



## Vibration Comparator **VC-2100**

The VC-2100 can serve as your vibration "watchdog" in a wide range of situations in which vibration-based judgments must be made, such as in go/nogo vibration testing of products, facilities diagnosis, and machine tool cutting tool damage.

Combined with an accelerometers, it provides a full range of functions, from vibration detection through measurement and diagnosis, in a single package.

**ONOSOKKI**

# Introduction

The VC-2100 Vibration Comparator accepts the output from an accelerometer, and provides high-performance vibration level judgments, detection of abnormalities in machinery, and verification of vibration level. By performing simultaneous digital processing over two frequency bands, it enables detection, measurement, and judgment for each abnormal phenomenon.

## Simultaneous Two-Band Judgment

Two frequency bands can be set, enabling a judgment based on the rms value or peak value on each band. Because the judgment is performed based on the vibration value, the achievement of more complex discrimination is facilitated.

## Digital Display Function

In addition to displaying the vibration values digitally, a bar graph provides a visual presentation of the vibration condition, enabling use as needle-indicating vibration meter used in the past.

## Analog Output

An AC signal and a DC signal are output for each set band, enabling use in combination with analysis equipment such as a FFT analyzer, and connection to a recorder.

## Compact 96 x 96 (DIN) Size

The VC-2100 was packaged for easy mounting into a control panel, with the functions of more than two units in this compact size, this representing less than 1/5 the space formerly required.

# Features

## Comparator Delay Time Setting

A comparator output is made when the vibration exceeds a comparison level for more than a set period of time. This prevents misoperation caused by human errors, such as when an operator accidentally strikes a sensor.

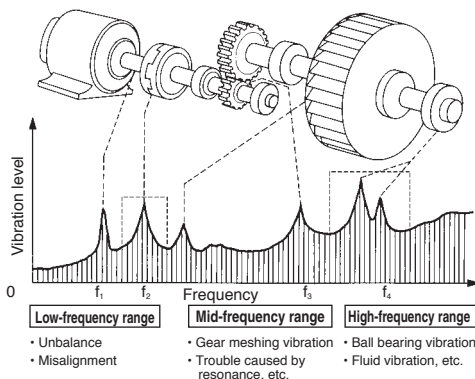
## Comparator Gate Input

The VC-2100 can be used for automatic go/nogo product testing on a production line. By controlling the measurement timing, it is possible to measure and diagnose vibrational phenomena of interest.

## Headphone Output

By connecting a pair of commercially sold headphones to the VC-2100, it is possible to make an auditory check of the vibration sound, enabling use of the VC-2100 as one would have used a stethoscopic probe in the past. Outputs are provided for each band, enabling a check for each phenomenon separately.

## ● Frequency Distribution of Abnormal Vibration from Machinery



## Why Bands?

The frequency band in which vibration occurs depends on the nature of the phenomenon that causes the vibration. The VC-2100 uses digital filtering to set the frequency band in which particular types of vibration might occur, thereby enabling independent monitoring and diagnosis for each phenomenon.

# VIBRATION COMPARATOR VC-2100

## Application Examples

The VC-2100 can be used in a wide variety of applications, thereby greatly expanding your capabilities for *shipping inspection, facilities diagnosis, and trouble detection.*

### Go/nogo Diagnosis Based on Product Vibration Values

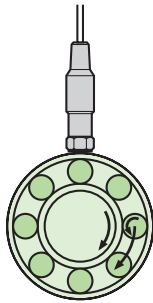
#### (Example)

It is possible to perform a go/nogo test of bearings based on vibration values.

The bearing is rotated and the diagnosis is made based on the resulting bearing vibration. By noting the vibration in a particular frequency band, it is easy to detect particular problems in bearings, such as damage, foreign matter, and unbalance). In addition to an accelerometer, it is possible to use a velocity sensor. When using a velocity sensor, the VC-2100 is switched to external signal input.

#### Related Fields

- Electric home appliances (e.g., washing machines, air conditioners)
- Automotive (e.g., power seats, door mirrors)
- Other product manufacturing (e.g., motors, gears, bearings)



### Inspection of Abnormal Operation in Machinery

#### (Example)

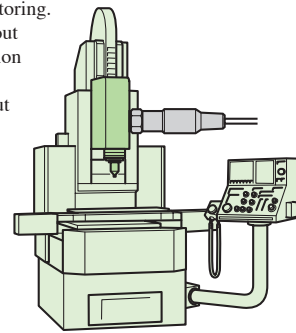
It is possible to detect abnormal operation of the main shaft of machine tools.

The runout of the main shaft of a machine tool greatly affects the accuracy of a machined workpiece. While the conventional method of measuring main shaft runout is that of using a displacement indicator, environmental and operating conditions and cost make the use of this approach difficult. The VC-2100, with its ability to detect abnormal main shaft vibration, provides a method that is immune to environmental conditions and which can be used for continuous monitoring.

When the main shaft runout becomes large, the vibration value also increases, enabling main shaft runout problems to be detected by detecting vibration.

#### Related Fields

- Machine tool manufacturing and machining



### Facilities Diagnosis

#### (Example)

It is possible to gain a grasp of and detect abnormalities in bearings and gears of production facilities without the need for human intervention.

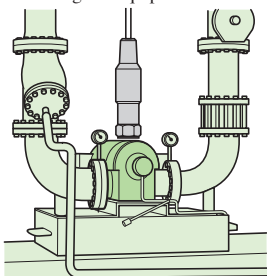
In facilities diagnosis in the past, the approach taken was that of periodically performing vibration measurements of such components as bearing boxes to determine when maintenance should be done, based on changes in the measured vibration values, this process being highly labor-intensive. In addition, suddenly occurring problems under this system could cause damage to equipment.

