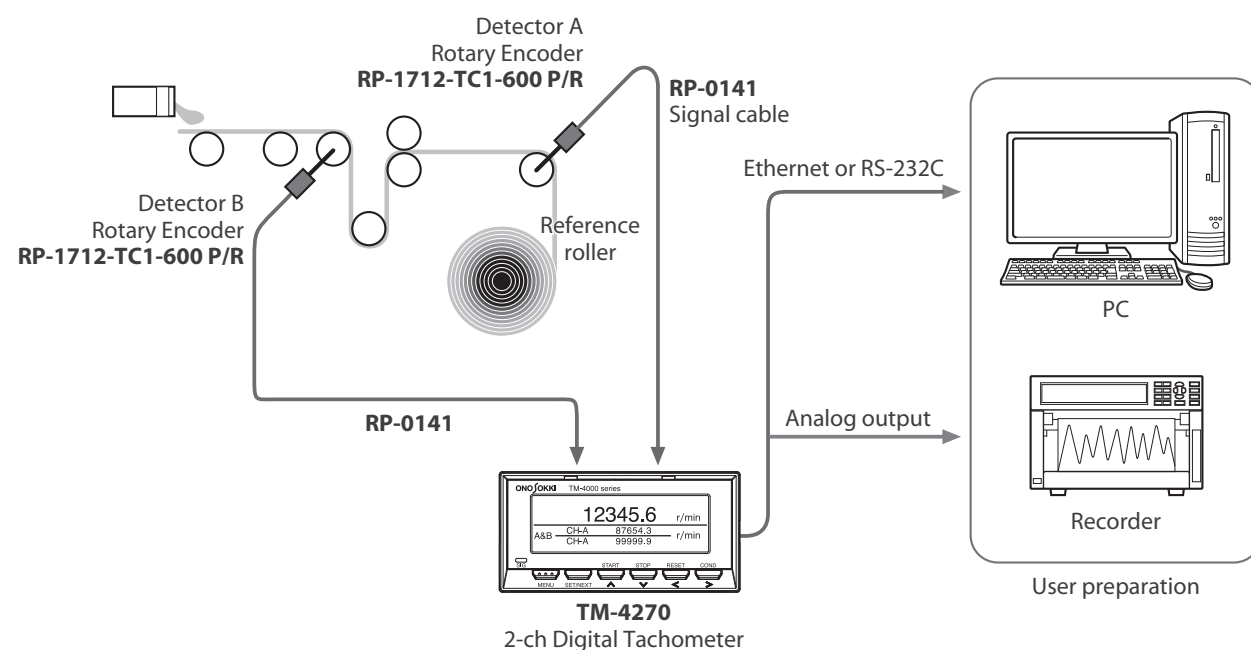
- This example shows how to measure the slippage amount of a belt on a roller, which is used for conveying materials or finished products. You can grasp the slippage amount from speed differences by measuring speed of both the conveyed object and the roller.
- For printing machines and copying machines, the slippage can be evaluated by measuring both the circumferential speed of the feeding roller and the speed of feeding or coming out papers.



Rotation speed calculation such as rotation ratio and rotation difference ratio on the production line

Measurement of drawing (line speed differences, speed ratio)

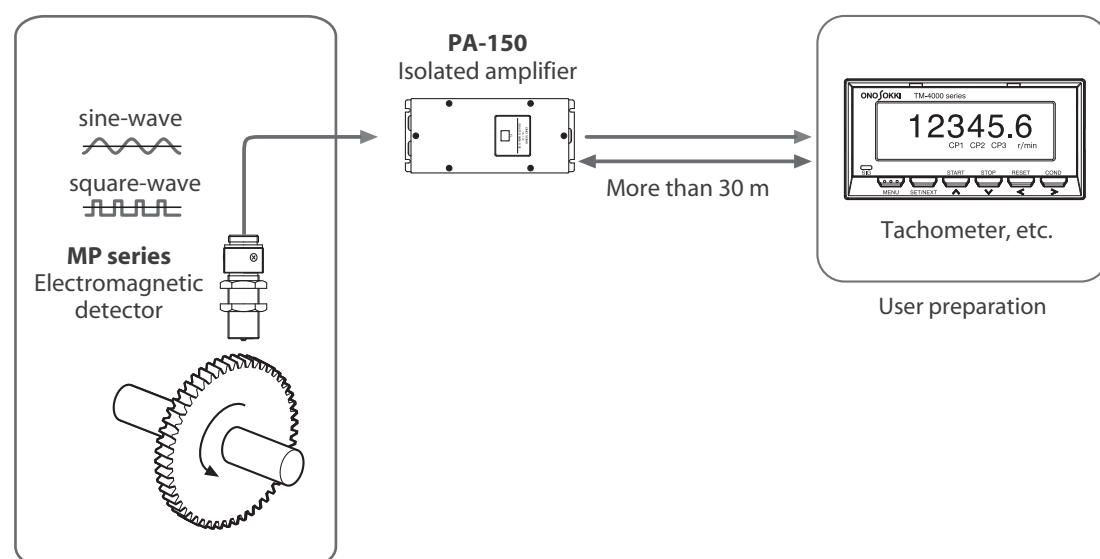
- Attach the rotation detectors (A, B) to the rotating parts of the paper or glass manufacturing lines and input signals to the TM-4270 2-ch Digital Tachometer. The speed change rate between the reference roller and the other roller is displayed in the TM-4270. Thus, by adjusting the speed of each part of the line, it is possible to obtain stable product quality.



Others

Transmitting signals from the rotational detector (electromagnetic type/magnetolectric type) over long distance more than 30 m

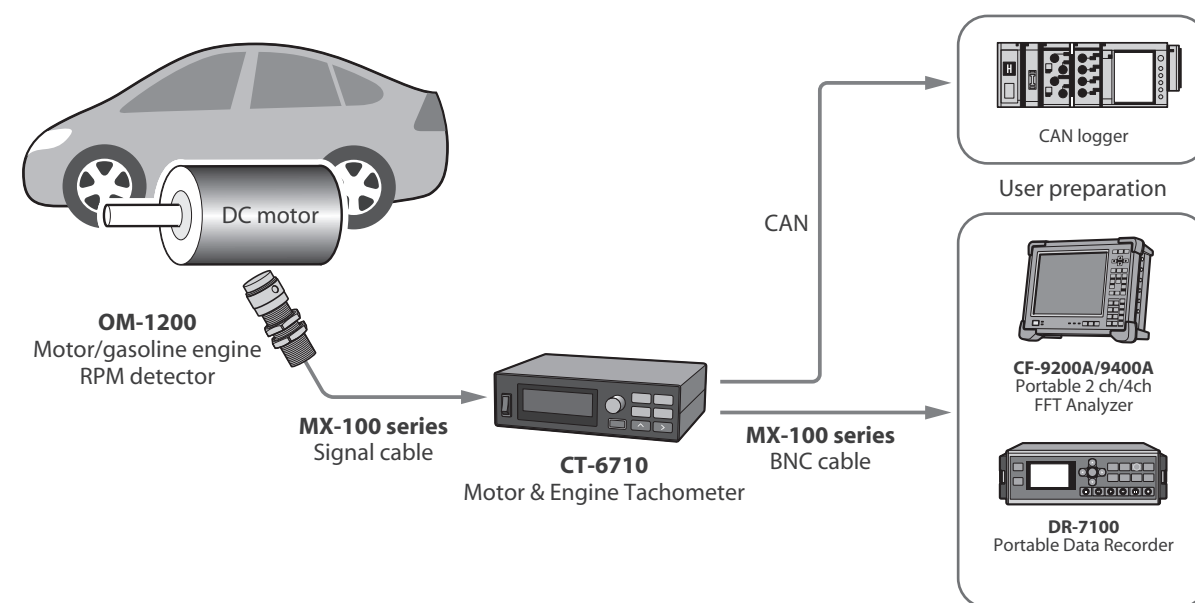
- The isolated amplifier PA-150, which isolates and amplifies input-output circuit, is optimal when the minute signals measured by the electromagnetic/magnetolectric type detector needs to be transmitted for a long-distance more than 30m.
- Input frequency range: 1 Hz to 50 kHz
Input waveform: sine-wave or square-wave
Operating voltage: sine wave at the range of 1 to 30 Vrms / square wave at the range of 0.3 to 30 Vp-p



Others

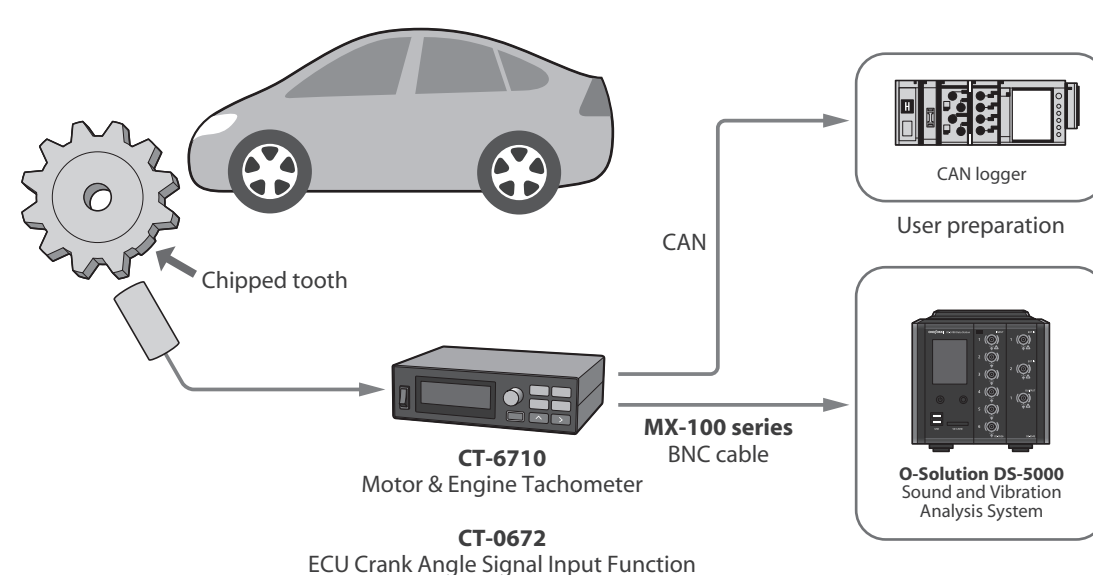
Measuring rotation speed of a DC motor in an EV

- This application shows how to measure rotation speed of a DC motor. In recent years, the more precise rotation measurement is necessary in usage of DC motors for electric vehicles. The magnetic flux leakage from a DC motor is detected by attaching the OM-1200 RPM detector perpendicular to the rotating shaft of the motor.
- The CT-6710 Motor & Engine Tachometer has the analog/pulse output as standard. With analog output, changes in rotational speed can be recorded with a data recorder, etc., and with pulse output, it can be imported into the CF-9200A/9400A portable 2ch/4ch FFT analyzer for tracking analysis.



Engine rotation measurement using crank angle signal for ECU

- The engine rotation speed is measured using the unequal interval pulse signals of the ECU crank angle signals. In order to detect the top dead center position, it learns the pattern of pulse signals that are not arranged at equal intervals on the gears and displays a stable rotational speed.
- With analog output, changes in rotational speed can be recorded with a data recorder, etc., and with pulse output, it can be imported into the O-Solution/DS-5000 Sound and Vibration Analysis System for tracking analysis.



