Fuji Electric

Innovating Energy Technology

Preventive Maintenance【Rotating Machine】

Wireless Diagnostic System for Rotating Machine Vibration

03Z1-E-0010d

Contribute to Planning of Preventive Maintenance

by early detection of the unusual movement with trend monitoring after measuring the vibration of rotating machine operated as production line or critical equipment.

Early detection of abnormality

- Rotating system (mechanical) abnormality:
  It can detect by the trend monitoring of the low frequency vibration.
- Rolling bearing abnormality:
  It can detect by the trend monitoring of the high frequency vibration.

appearance of bearing (M side)
brinelling marks appear on all of orbital plane.
exfoliation is dotted

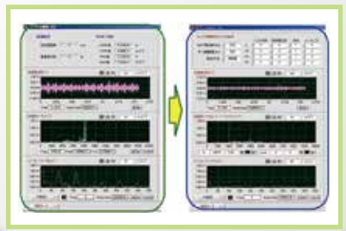
orbital plane of outer ring

Reduction and safety correspondence of maintenance work.

- The sensor that is wireless vibration type can easily establish to existing facilities.
- The worker can measure without approaching to the dangerous place by automation measurement.

Remove the vibration noise by inverter carrier

- The original bearing vibration of rotating machine can measure by clearing the carrier vibration that occur by inverter operation.



Wiserot

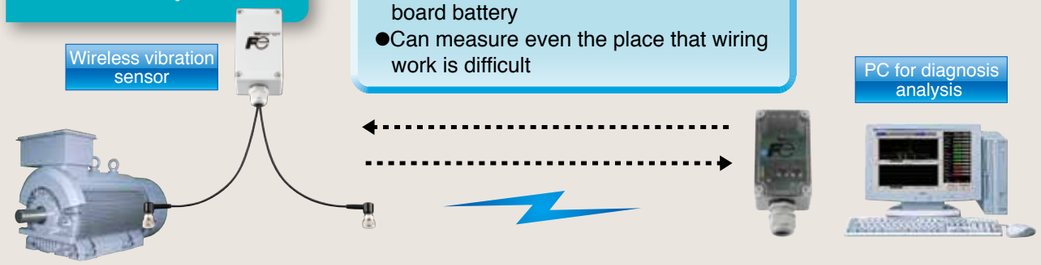
Fuji Wireless Diagnostic System for Rotating Machine Vibration

Wiserot is not a system for continuous measurement and constant monitoring
The work that is petrol measurement with handy-type instrument by maintenance staff is changed to automation system by Wiserot.
And, it can perform quick diagnosis using frequency analysis function

Features of Fuji's System

POINT 1 Measuring by remote system

- Can easily install on existing equipment because the wireless sensor have on board battery
- Can measure even the place that wiring work is difficult



POINT 2 Simultaneously perform trend monitoring and diagnosis

Wiserot =

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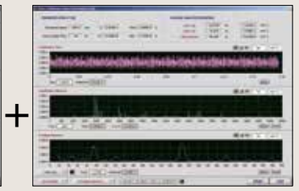


trend monitoring of vibration level | FFT analysis of mechenical vibration | FFT analysis of bearing vibration

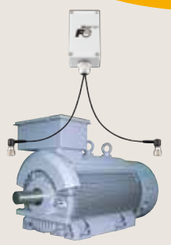
- Trend monitoring by several PV values is possible (acceleration, velocity, displacement)
- Can apply to evaluation standard value of maker's know-how to reduce cable construction cost by wireless communicaiton system

At the computer side for diagnosis analysis
- FFT analysis of mechenical vibration is possible
- FFT analysis of bearing vibration is possible
- Filter treatment of inverter noise etc is possible
- Can confirm the variation of vibration quality by FFT analysis