Using the VC-2100, a vibration comparator takes the place of the human operator, and performs constant monitoring of vibration, thereby enabling a great reduction in labor, while contributing to the prevention of damage to equipment when problems occur.

The ability to arbitrarily select frequency bands further enhances the diagnosis precision.

#### Related Fields

- Steel
- Chemical plants
- Other production line facilities management



### Detection of Tool Breakage and Wear

#### (Example)

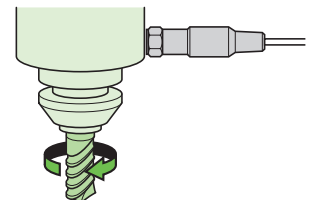
It is possible to detect breakage of drills and bites used on a machine tool without human intervention.

Machine tools used for mass production of parts run almost completely unattended by operators. If a drill or other cutting tool breaks during this type of unattended operation, bad production can result, thereby requiring reworking. In the worst case, the product might even need to be discarded.

The VC-2100 Vibration Comparator detects the vibration occurring when a cutting tool breaks and stops the machine, thereby minimizing the resulting production of bad workpieces. Because a worn cutting tool results in poor machining precision, by monitoring the change in vibration values caused by tool wear, it is possible to improve machining precision.

#### Related Fields

- Parts machining
- Machine tool manufacturing
- Monitoring on a machining line



# Total Support for Detection, Measurement, and Diagnosis

## ( Simultaneous Two-Band Processing ) Detects bearing damage and wear in a single pass.

### Compact Size: 96 x 96 mm DIN Panel

The performance of more than two units have been housed in a space that is less than 1/5 that formerly required.



### Measurement: Digital and Bar-graph Display of Vibration Values

High-accuracy analysis is performed in accordance with analysis conditions, and a display is presented of vibration values and vibration condition (bar-graph display). By displaying measurement screens for each band separately, it is possible to collect the required data.

### Provides Essential Sophisticated Features

Measurement and diagnosis of vibration is a complex process, and demands highly precise results. The VC-2100 provides that high-level of precision, enabling detailed conditions settings, in addition to meeting other tough measurement and diagnosis requirements.

### Superb Diagnosis Capability Using Rms and Peak Values

The rms and peak values can be used for diagnosis in each band individually, enabling enhanced-precision diagnosis of complex machine vibrations.

### Verification of Vibration Sound

By connecting a pair of conventional headphones, it is possible to monitor the vibration sound. An output is provided of the vibration sound for each band, enabling verification of particular vibration phenomena.



### Direct Key Settings Enhances Ease of Operation

Frequently used conditions can be directly set, enabling the optimum settings to be made while observing the vibration condition.

- Measurement mode switching: Rms, Peak, Max hold (maximum rms value hold), Peak Hold (peak value hold)
- Measurement screen switching and band setting
- Bar-graph scale modification
- Input range setting: Optimum range setting to suit the vibration condition
- Comparator level setting: Setting is possible to suit a diagnosis criterion.

### ● Optional Functions

#### • Integration (VC-0251)

The signal from an accelerometer is integrated to enable measurement of velocity and displacement. This can be combined with the comparator function to perform diagnosis based on velocity and displacement criteria.