Torque



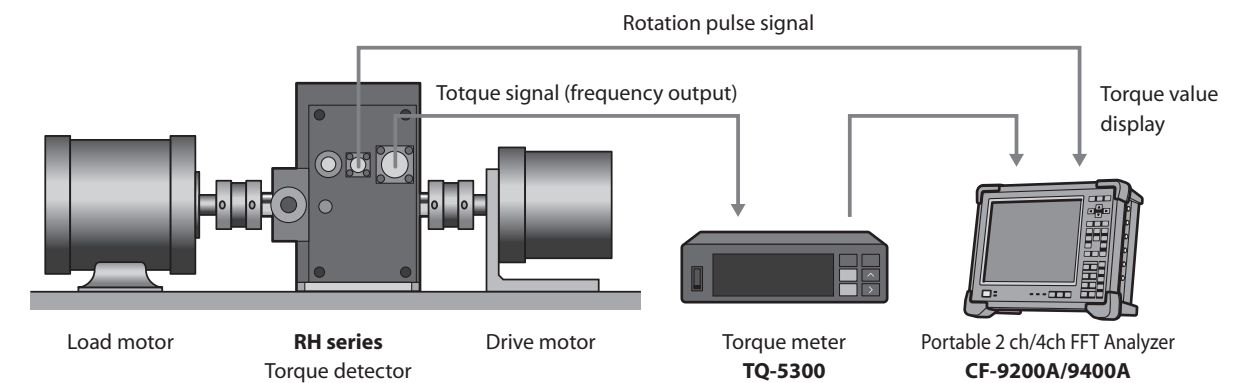
■ Torque measurement

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| Torque characteristic measurement of automotive motors, etc. | 31 |
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■ Torque measurement

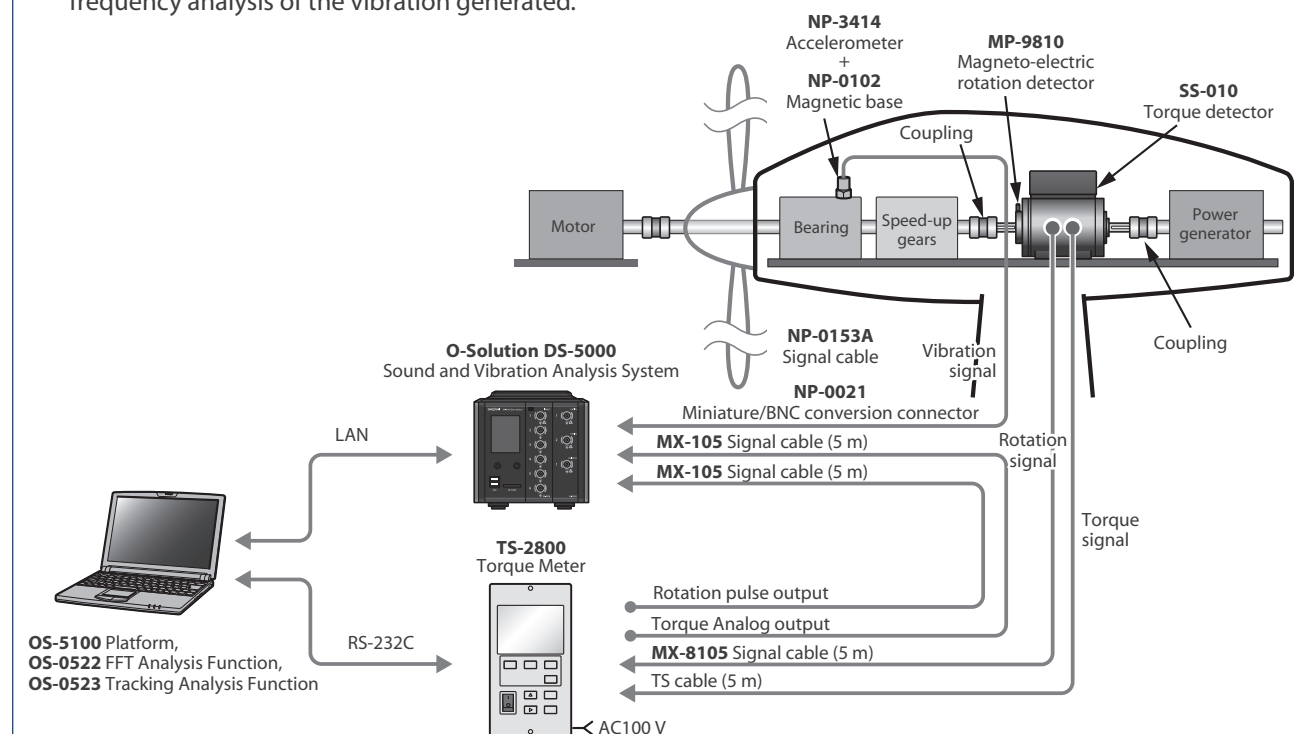
Torque characteristic measurement of automotive motors, etc.

- As the shift to electrification, the development of motors have been required by minimizing cogging torque and torque ripple that cause vibration and noise. The RH-1000 series can accurately detect torque fluctuations with high rigidity, and supports high-speed rotation.
- In TN/TI characteristics measurement, it is possible to measure torque fluctuations during high-speed rotation in addition to highly accurate measurements.
- It can output signals directly, and is more compact and easy to handle.



Simultaneous measurement/analysis of cogging torque and bearing vibration using wind-powered electricity (or dynamo)

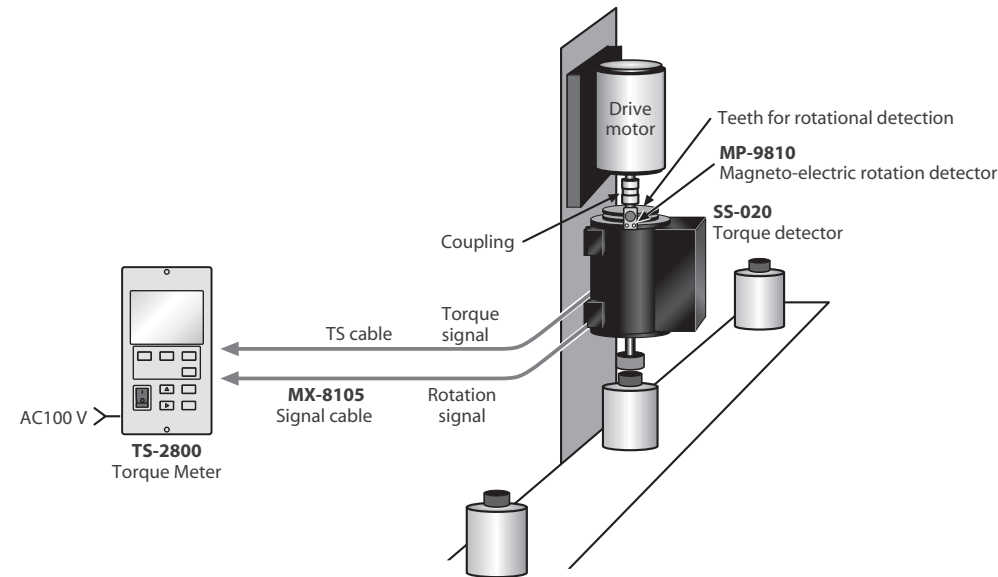
- The increase of cogging torque not only decreases effectiveness in energy but also is deeply related to noise and vibration problems. This example shows how to analyze the correlation with cogging torque and vibration. First, measure and monitor the cogging torque from wind power generator blades, and then perform real-time frequency analysis of the vibration generated.



Torque measurement

Inline inspection by using clamping torque

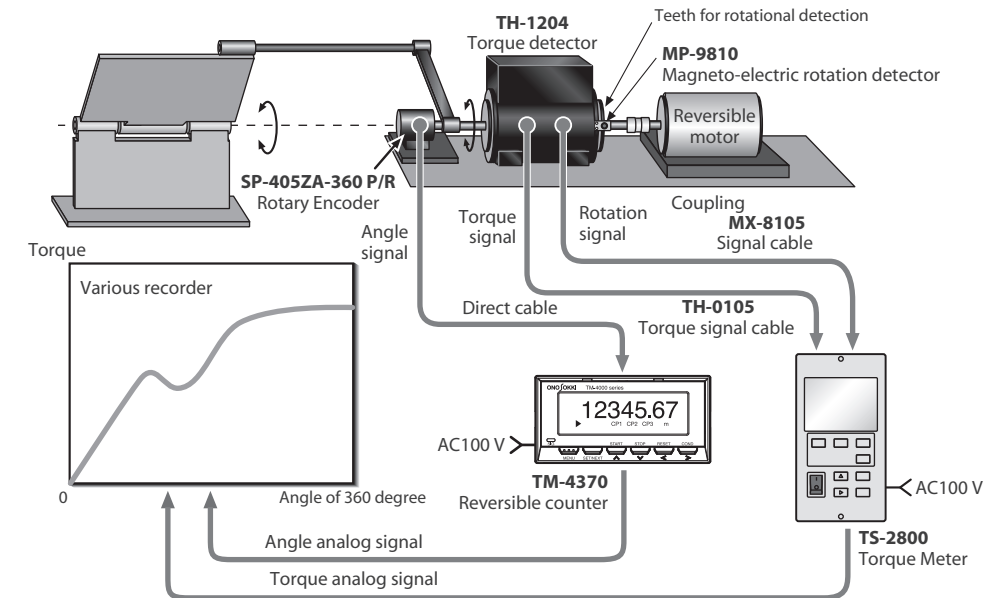
- This example shows how to measure and monitor tightening force of lids of beverage and cosmetics bottles which are continuously carried on production line by using clamping torque.
- By using the RS-232C interface of the TS-2800 Digital Torque Meter, you can connect it to a PC to save result data and perform system control.



Torque measurement

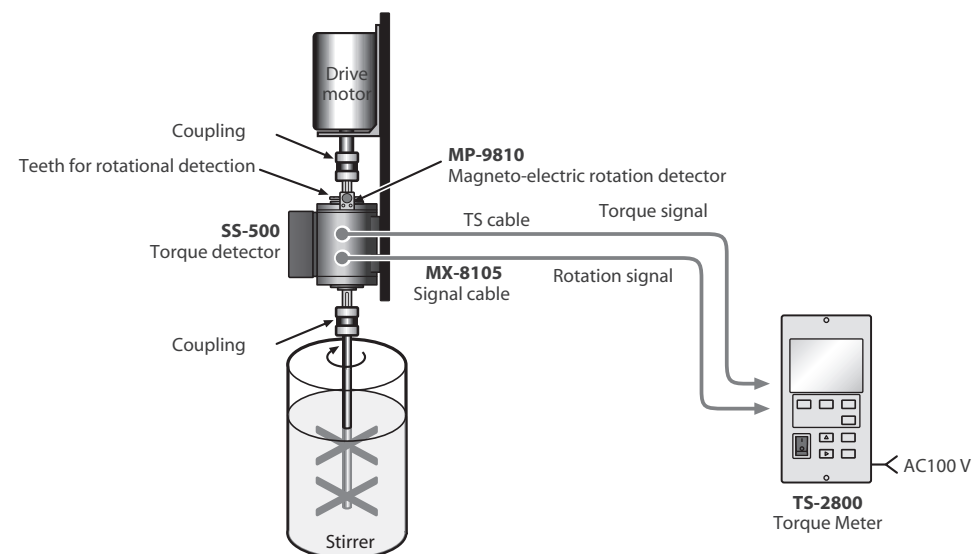
Evaluating torque characteristic of hinge at OA equipment, cell phone etc.

- This example shows how to measure torque characteristic of hinge used in various fields; home appliances such as a rice cooker, a microwave, OA equipment including a fax or photo copy machine, a cell phone, etc.
 - Control of power in opening and closing
 - Measurement of changing hinge characteristic after a long period of use over ten thousand times of open-close tests
- By combining it with a rotary encoder as an angle detector, angle-torque characteristics can be determined.



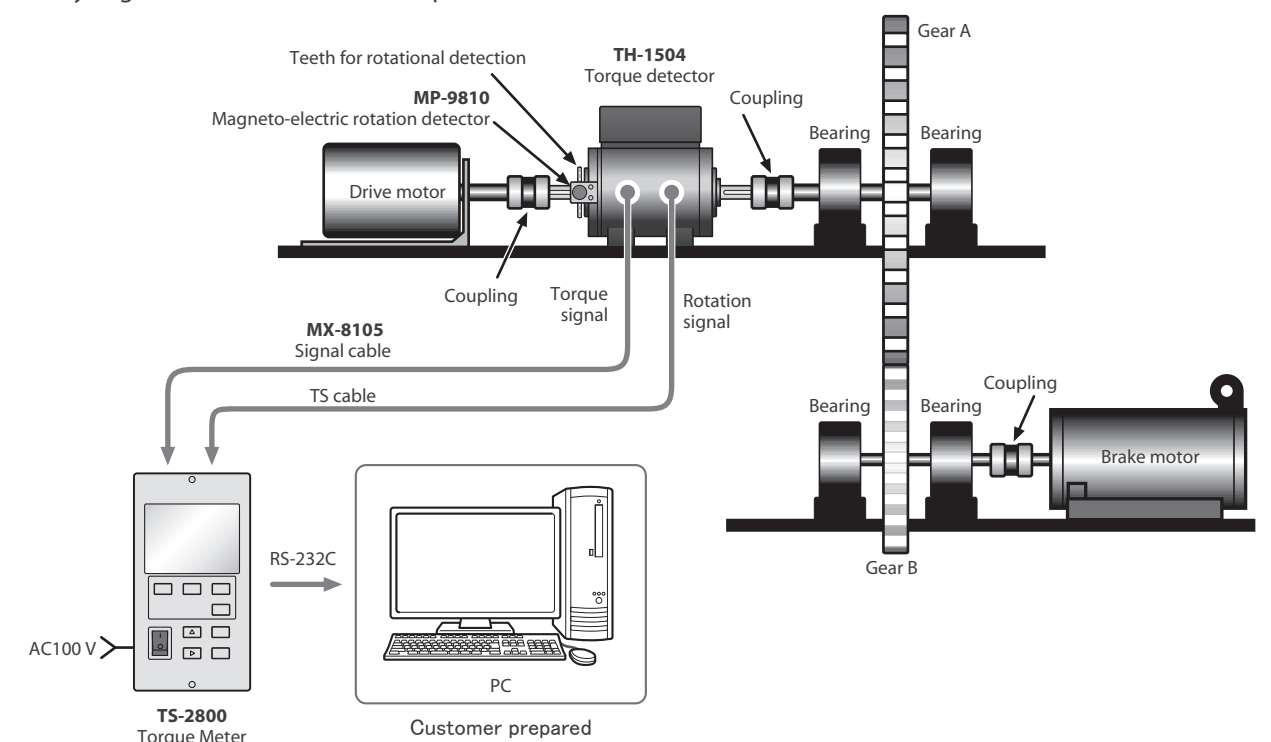
Measurement of agitation torque

- The viscosity of liquid such as chemical agent or resin is changed when it produces chemical reaction (polymeric). By capturing this change in viscosity as a change in agitation torque value, you can understand the degree of chemical change.
- By using the RS-232C interface of the TS-2800 Digital Torque Meter, you can connect it to a PC to save result data and perform system control.



Endurance test of gear teeth

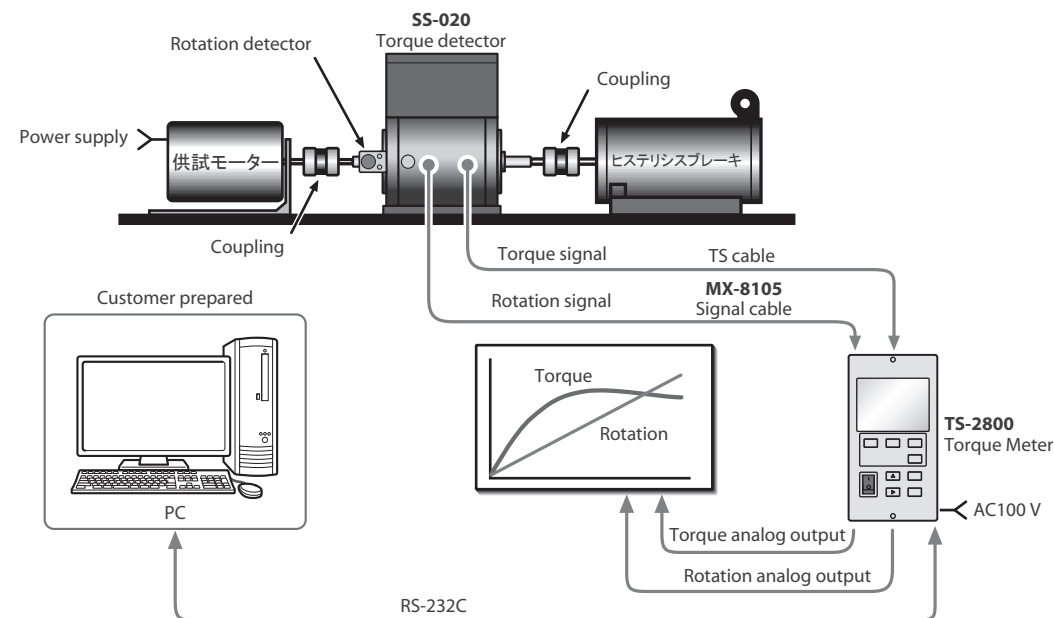
- This example shows how to perform an endurance test of rotating measurement object such as gears, rubber belt or chain for a long time while being applied load as same as real operating status. This result is helpful in analyzing wear or deformed state of parts.



■ Torque measurement

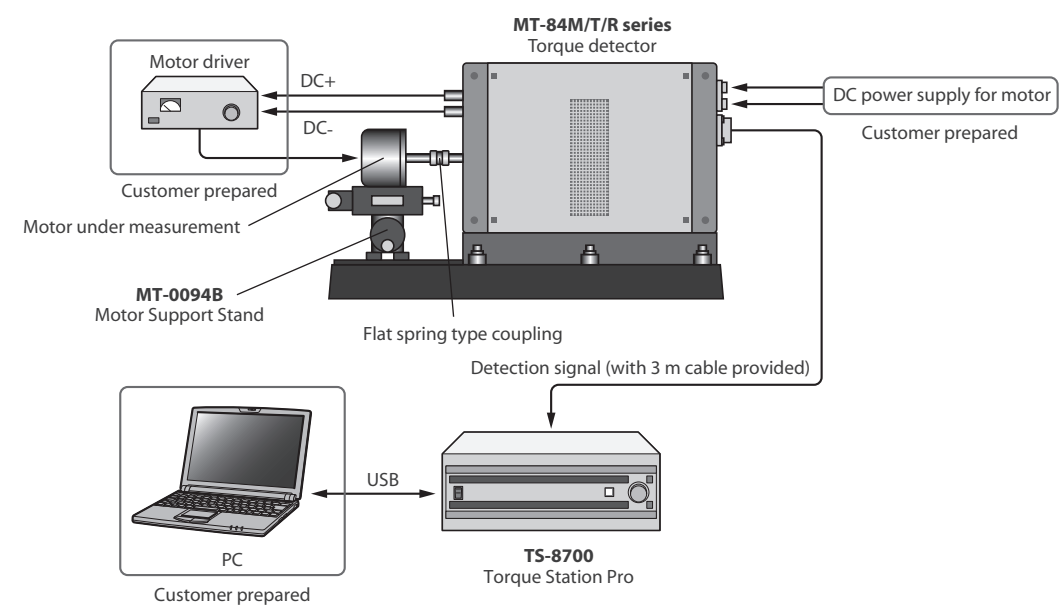
Evaluating torque characteristic of precision miniature motor

- This example shows how to measure and evaluate torque characteristic of precision miniature motor used in various industrial fields; AV equipment such as a camcorder, a DVD player and OA equipment including a printer, a fax, or a HDD, and electric installation for automobile.
- By using the RS-232C interface of the TS-2800 Digital Torque Meter, you can connect it to a PC to save result data and perform system control.
- We provide the TS-8700 Torque Station Pro which is a torque measurement system for motor basic property.



Measuring torque characteristic of brushless motors

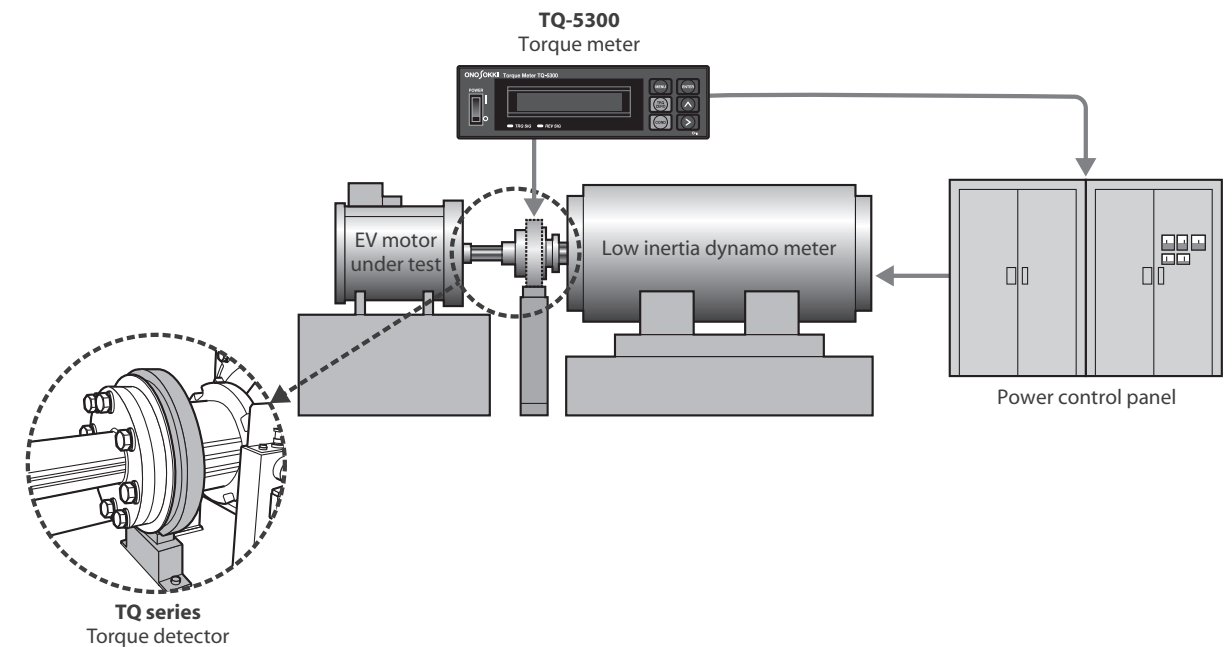
- This example shows how to measure torque, rotational speed, current, voltage of a brushless motor and display in a graph the its characteristics. The efficiency also can be displayed by internal calculation.
- To measure the voltage and current between a three-phase brushless motor and a motor driver (drive device), a commercially available power meter is separately required.



■ Torque measurement

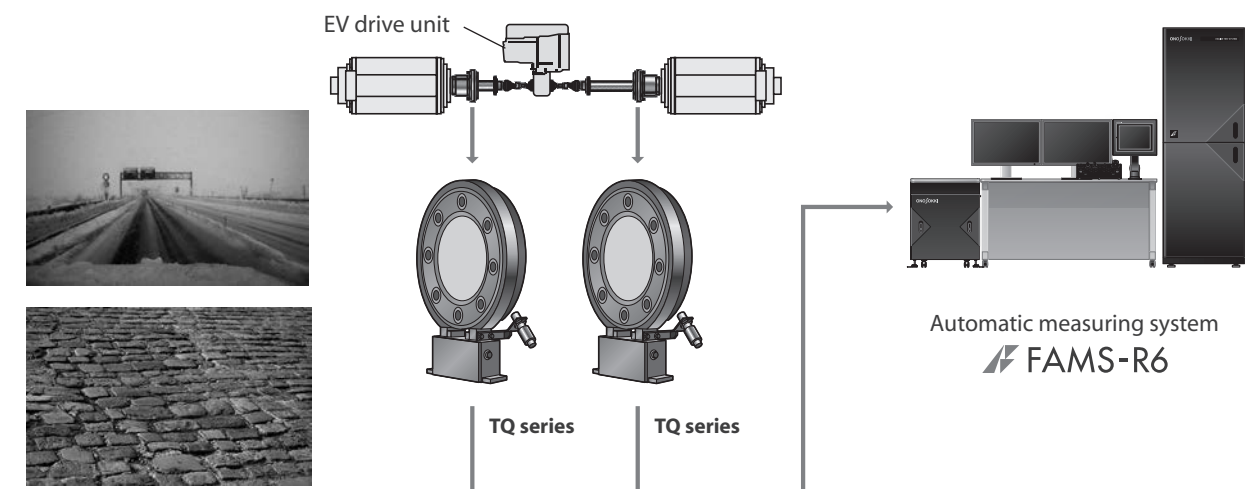
Test system for EV motors

- It can provide data to faithfully reproduce virtual loads on motor benches. Highly responsive torque data enables more optimal load control.
- A slim flange type detector without bearings that can be mounted directly to the rotating shaft. No additional lubrication equipment such as drip lubrication equipment is required.



Bench system for evaluation of EV drive unit

- The Flange type High-stiffness Torque Detector TQ series has high rigidity and accurately captures minute torque fluctuations.
- It can accurately measure the transient torque when driving on a snowy road or on a wavy road that is reproduced on a bench.