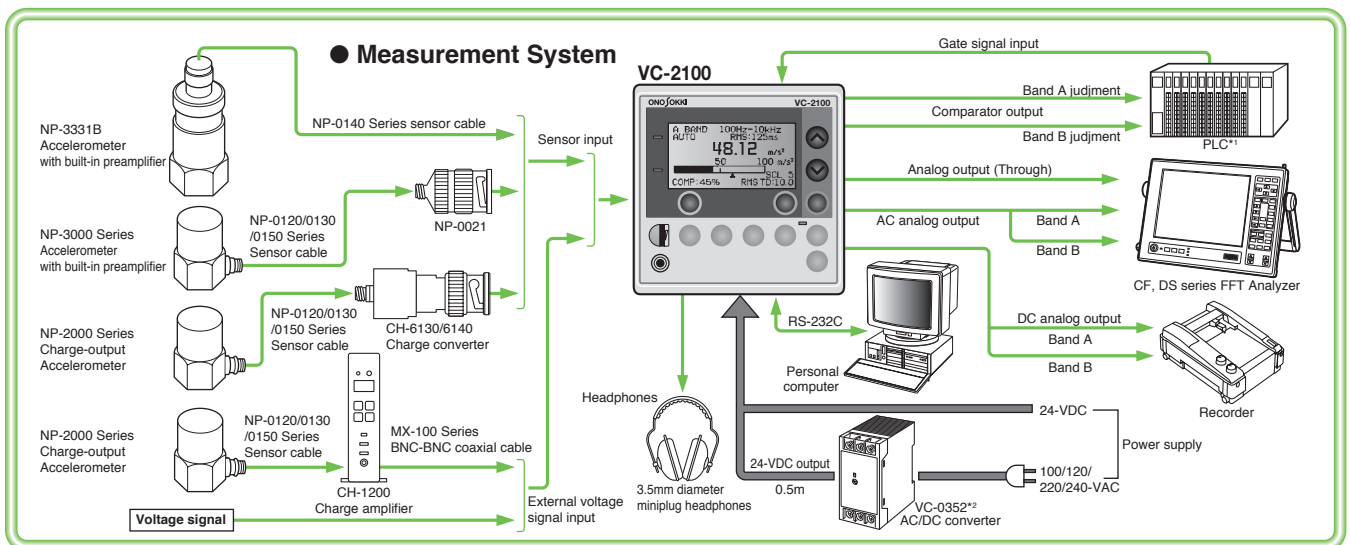
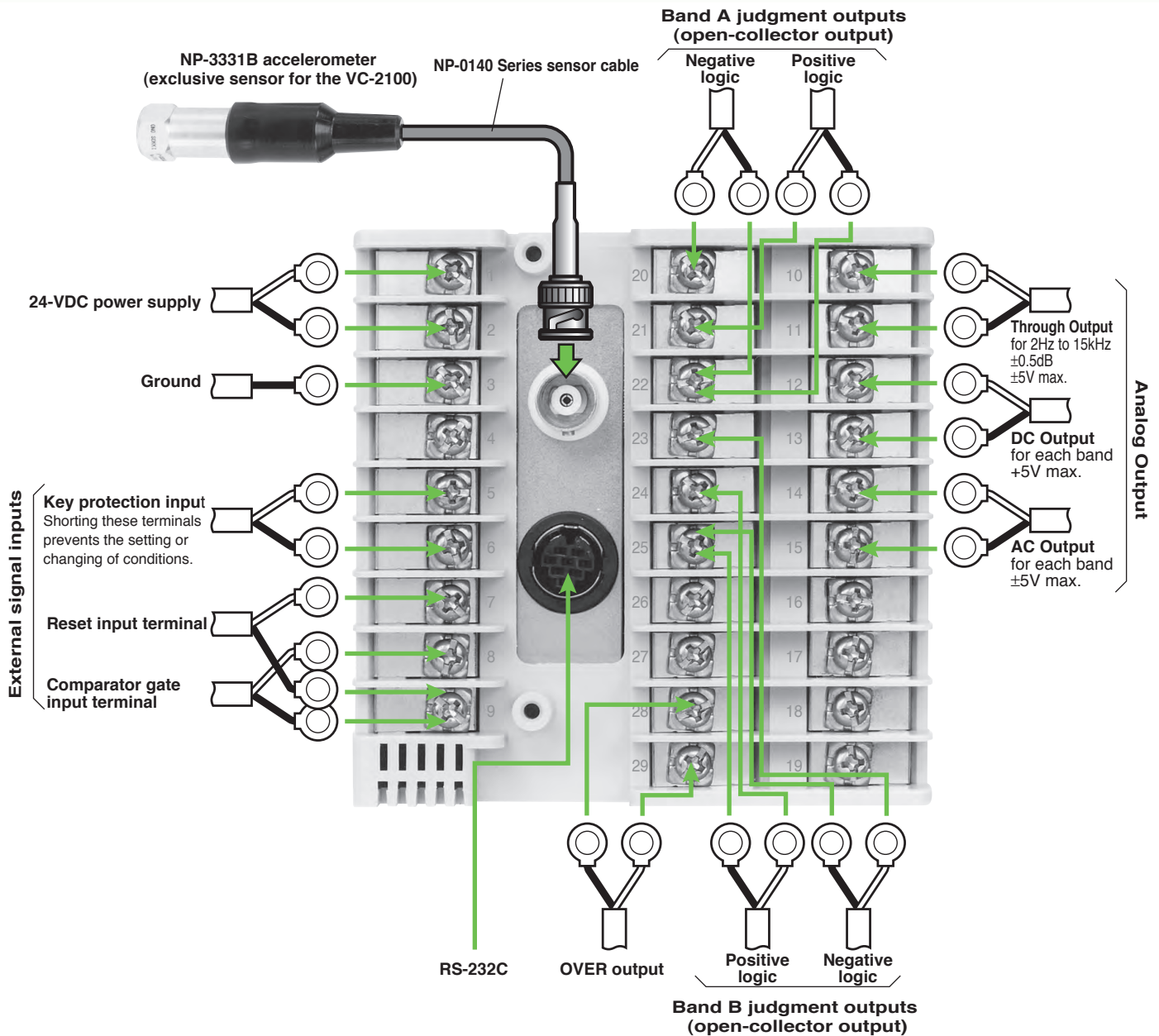
#### • Current output (VC-0253)

The analog DC output is converted to a 4-to-20mA current output (voltage output is standard). This option is effective in remote sensing applications.

#### • Single Additional Band (VC-0252)

This option expands the VC-2100 to 3-band operation, enabling even more complex measurement and diagnosis applications.

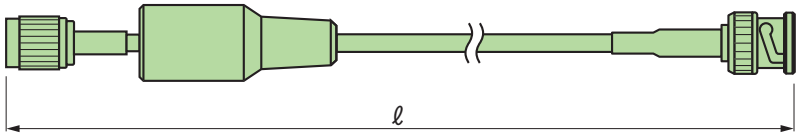
# Automated Data Collection With Less Labor



\*1 PLC : Programmable Logic Controller \*2 AC power cable for VC-0352 is prepared by customer.

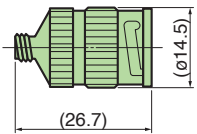
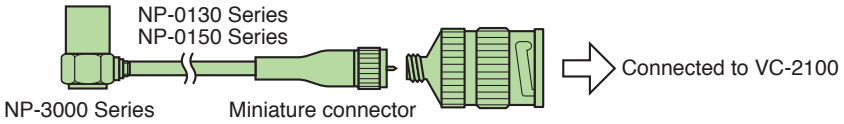
# Accessories

## NP-3331B Signal Cables

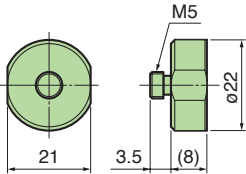
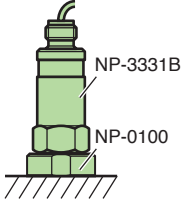
Model	Length	Appearance
NP-0143	5m	
NP-0144	10m	
NP-0146	20m	
NP-0148	30m	

\*NP-0146 and NP-0148 are made-to-order specials.