Noise



■ Noise measurement

- Sound level measurement in a factory (sound level measurement of working environment) . . . 37
- Sound measurement at a factory worksite 37

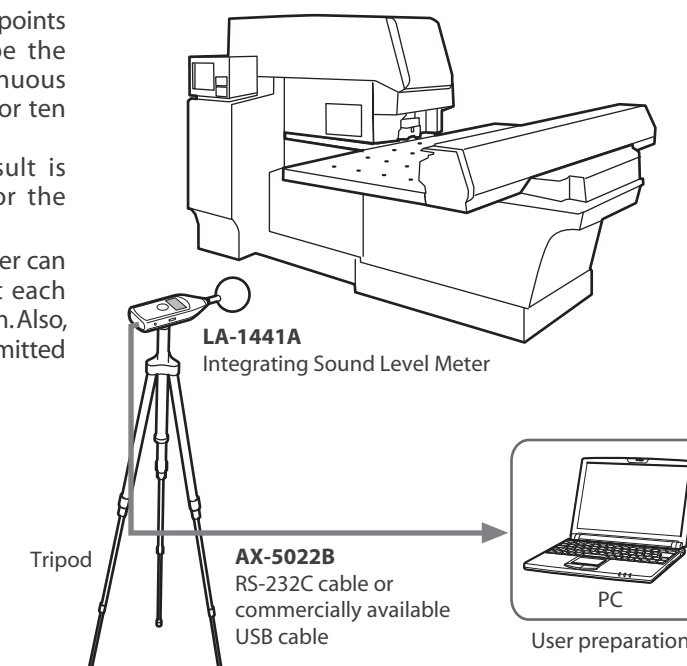
■ Noise analysis

- Sound source probing of abnormal sounds from mechanical equipment 38
- Measurement of NC value in the air-conditioned room 38
- Inspection/analysis of railroad vehicle's components by hammering sound 39
- Performing the frequency analysis of noise from home appliances 39
- Analysis and Pass/Fail judgment of noise from a compact motor 40
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■ Noise measurement

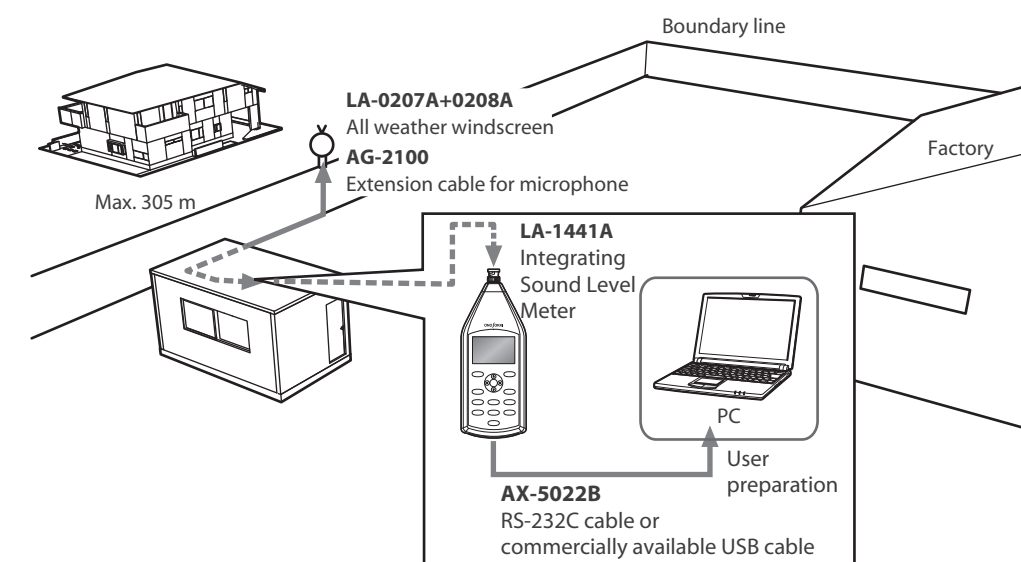
Sound level measurement in a factory (sound level measurement of working environment)

- (A) Measurement at the working area where the sound level is approximately uniform
Set the sound level meter above the floor surface at 1.2 m to 1.5 m on the cross points (more than five points) of vertical and horizontal lines which are made at even intervals (6 m or less for each side).
And then, the equivalent continuous A-weighted sound pressure level (LAeq) for ten minutes can be measured.
- (B) Measurement at the working area near the sound source
Set the sound level meters on the working points when the sound level is expected to be the highest. And then, the equivalent continuous A-weighted sound pressure level (LAeq) for ten minutes can be measured.
- After A and B measurements, each result is evaluated in order to take measures for the improvement in working area.
- The LA-1441A Integrating Sound Level Meter can store the data of sound pressure level at each point in the internal memory and recall them. Also, the stored measurement data can be transmitted to the PC via USB or RS-232C interface.



Sound measurement at a factory worksite

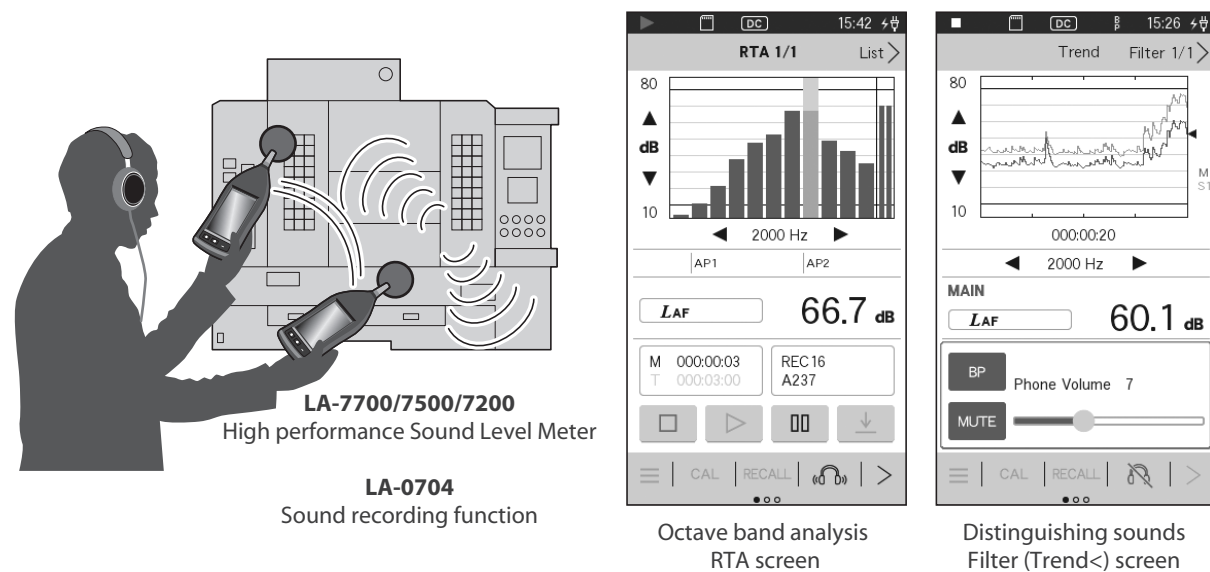
- Separate the microphone from the main unit of LA-1441A and set it at the boundary line between the factory and the private house which is required noise monitoring. Then, place the main unit of LA-1441A in the office away from the microphone at 300 m. (Microphone can be separated from the main unit of LA-1441A maximum at 305 m.)
Noise is monitored by repeatedly measuring the equivalent continuous A-weighted sound pressure level (LAeq) every hour.
- The measured data is automatically stored in the built-in memory, and the stored data can be transmitted to the PC.
- By installing LA-0141 comparator output function (option), it can lighten the external alarm lamp when the sound level exceeds the setup value. Please feel free to contact your nearest distributors.



Noise analysis

Sound source probing of abnormal sounds from mechanical equipment

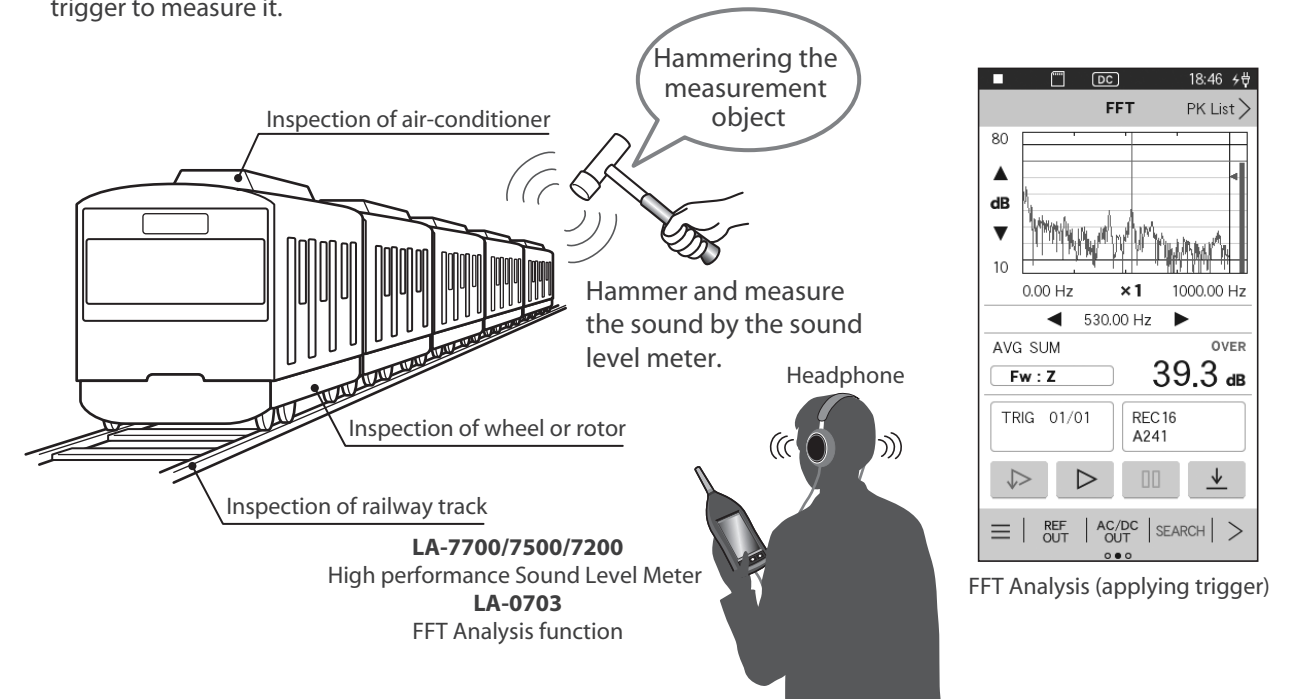
- By performing octave band analysis of mechanical sounds, you can find out the pitch distribution of the sounds. In addition, even in situations where there is a lot of background noise, you can only hear the sound of a single frequency (band) that you specify, which helps you distinguish the pitch of the sound you are concerned about. Furthermore, while moving the microphone, you can find the sound source. By combining with the LA-0704 Sound recording function, it is also possible to record only the bothering sounds (bandpass sounds).



Noise analysis

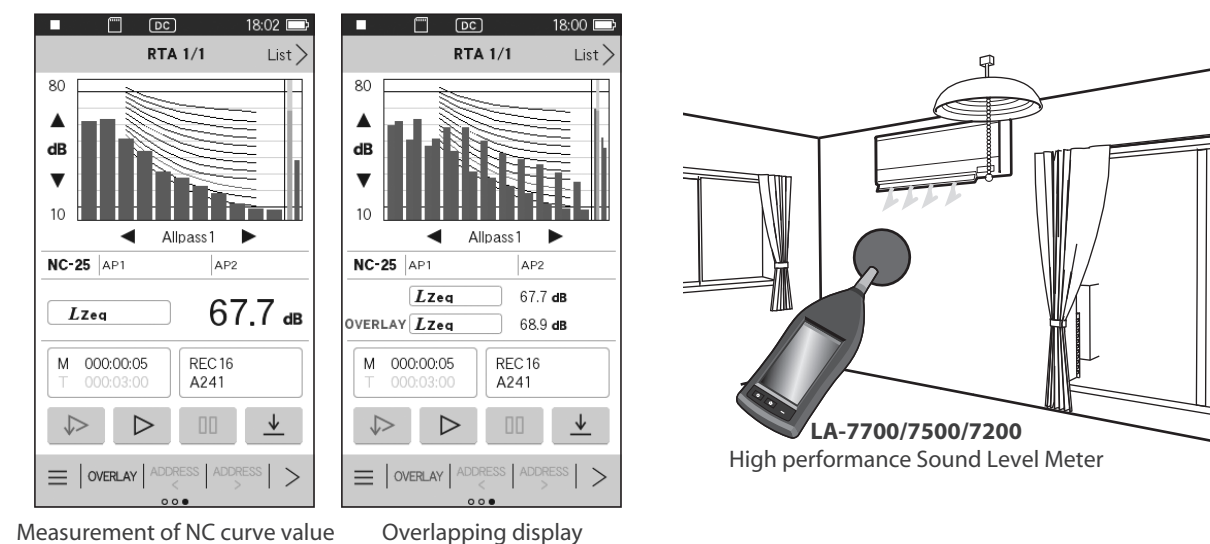
Inspection/analysis of railroad vehicle's components by hammering sound

- While hammering the components and checking the generated sound through headphones, measure the loudness of the generated sound using the LA-7700/7500/7200 High performance Sound Level Meter. By adding the LA-0703 FFT analysis function, you can perform frequency analysis of generated sound on the spot. Also, for excitation sounds and a single-shot sound, it is effective to set the sound pressure level and apply a trigger to measure it.



Measurement of NC value in the air-conditioned room

- The NC value is used as an evaluation value of the indoor environment, and is obtained by performing 1/1 octave band analysis (standard function) using the Z frequency weighting to apply the analysis data to the NC curve graph. The NC values can be directly obtained by using 1/1 octave band analysis (standard function) of the LA-7700/7500/7200 High performance Sound Level Meters. You can also see at a glance at which frequencies the NC value is high. Also, by displaying graphs overlapping, it is possible to compare when the air conditioner is operating and when it is stopped.



Performing the frequency analysis of noise from home appliances

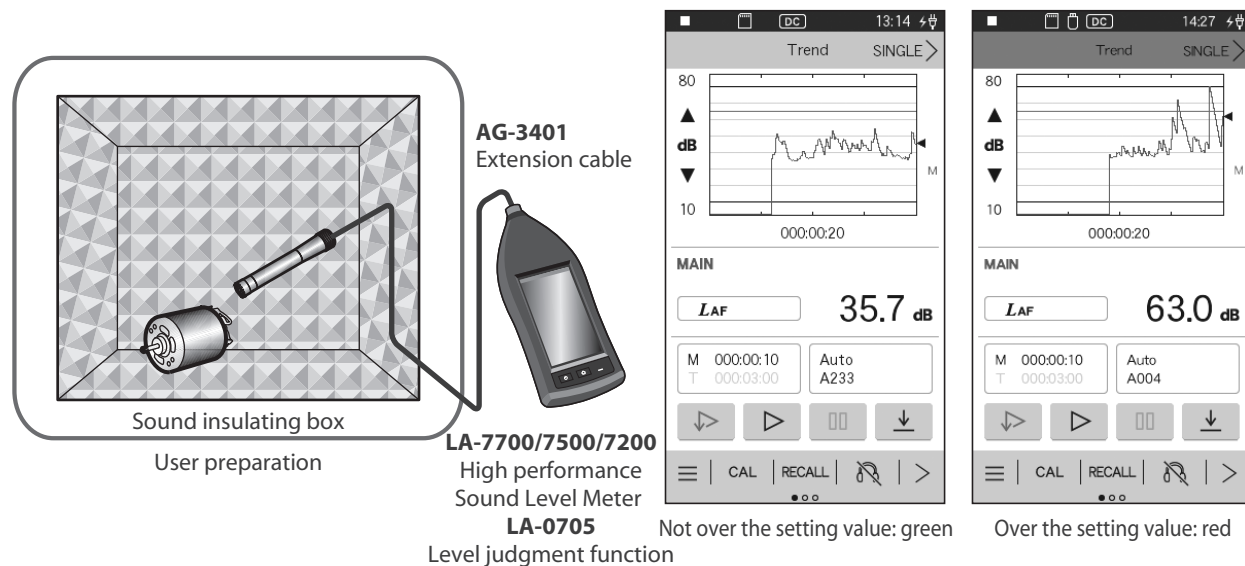
- Perform 1/3 octave analysis of the noises which are generated from home appliances. After installing the LA-0702 1/3 Real-time octave analysis function onto the LA-7700/7500/7200 High performance Sound Level Meter, measure and evaluate the target noises. It can perform the wideband analysis from 12.5 Hz to 20 kHz band and more detailed analysis than 1/1 octave band analysis (standard function). Furthermore, you can listen to only the interested sound and find out where the abnormal sounds are coming from while moving a microphone.



■ Noise analysis

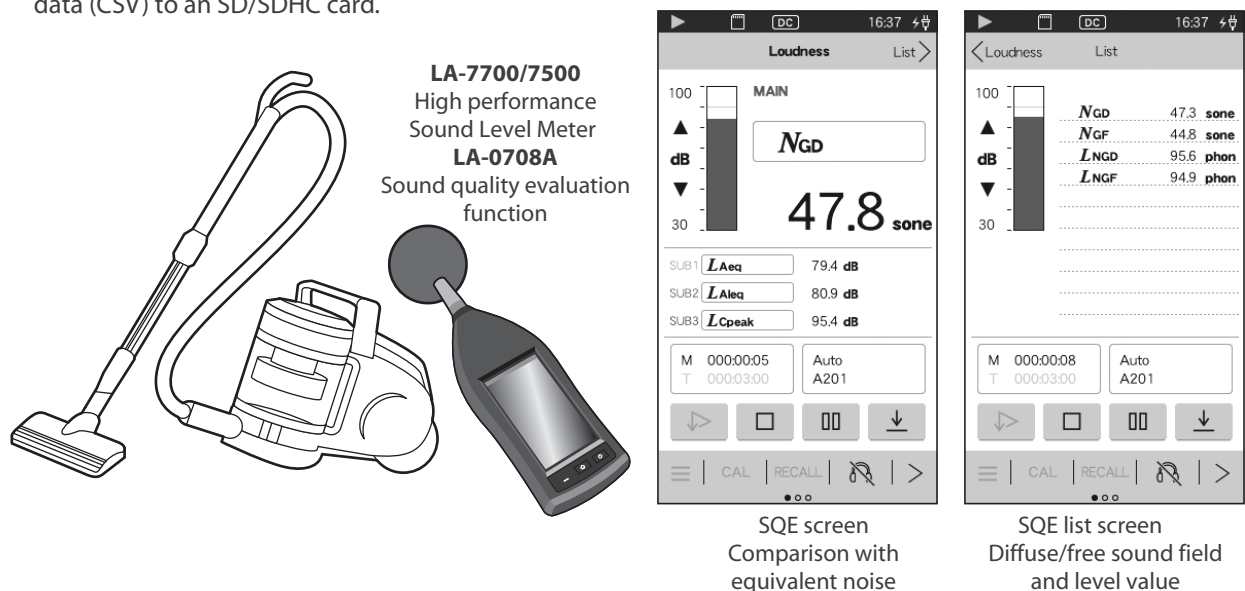
Analysis and Pass/Fail judgment of noise from a compact motor

- When evaluating the sound pressure level of operating sounds of electrical parts such as small motors, adding the LA-0705 Level judgment function to the LA-7700/7500/7200 High performance Sound Level Meter allows you to determine the threshold value and to judge whether it exceeds or not. It is easy to recognize as the background color changes green or red, and there are HOLD setting and DELAY setting, which are effective for system upgrades with other devices.



Measurement of loudness (sone) from home appliances

- For checking the sounds which are generated from home appliances such as vacuum and laundry machine, measuring the loudness (sone) becomes common as well as the sound level measurement (dB). The loudness is used as value index for evaluation of improvement effect before and after countermeasures for noise reduction. The value of loudness (sone) falls by half in proportion to human hearing sound. By comparing the loudness values before and after the countermeasures, you can confirm the efficiency of improvement.
- By installing the LA-0708A Sound quality evaluation function with the High performance Sound Level Meter, LA-7700/7500, it is possible to simultaneously display the equivalent continuous -weighted sound pressure level, LAeq (dB) and the stationary sound loudness calculation value (sone). It is also possible to save numerical data (CSV) to an SD/SDHC card.



Vibration



■ Vibration by impulse hammer

Measuring natural vibration frequency and damping ratio by hammering test 42

■ Product inspection

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■ Monitoring for abnormal machine operations

Monitoring a sieve operation (chemical plant) 46

■ Facility Monitoring

Monitoring vibrations of motors and pumps 47
 Monitoring for abnormality in main shaft of machine tool 47

■ Detection of broken or worn machine tools

Detection of wear of grinding wheels 48

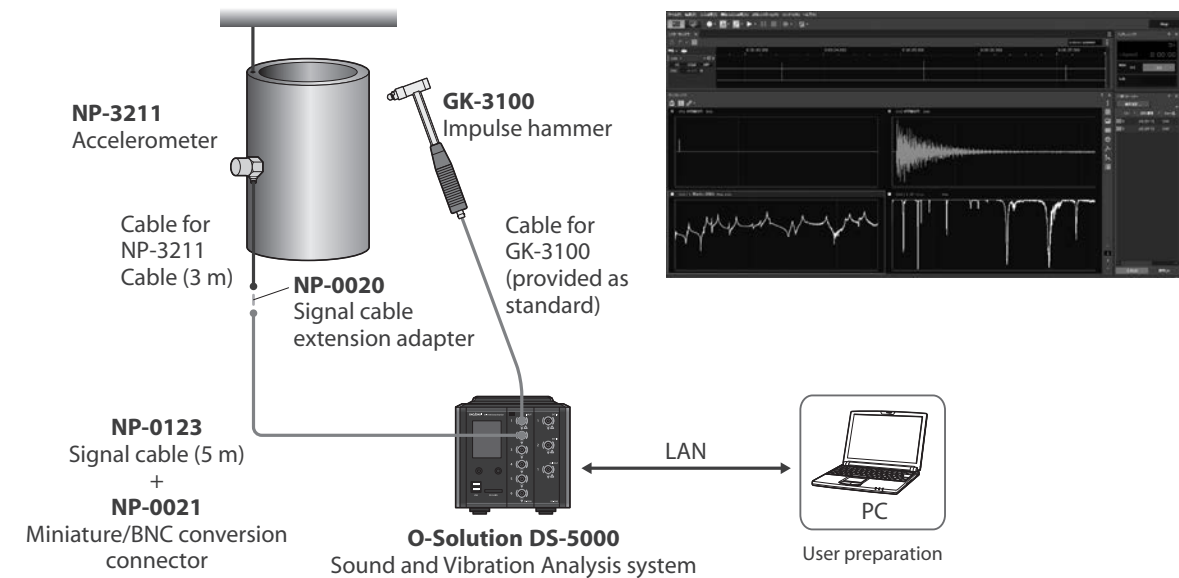
■ Vibration measurement with Laser Doppler Vibrometer

Vibration measurement of ultrasonic tools 48
 Measurement of ultrasonic cleaning tank in liquid 49
 Measurement of thin film vibration 49

Vibration by impulse hammer

Measuring natural vibration frequency and damping ratio by hammering test

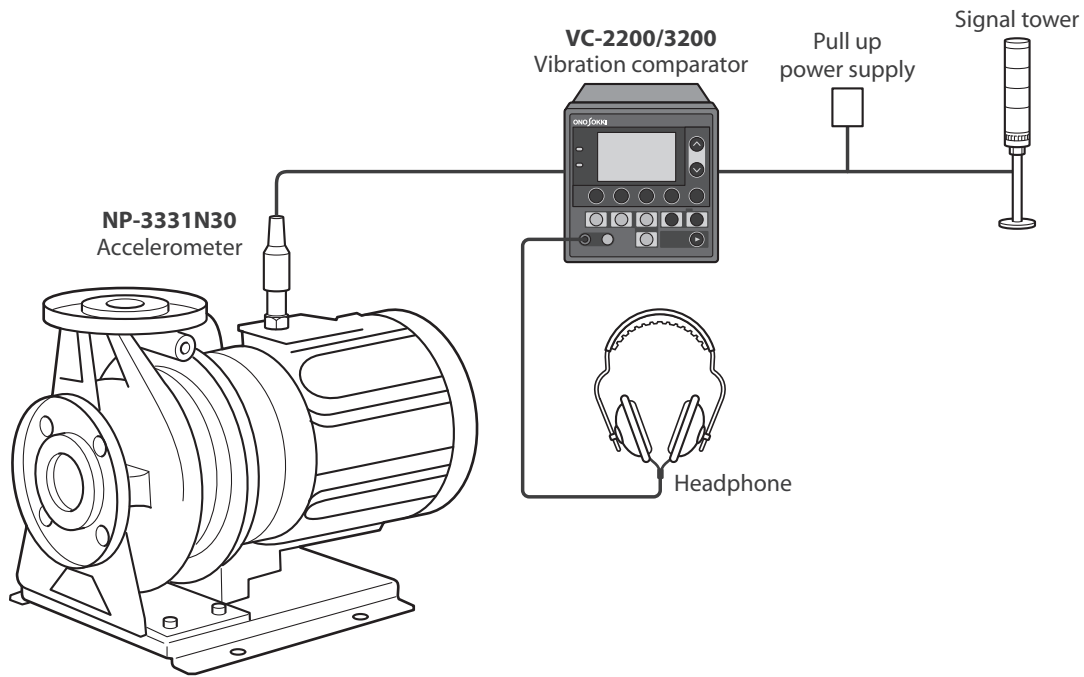
- Suspend a measurement object in a free vibration (or place it on something soft) and perform hammering test by the GK-3100 Impulse hammer. And then detect the free damping vibration by an accelerometer. Measure the frequency response function of the impact force of GK-3100 (F) and Acceleration (A) = Acceleration (A) / Force (F) = (Accelerance < Inertance), and find the resonance frequency at which A/F peaks, and then obtain the natural frequency. You can see several peak values depending on a shape of a measurement object. The damping ratio also can be calculated by using half-power bandwidth method. Moreover, integrating function of the DS-5000 series enables to display and evaluate velocity/power (mobility), displacement/force (compliance), force/acceleration (dynamic mass), force/velocity (mechanical impedance) or force/displacement (dynamic rigidity).