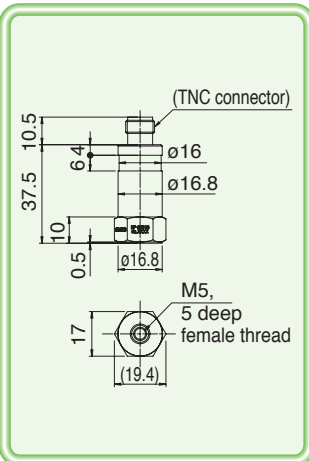
## Miniature/BNC Connector Adapter

Model	Outer Dimensions	Example of Use
NP-0021		<p>Signal cable NP-0120 Series NP-0130 Series NP-0150 Series</p>  <p>NP-3000 Series      Miniature connector</p> <p>Connected to VC-2100</p> <p>The sensor input of VC-2100 is a BNC connector. To connect a sensor with a miniature connector to the VC-2100, the NP-0021 is required.</p>

## Magnetic Base

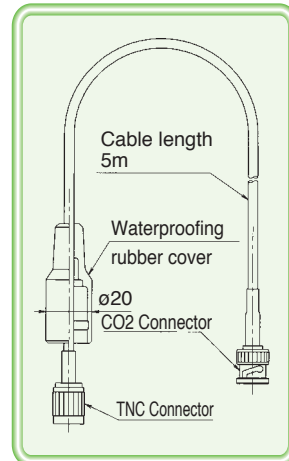
Model	Outer Dimensions	Example of Use
NP-0100		 <p>NP-3331B NP-0100</p> <p>This is a magnetic base for the NP-3331B. For details about using other NP Series accelerometers, refer to the NP Series catalog.</p>

## NP-3331B Accelerometer



- Feature : Insulated
- Structure : Shear-type
- Sensitivity : 5.0mV/(m/s<sup>2</sup>)±10%
- Resonant frequency : Approx. 25kHz
- Frequency characteristics : 2Hz to 4kHz ±5%  
2Hz to 10kHz ±3dB
- Maximum usable acceleration : 700m/s<sup>2</sup>
- Maximum tolerable shock : 10000m/s<sup>2</sup>
- Operating temperature range : -20 to +110°C
- Output impedance : 100Ω max.
- Detector noise : 20μVrms max.
- Power requirement: 15 to 25VDC  
0.5 to 5mA
- Weight : Approx. 50g
- Case material : Stainless (SUS303)
- Outer dimensions : 17Hex x 37.5H (mm)
- Connector : TNC connector (top)
- Detector mounting : M5, 5 deep female thread

## NP-0143 Sensor Cable



- Capacitance : 75pF/m
- Insulation resistance : 1000MΩ
- Operating temperature range : -20 to +110°C
- Cable outer diameter : ø4.2mm
- Material : FEP/PUR(Black)
- Waterproofing rubber cover : NBR
- Sensor connector : TNC
- Amp connector : CO2 (BNC)
- Cable length : 5m

# Specifications

## ■ VC-2100 Main Unit

### ■ Input Section

- Number of input channels : 1
- Signal input : Input switched between an accelerometer with built-in preamplifier and an external voltage signal.
  - \*Accelerometer with built-in preamplifier: 2mA/18VDC sensor power supply (constant current)
  - \*External voltage signal: Input voltage;  $\pm 5V$   
Input impedance; 100k $\Omega$  or more
  - \*Input connector: C02 (BNC)
- Sensor sensitivity setting : 1.00 x 10<sup>-2</sup> to 9.99 x 10<sup>2</sup>mV/(m/s<sup>2</sup>), digital input
- Units setting : m/s<sup>2</sup> or engineering units (EU)
- Input ranges : 0.1 to 50000m/s<sup>2</sup> (Setting range depends on the sensor sensitivity.)  
(Ex. ; 2.000 to 1000m/s<sup>2</sup> for a sensor sensitivity of 5mV/(m/s<sup>2</sup>))
- Frequency characteristics : 3Hz to 15kHz:  $\pm 0.5dB$   
1.5Hz to 20kHz:  $\pm 3dB$
- Input-referenced noise : 3Hz to 20kHz band: 30 $\mu$ Vrms or less

### ■ External Control Signal Input

- Functions : Key lock, reset input, gate input
- Input voltage : High: +4.2 to 5.0V  
Low: 0 to +0.8V
- Non-voltage input : Open voltage: 5V  
Short-circuit current: 0.5mA

### ■ Analysis Section

- Number of settable bands : 2 (3-band as an option of VC-0252)
- Band filters : HP filter: Thru, 100, 300, 500, 1k, 3k, 5k, 10kHz  
LP filter: Thru, 100, 300, 500, 1 k, 3k, 5k, 10kHz  
Roll-off: -48dB/oct (Butterworth, -3dB $\pm$ 1dB at fc)
- Analog filters : Low-cut (highpass) filter: 10Hz  
High-cut (lowpass) filter:  
1kHz-10kHz; -3dB $\pm$ 1dB at fc, -18dB/octave roll-off  
Note) fc: cut off frequency

### ■ Processing Section

- Measurement modes: Switchable between rms value, peak value, maximum hold, and peak hold.  
Calculation and display made for each band separately.
  - \*Rms value: True rms value  
Time constant; Selectable as FAST (0.125s), MID (0.25s) or SLOW (1s).
  - \*Peak value: Absolute PEAK value of time-axis waveform
  - \*Maximum hold: Held maximum of rms value
  - \*Peak hold: Held maximum of peak value