Product inspection

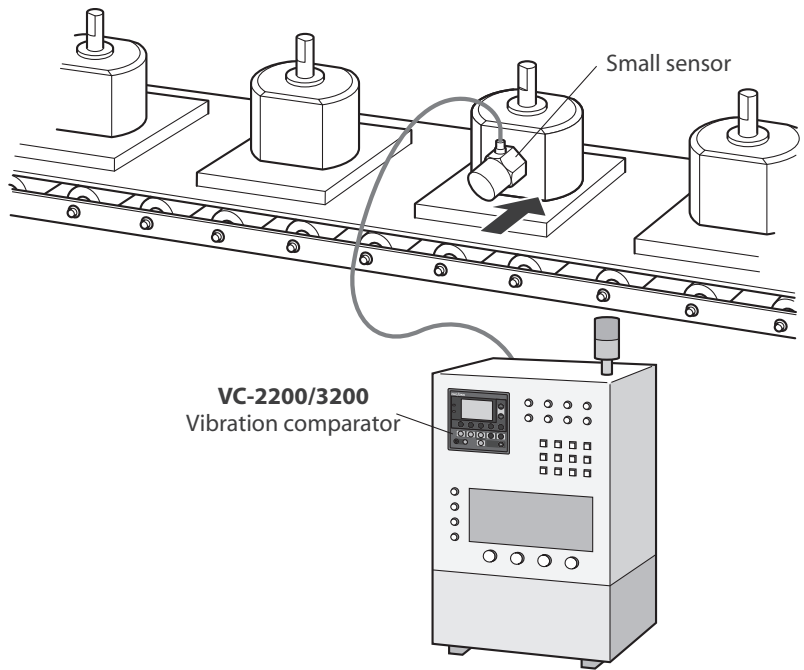
Inspection of pumps before delivery (inspection of rattling/abnormal sound)

- Although the visual checking by vibrometer or listening check using a stethoscopic rod are popular, the VC-2200/3200 enable automatic inspection according to the numerical values. They can make the Pass/Fail judgment by overall vibration values (velocity and displacement) of the pumps as well as inspection of the wrong assembly of internal bearings.



Inspection of motors before delivery (inspection of abnormality)

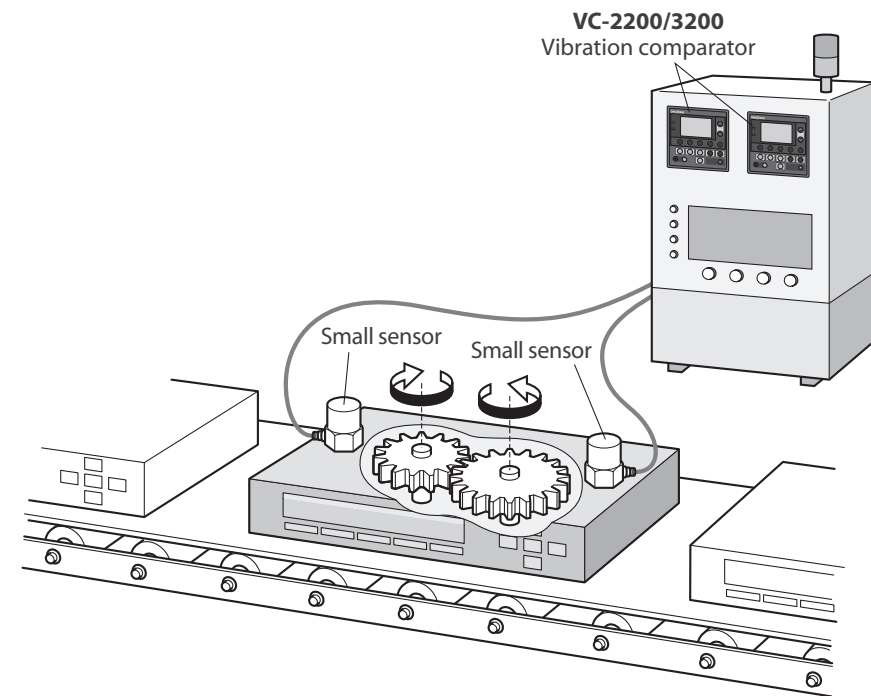
- The VC-2200/3200 enable automatic inspection of products by replacing the sensory inspection (especially for the listening check) by operators. They can make the Pass/Fail judgment by overall vibration value of motors as well as detecting the problem of internal bearings by specifying and taking measures of the frequency band which leads to the abnormality.



Product inspection

Inspection of chipped resin gear teeth

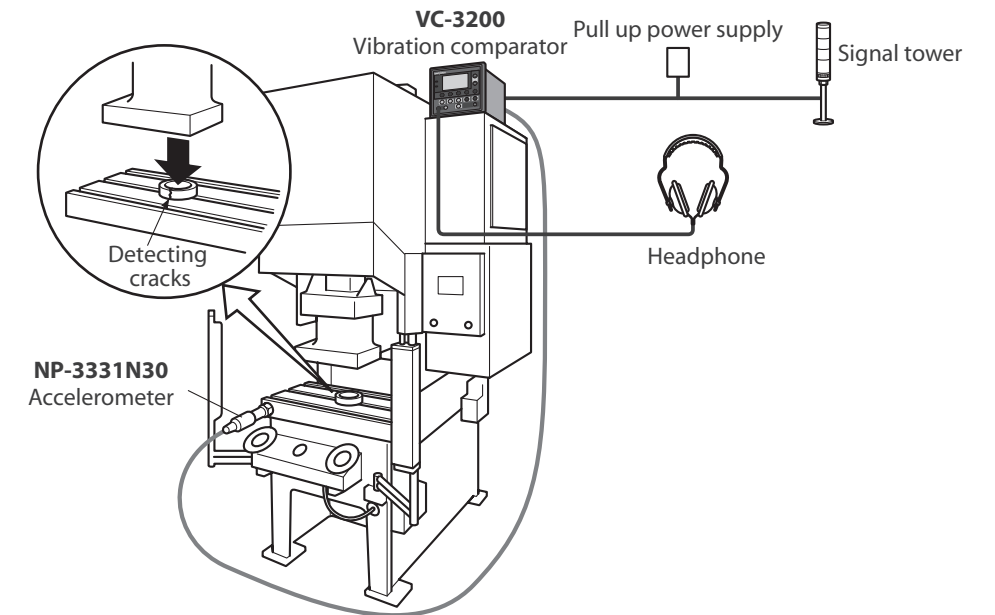
- This example shows how to detect the damages (deformation, flaws) of resin gear teeth used for audio visual systems and office equipment and abnormalities caused by foreign materials trapped inside the equipment. The VC-2200/3200 allow quantification of the abnormalities and automatic determination, instead of the listening check by operators. Also, they ensure that all products are inspected for consistent quality on production line.



Product inspection

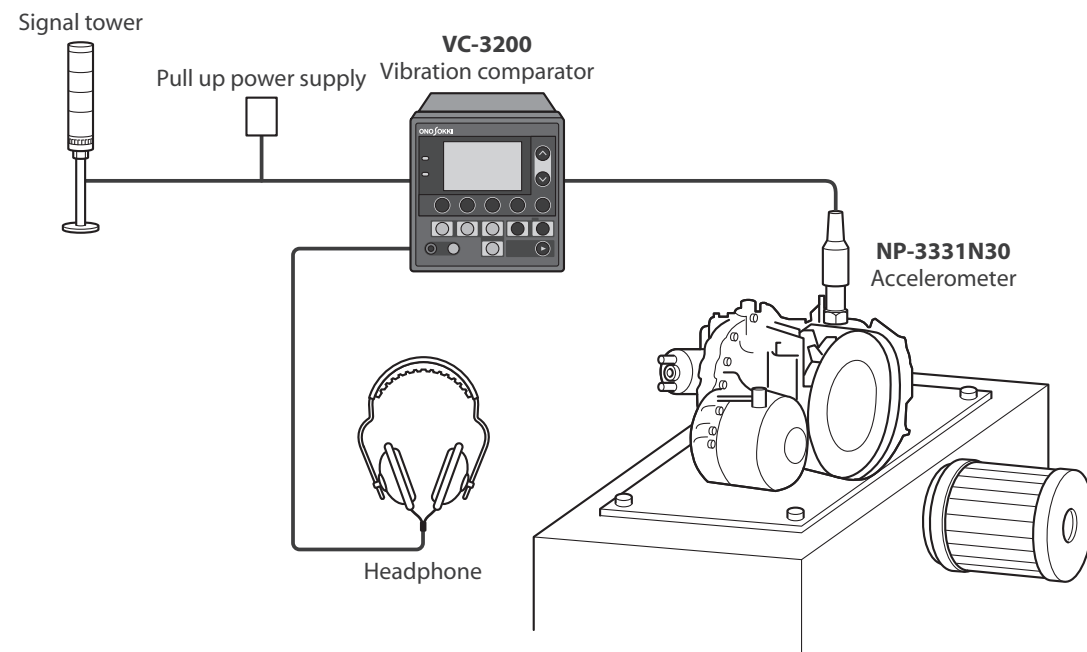
Detection of cracks in products during the press process

- Inspection of cracks in pressed products is normally done by operators after the press process. If a defect is found in an inspection after the process, the products in the entire lot may have to be rejected. In addition, visual inspection of a huge number of products takes time and effort, and so operators may overlook during checking. Since overlooking cracks in this process greatly affects the quality of the subsequent products, it is important to detect cracks during the process and to prevent the outflow of detectors. The VC-3200 detects vibrations generated from cracks and makes the Pass/Fail judgment, thus it improves process efficiency and prevents products with cracks from processing to a later processes.



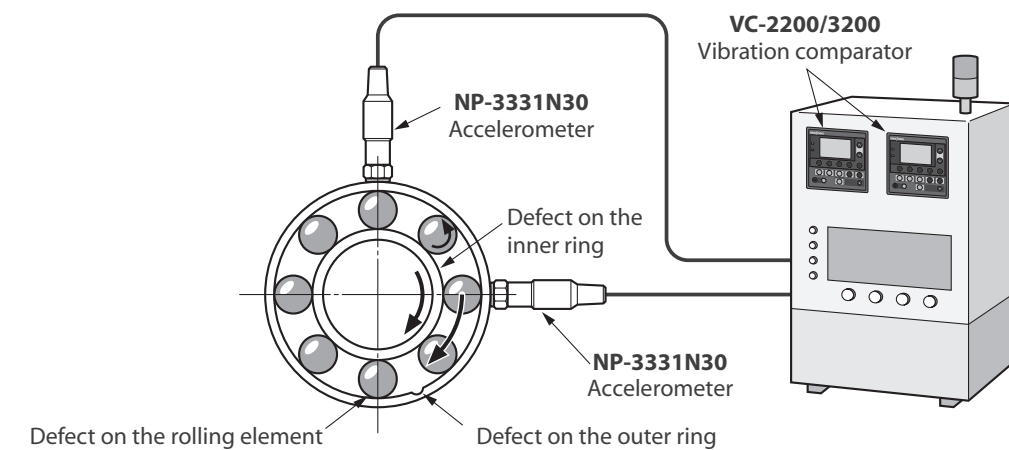
Inspection of dents on gear boxes

- As an inspection whether there is a dent or not on the gear box, sensory test by operators (touching with hand, listening the difference with stethoscopic probe) is popular. In this inspection, there is a problem with variations in quality due to the operator's sense. The determination by quantitative value is necessary in order to improve the quality and stable supply of product. The VC-3200 can detect whether there is a dent or not on the product and make determination by quantitative value.



Inspection of bearings before delivery

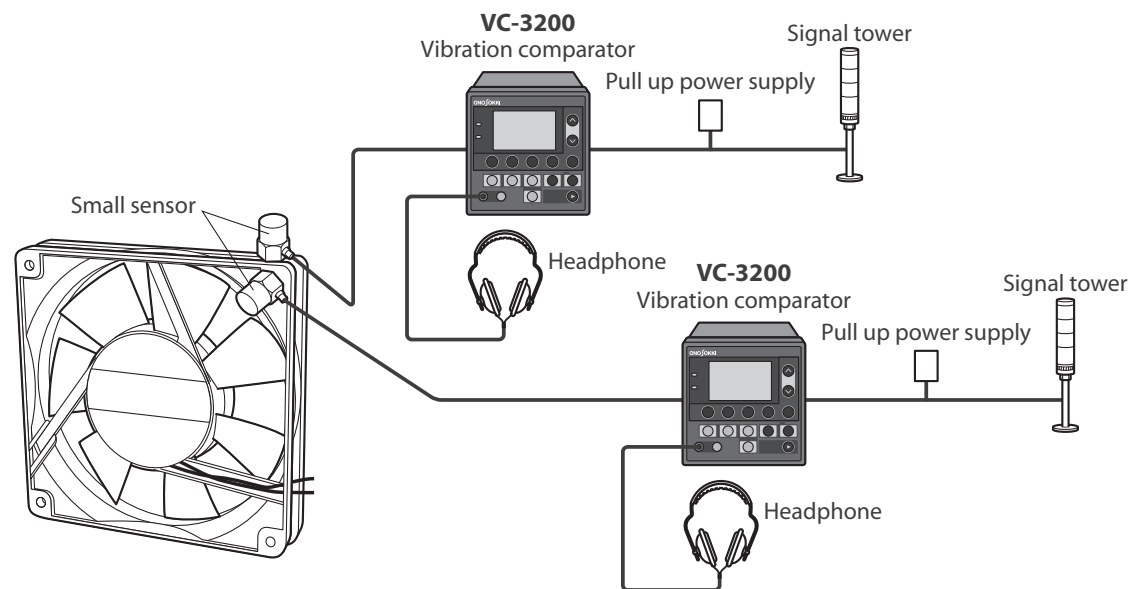
- At an inspection of bearings before delivery, scratch, foreign material and rattling due to bad installation are inspected. The figure below shows an example of the inspection using the VC-2200/3200. They can detect smaller scratches securely by measuring the peak/maximum rms value factor in addition to the peak and rms values.



Product inspection

Inspection of small fans before delivery

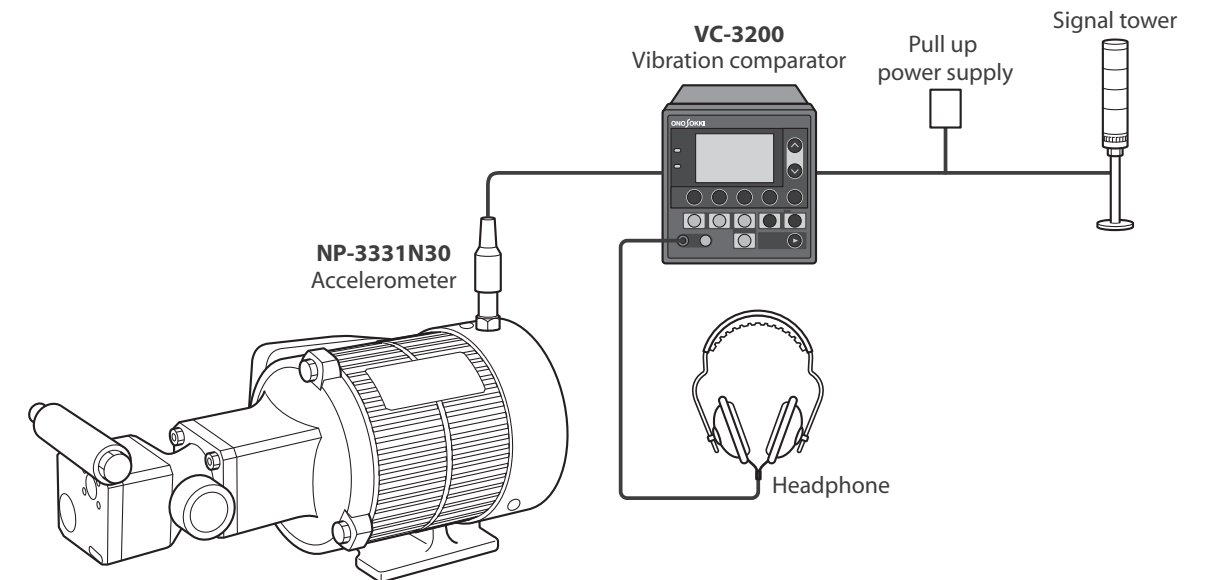
- Inspection of small fans before delivery is mostly performed in the form of sensory inspection by operators. Judgment of rattling and abnormal sounds at the rated rotation speed is dependent on the operators' sense. In recent years, quantitative judgment has become necessary to achieve stable product quality, particularly as manufacturing plants have been transferred overseas. The figure below shows an example system which sensors are installed in the radial and thrust directions of a fan, and detects rattling and abnormal sounds for level judgment. There are two ways to install a sensor to a fan: pressing a sensor against a fan with a jig or installing a sensor on a jig in advance. The latter way detects vibrations transmitted from the sensor to the jig, which is used when it is structurally difficult to press the sensor against the object to be measured.



Facility Monitoring

Monitoring vibrations of motors and pumps

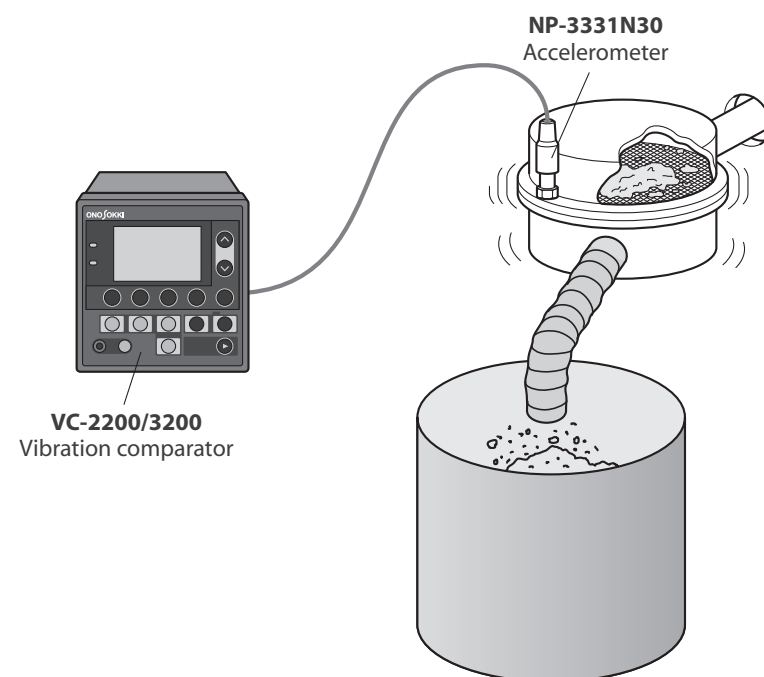
- This example shows continuous monitoring of a motor in equipment. In this case, parts such as bearings in the equipment are used to be replaced early to prevent accidents such as production line interruption. Periodical inspection using a vibrometer also incurred a high cost and required much labor. By using the VC-3200, it is possible to accurately determine the parts replacement time, thus saving time. The comparator also plays an important role in preventing accidents caused by sudden failures and enables to detect abnormality of the equipment and wear of parts based on changes in vibration values. The value-based management and vibration sound hearing through a headphone can be done simultaneously.



Monitoring for abnormal machine operations

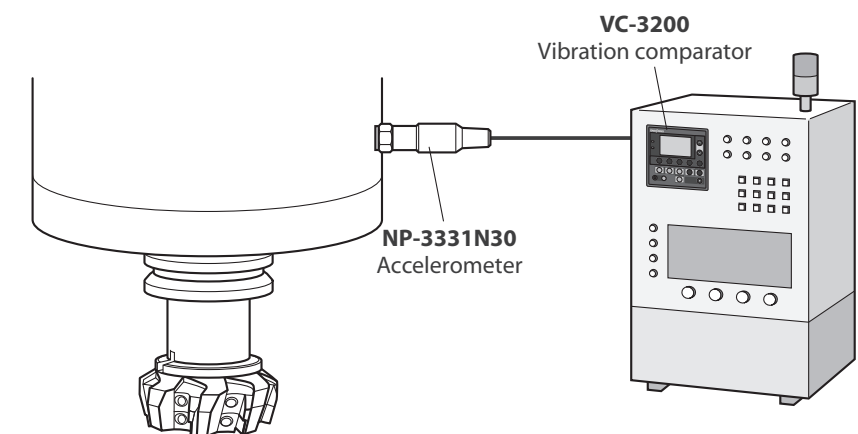
Monitoring a sieve operation (chemical plant)

- When powder is sifted through a sieve, the sieve vibrates at smaller amplitude if it is clogged. While, a sieve vibrates at larger amplitude if there is any abnormality in a way of installing equipment or motor. With the VC-2200/3200, you can constantly monitor the sieve whether the vibrations are in normal range.



Monitoring for abnormality in main shaft of machine tool

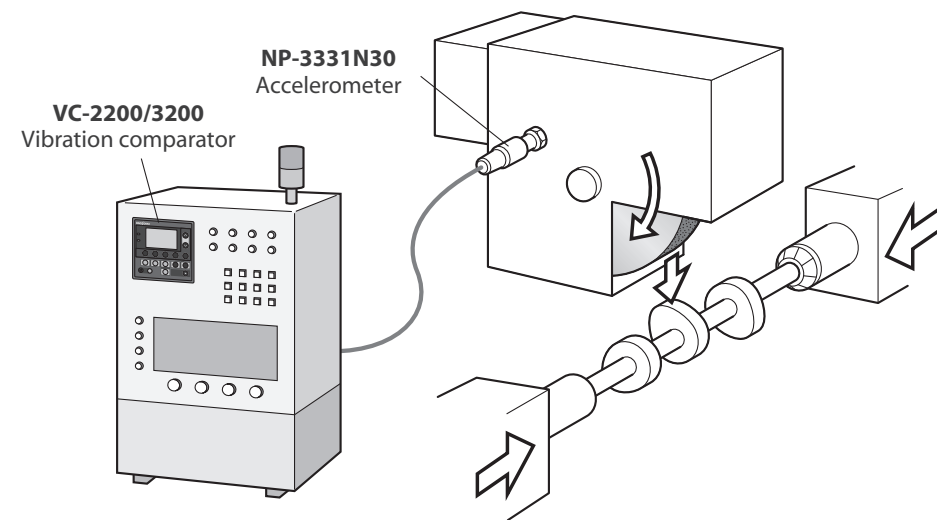
- Deterioration of a bearing that supports the main shaft of a machine tool significantly affects the accuracy of parts machining. Even if maintenance such as greasing the bearing is conducted periodically, the deterioration time largely depends on the frequency of use. By using the VC-3200 to monitor the vibration of the main shaft, failures in the bearing can be detected in the early stages. Since bearing failures may not be accurately detected during machining due to vibrations in cutting operation, monitoring is performed at specific timings when the machine is running at idle.



Detection of broken or worn machine tools

Detection of wear of grinding wheels

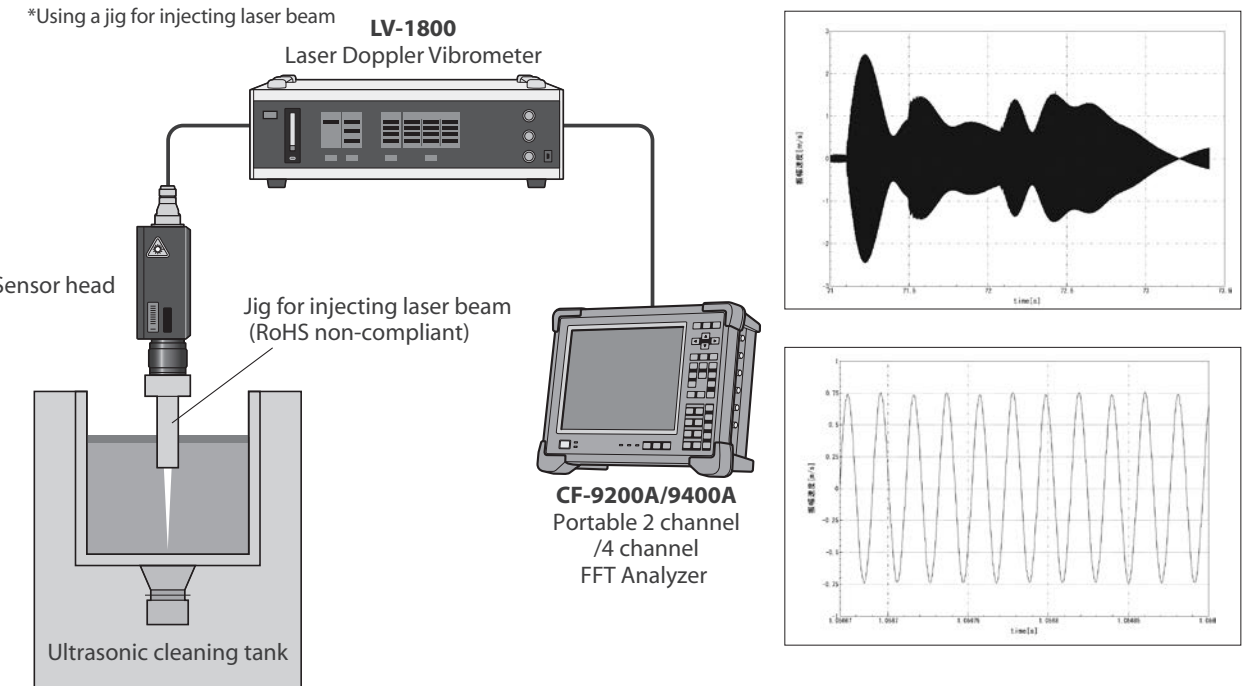
- In parts grinding processes, wear of grinding wheels is one of the factors that reduces the accuracy of finished products. Currently, the maintenance of grinding wheels is based on the number and period of machining operations, so even good cutters are subject to periodic inspection. On the other hand, if abnormal wear occurs for some unknown reason, defective parts may be produced. The VC-2200/3200 can detect imbalance caused by wear based on vibrations, which helps to improve product quality and reduce maintenance costs.