### ■ Output Section

- Analog output : Thru, AC and DC outputs (simultaneous)
  - \*Output impedance: 100 $\Omega$  max.
  - \*Thru output:  
Maximum rated output;  $\pm 5V$   
Frequency range; 3Hz to 15kHz  $\pm 0.5dB$   
1.5Hz to 40kHz  $\pm 3dB$
  - \*AC output:  
Switchable output for each band  
Maximum rated output;  $\pm 5V$   
Frequency range; 3Hz to 15kHz  $\pm 0.5dB$   
1.5Hz to 20kHz  $\pm 3dB$
  - \*DC output:  
Switchable output for each band

Maximum rated output; +5V  
4-20mm(Option)

\* In case of selecting the 4-20mA output function, the voltage signal can not be output.

- Headphone output : AC output for each band  
\*Power consumption: 15mW or more into the rated impedance of 24 $\Omega$   
\*Connector: 3.5mm diameter miniplug
- CAL signal output : 160Hz, 1V<sub>0-p</sub>  $\pm 3\%$  (output at AC output)
- RS-232C output : Provided as standard.
  - \*Transmission rate: 9600bps  
Connector; HR12-10R-8 SD (HIROSE ELECTRIC CO., LTD) or equivalent
  - \*Cable: AX-5022(9-pin Dsub connector)
- Over output : Output when input range or A/D range is exceeded.  
Open-collector output (negative logic)
  - \*Voltage: 30VDC max.
  - \*Sinking current: 25mA max.

### ■ Comparator Output

- Functions : Judgments made independently for each band  
Selection of either rms or peak value judgment for each band.
- Comparator level setting : Settable in steps of 1% of the full-scale range
- Output : Outputs made when the measured value is above or below a set value.  
Open-collector output (positive and negative logic outputs made simultaneously)
  - \*Voltage: 30VDC max.
  - \*Sinking current: 25mA max.
- Operating time : 100ms max.
- Delay time setting : Selectable from 0, 0.5, 1, 1.5, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, and 20 seconds

### ■ Display

- Display type : Liquid Crystal Display with back light
  - \*Measured value: 4-digit digital display
  - \*Display refresh: 0.5s
  - \*Bar-graph display
  - \*Comparator level display
- OVER indicator : Lights red when the input range or A/D range is exceeded.
- NG (nogo) indicator : Lights red when a comparison result causes a Nogo output.
- Comparator ON/OFF display : Lights green when the comparator function is operating.

### ■ Accuracy

- Total accuracy :  $\pm 3\%$  at 160Hz

### ■ Other Specifications

- Setting conditions backup : Setting values are saved in memory when the power is switched off.
- Terminal strip : M3.5 free screw terminals

### ■ Accessories

- Panel mounting fixtures (2 pcs.)

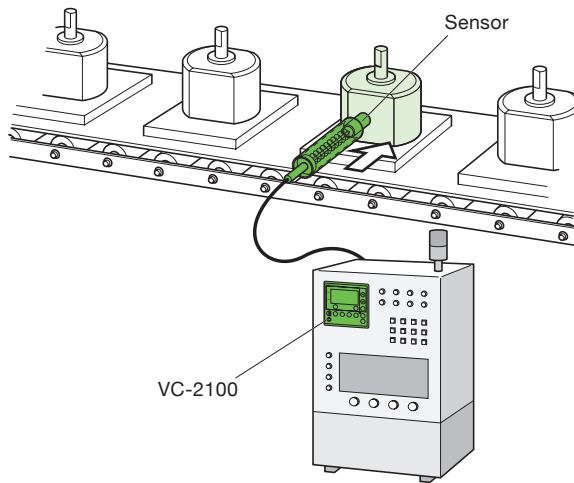
### ■ General Specifications

- Power requirements : 22 to 26VDC
- Current consumption: 160mA max. (at 25°C)
- Operating temperature range : 0 to +50°C
- Storage temperature range : -5 to +55°C
- Operating humidity range : 85% relative humidity max. (with no condensation)
- Outer dimensions : 96 x 96 x 112mm (DIN)
- Material : PBT (polybutylene terephthalate)
- Weight : Approx. 500g

## Product inspection

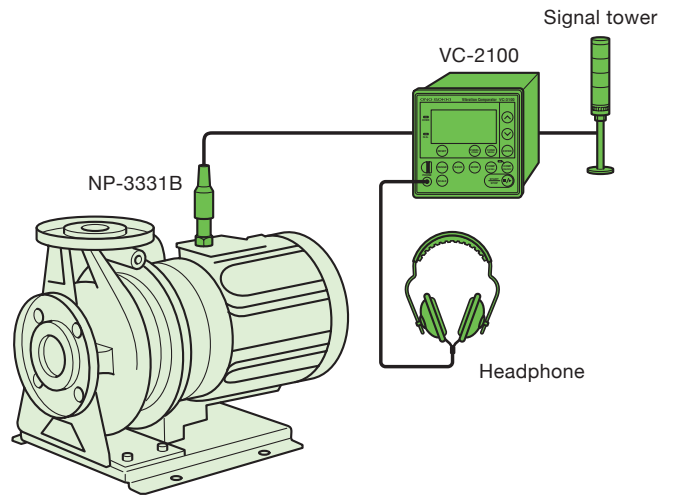
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### Inspection of a motor before delivery (inspection of abnormality)