Vibration measurement with Laser Doppler Vibrometer

Measurement of ultrasonic cleaning tank in liquid

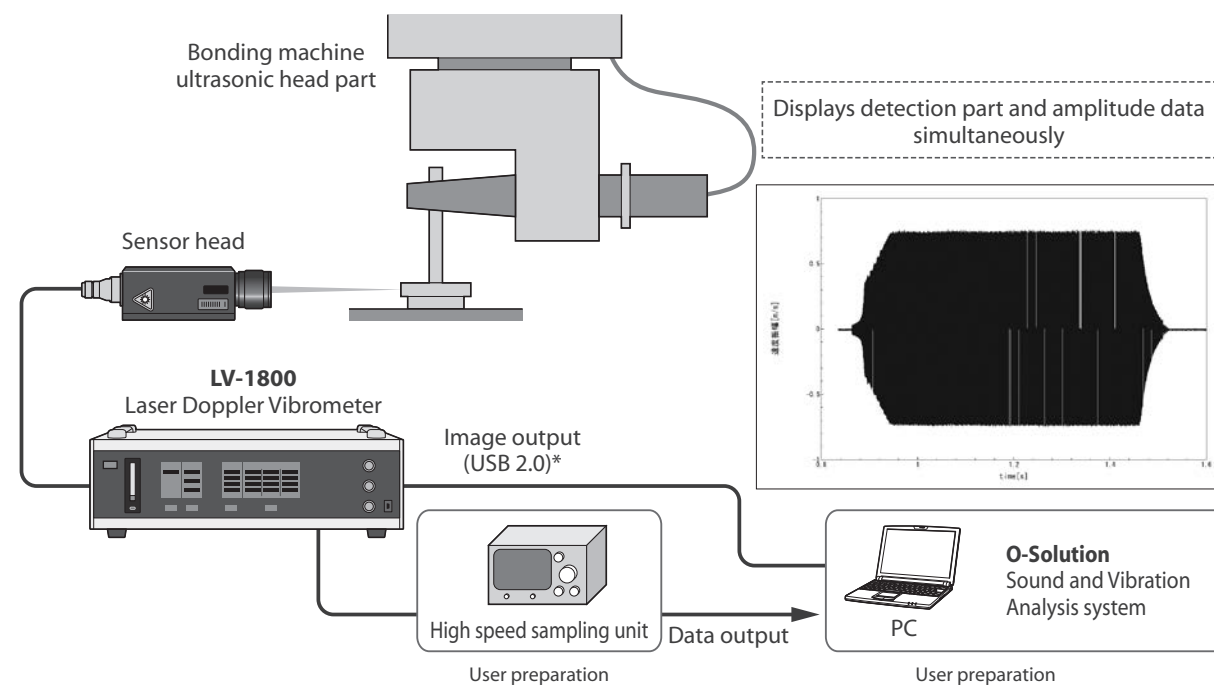
- Vibration measurement is also possible even in liquid as long as the color or range allows the laser beam to pass through and reflect back from the object. The amplitude and frequency can be measured by using a jig to irradiate the bottom or sides of the ultrasonic cleaning tank with laser beam. The measurement can be performed even during cleaning.



Vibration measurement with Laser Doppler Vibrometer

Vibration measurement of ultrasonic tools

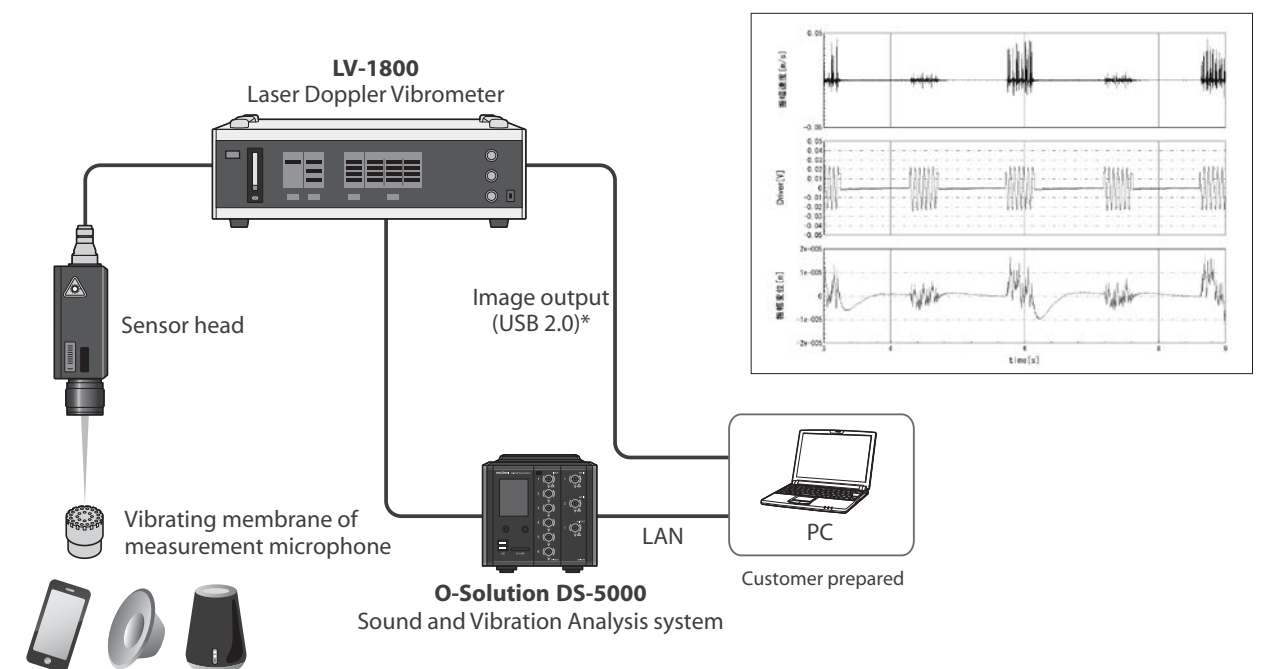
- This application can measure the amplitude of objects vibrating at high speeds, such as ultrasonic welders and bonding machine tools, at frequencies above 20 kHz. Using the amplitude values and frequency analysis, you can check welding quality or determine maintenance timing of equipment.



*The image display is available when the LV-0181 (option: Built-in positioning camera) is installed.

Measurement of thin film vibration

- LV-1800, that features non-contact and no-load detection, is the most suitable device for amplitude measurement of thin film, such as a diaphragm of cell phone microphone, a corn paper of receiver or speaker, and a transparent film like a liquid crystal display film.



*The image display is available when the LV-0181 (option: Built-in positioning camera) is installed.

JCSS (Japan Calibration Service System)

Ono Sokki's JCSS calibration is compliant with international MRA based on ISO/IEC17025, thus the calibration certificate is acceptable in the world through the ilac-MRA. Furthermore, the JCSS calibration certificate complies with the requirements of IATF 16949, a quality management system standard for the automotive industry. We attach the test report issued for general calibration to the JCSS calibration certificate, allowing a smooth transition from general calibration to JCSS calibration. As for JCSS calibration, please contact your nearest distributor or Ono Sokki sales office nearby.

Acoustics/Ultrasound

● Measurement microphone

Calibration unit: Free-field sensitivity level (dB)

Frequency range: 20 Hz to 20000 Hz

● Sound level meter


Calibration unit: Free-field sensitivity level (dB)

Frequency range: 20 Hz to 12500 Hz

● Sound calibrator

Calibration unit: Sound pressure level (dB)

Frequency: 250 Hz, 1000 Hz



Acceleration

● Accelerometer wit built-in preamplifier


Calibration unit: Voltage sensitivity (mV/(m/s²))

Frequency range: 20 Hz to 10000 Hz

● Accelerometer (Charge output type)

Calibration unit: Voltage sensitivity (pC/(m/s²))

Frequency range: 20 Hz to 10000 Hz




Torque

● Torque meter

Calibration unit: Torque (N·m)

Calibration range: 1 N·m to 5000 N·m

Torque direction: clockwise, counterclockwise




Time & Frequency & Rotational speed

● Tachometer

Calibration unit: rotational speed (r/min)

Calibration range: 0.5 to 100,000 r/min




Electricity

● FFT Analyzer

Calibration unit: AC voltage (V)

Calibration range: 100 mV to 10 V

Frequency range: 1 kHz to 100 kHz



Speed

● GPS speedometer

Calibration unit: Vehicle speed (km/h)

Calibration range: 15 km/h to 120 km/h




Fluid flow

● Volumetric flow meter

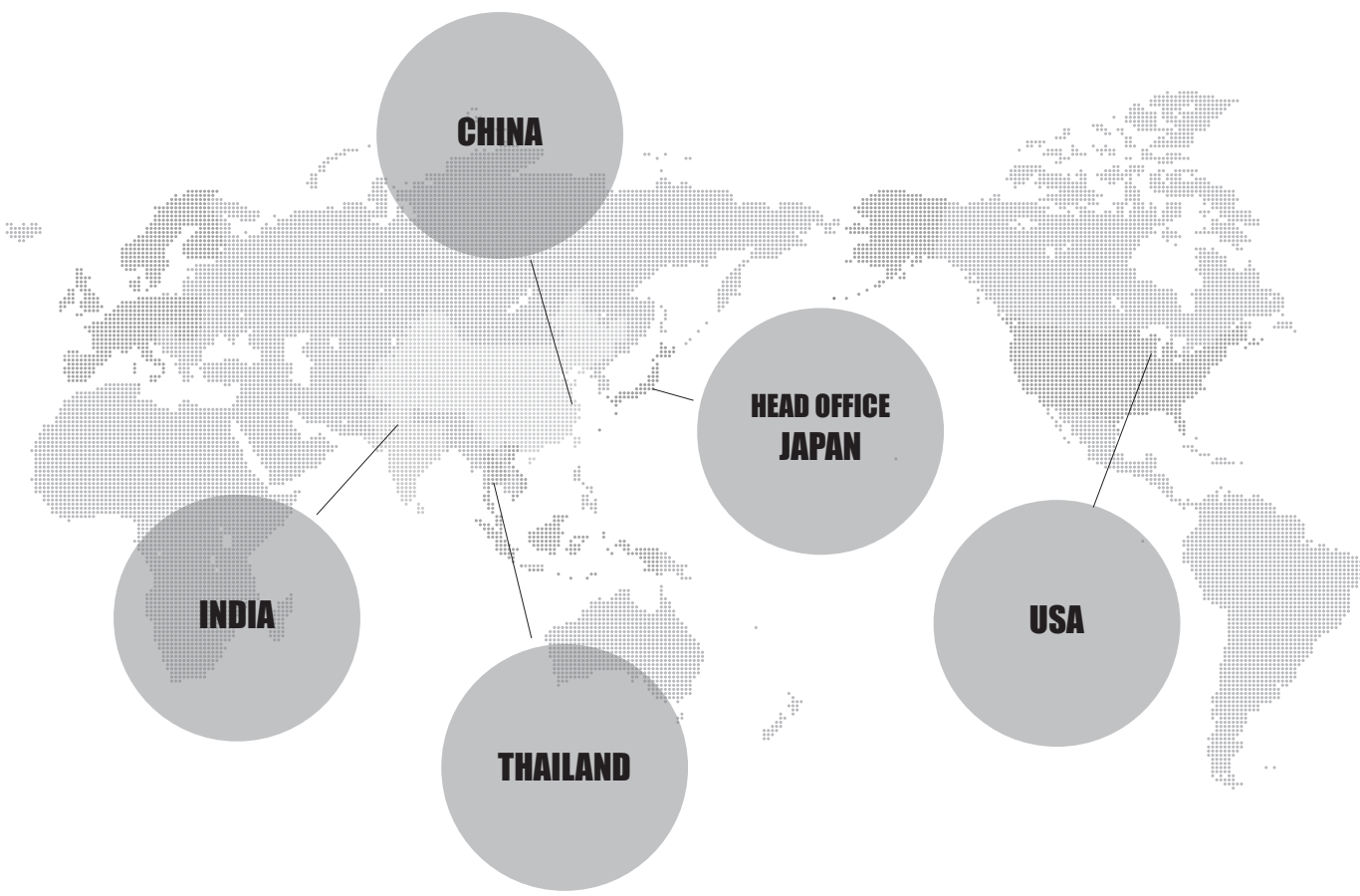
Calibration unit: K factor (Pulse/ml)

Test materials: light oil, gasoline

Calibration range: 0.02 L/h to 300 L/h



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