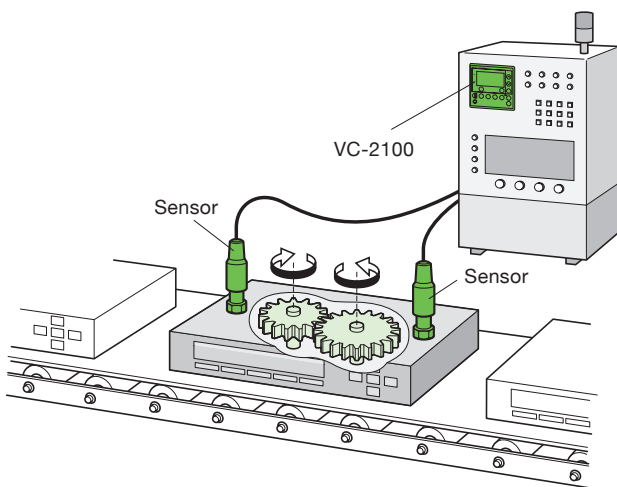
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### Inspection of a pump before delivery (inspection of rattling/noise from a pump)



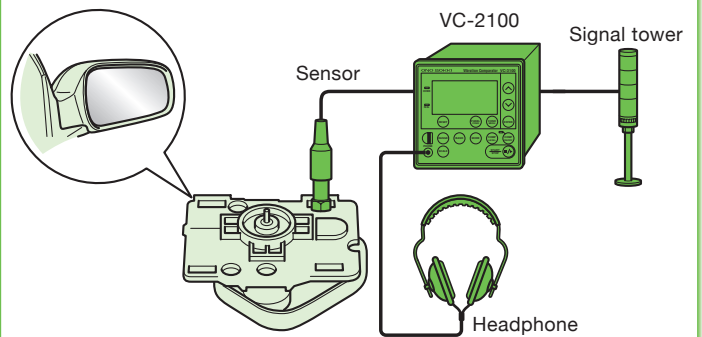
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### Inspection of chipped resin gear teeth



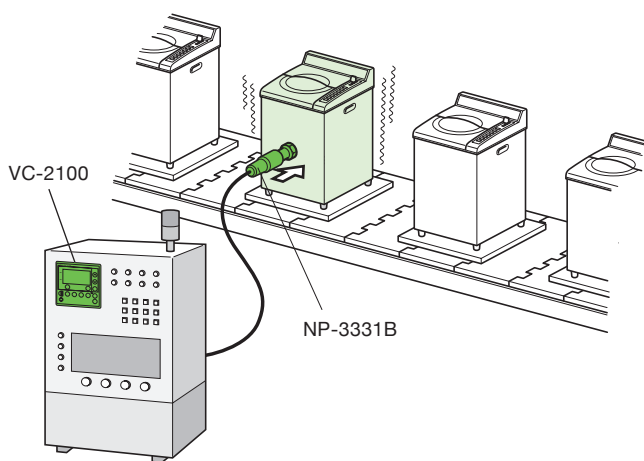
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### Detecting the abnormal noise from an actuator for the door mirror



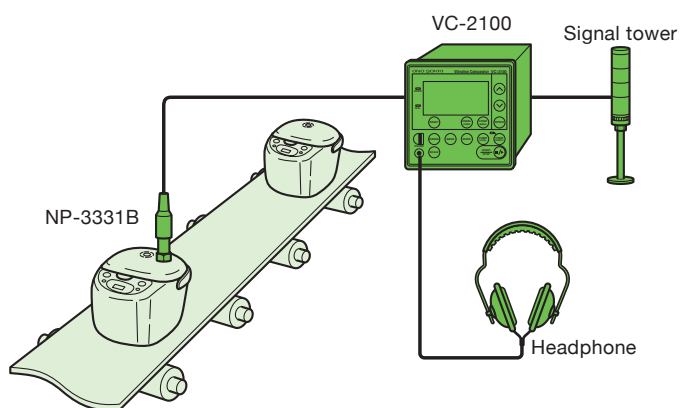
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### Inspection of rattling from the laundry machine



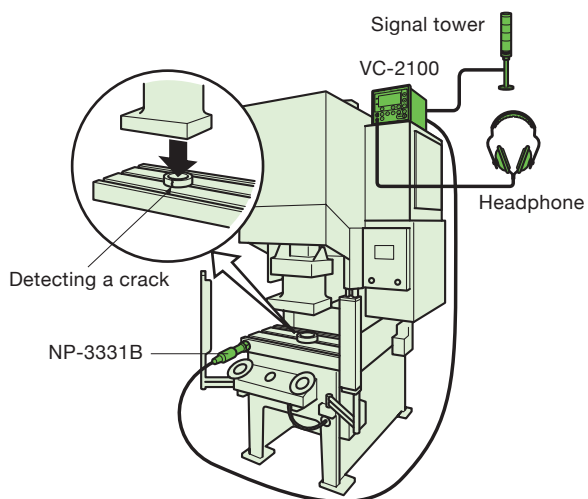
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### Inspection of a rice cooker before delivery (operation checking)



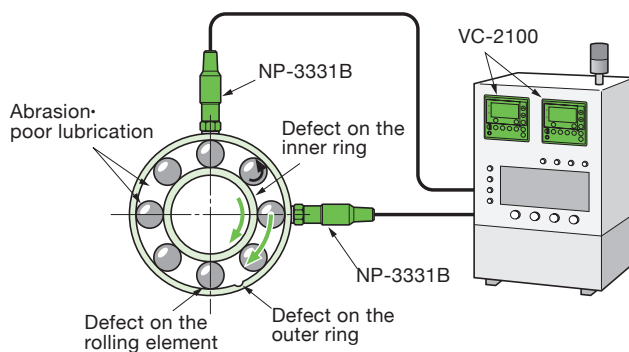
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### Inspection of a crack of product during press working



8

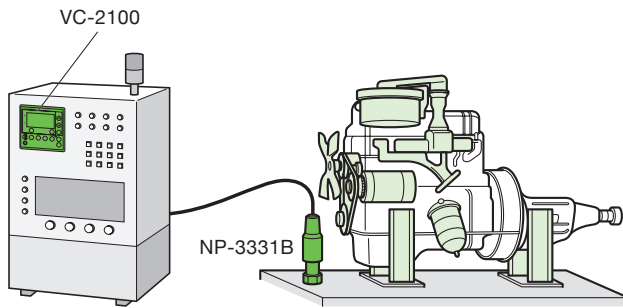
### Inspection of a bearing before delivery (inspection of scratch, foreign material and rattling)



## Monitoring the abnormal operation of machinery

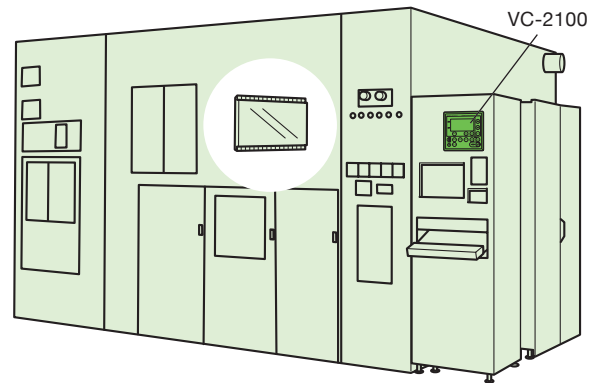
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**Detection of the trouble with the engine during the endurance test**



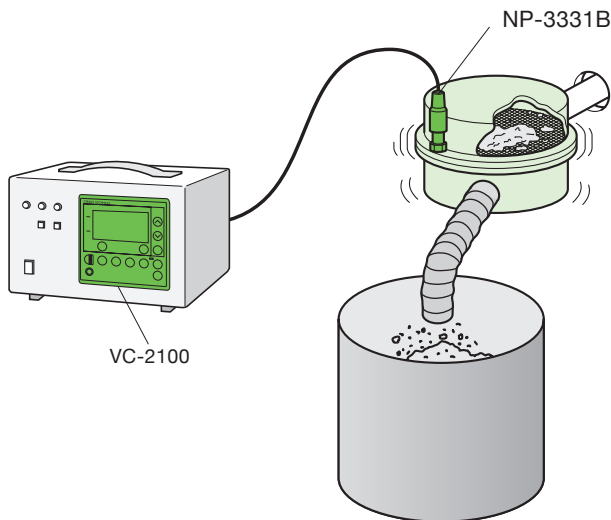
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**Monitoring the abnormal vibration of LCD manufacturing machine during the production**



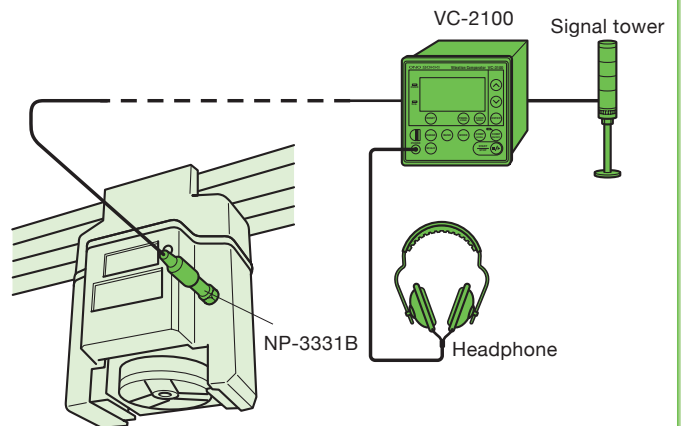
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**Monitoring the sieve operation (Chemical Plant)**



4

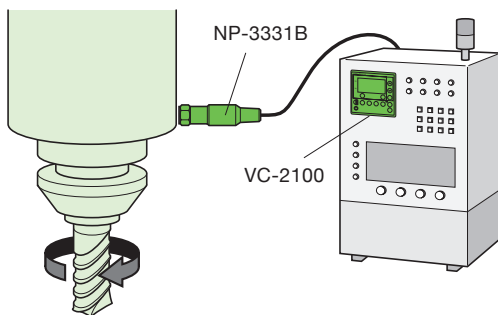
**Monitoring the abnormal vibration of wafer carrier system**



# Detecting the broken or worn of machinery tool

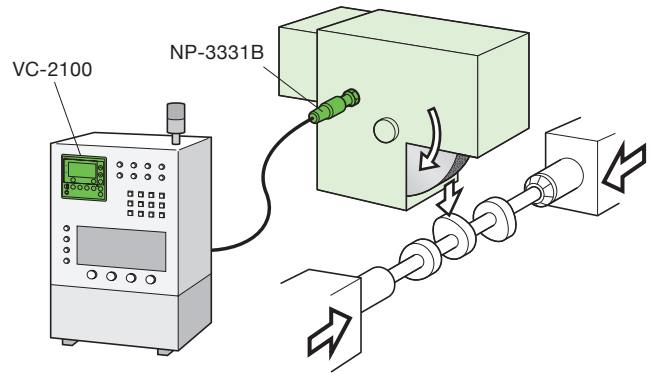
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## Detecting the broken or worn drill



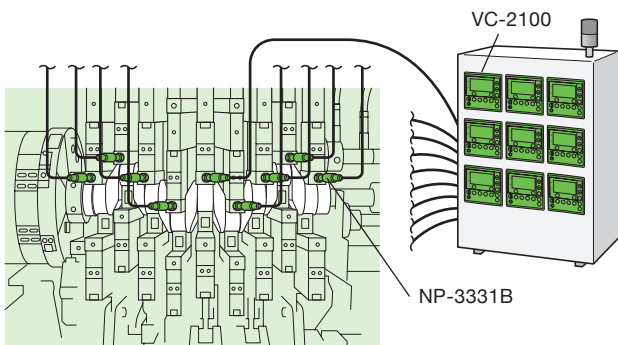
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## Detecting the worn of grinding machine



3

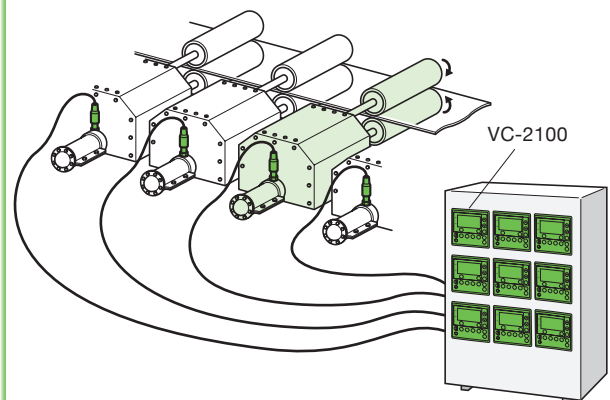
## Detecting the nicked edge during the fillet roll processing



# Equipment diagnosis

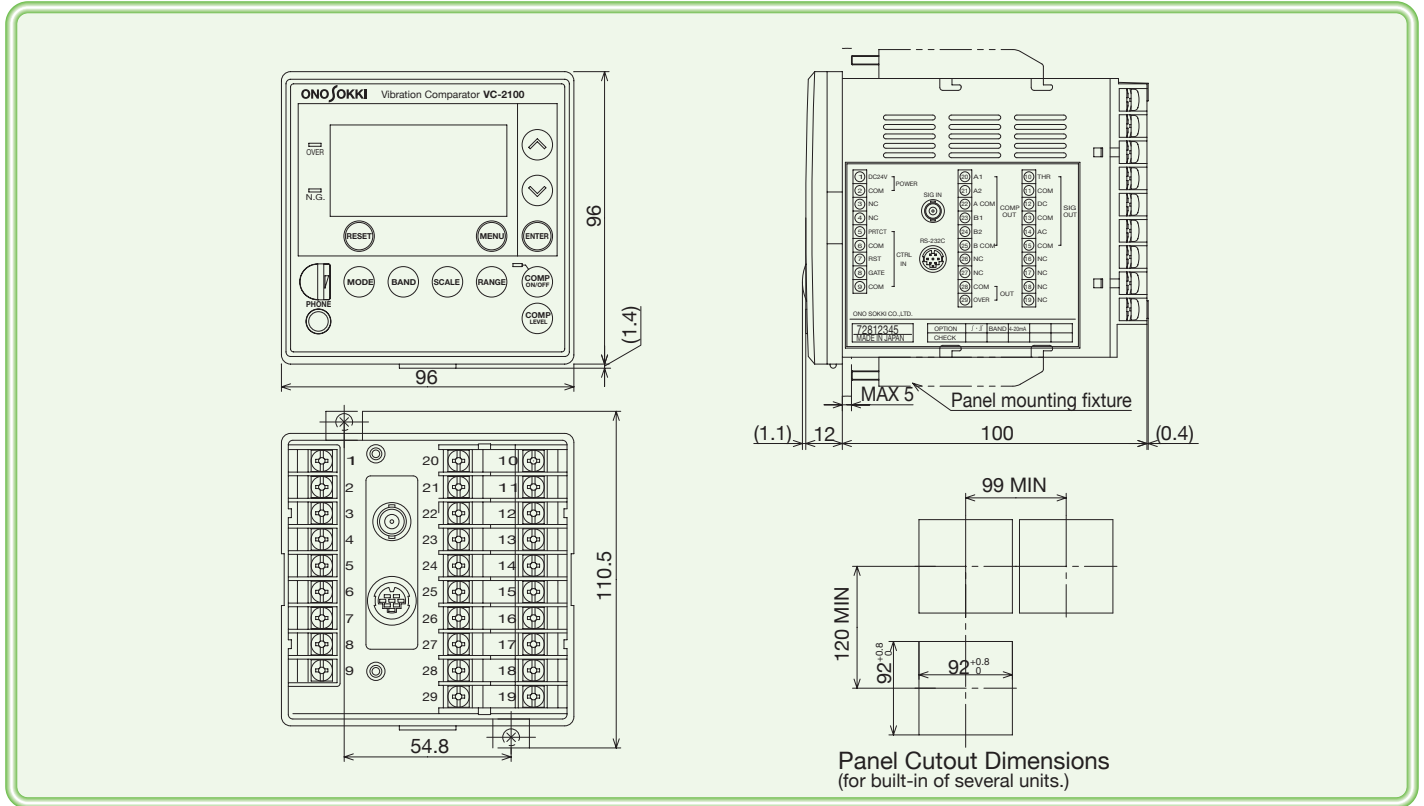
1

## Monitoring the vibration from rolling mill



# Outer Dimensions

## VC-2100



**ONOSOKKI**

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

URL: <http://www.onosokki.co.jp/English/english.htm>

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