Occurrence of Malfunction

・Automation
・Labor management
・Safing

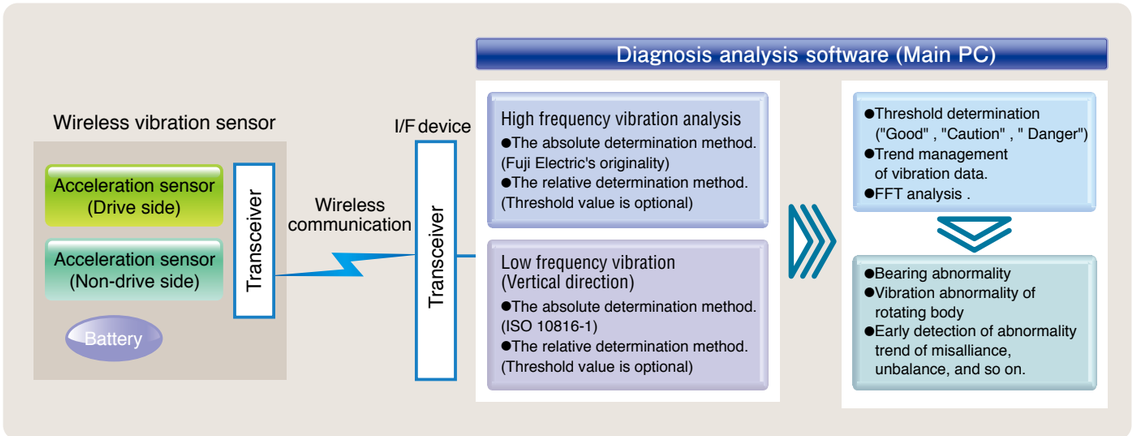
Correspondence to the decrease of the expert engineer



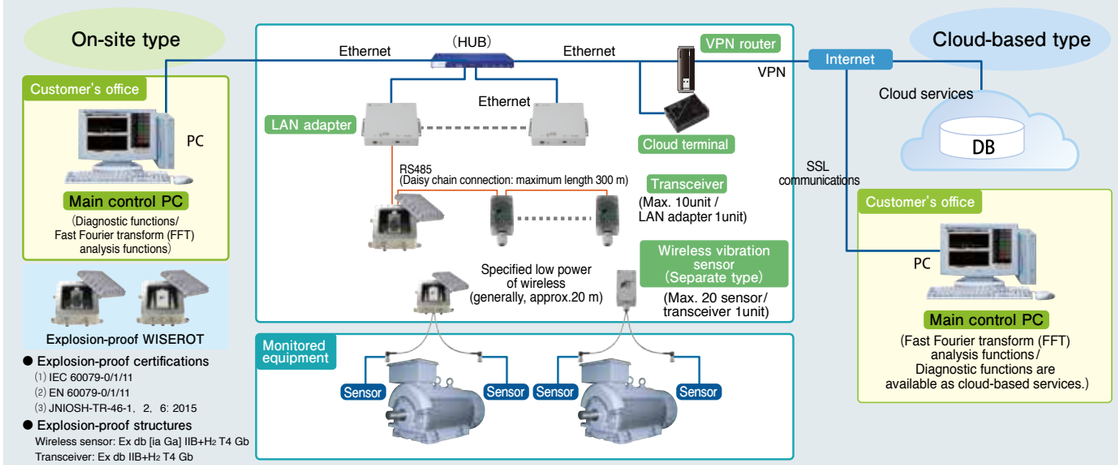
"Wiserot" for vibration monitoring of rotating machine!

support bearing malfunction by trend monitoring graph and FFT analysis.

Constitution and Function of " Wiserot "

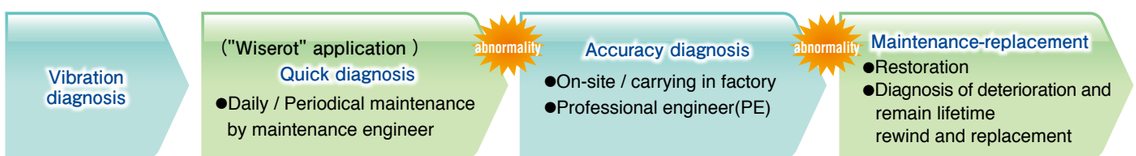


System Constitution



● Explosion-proof certifications
(1) IEC 60079-0/1/11
(2) EN 60079-0/1/11
(3) JNIOSH-TR-46-1, 2, 6: 2015
● Explosion-proof structures
Wireless sensor: Ex db [ia Ga] IIB+H_2 T4 Gb
Transceiver: Ex db IIB+H_2 T4 Gb

Vibration Diagnosis Flow for Rotating Machine



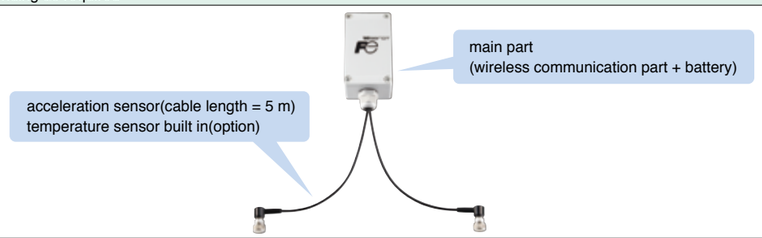
Specification

Diagnosis Target (Application scope: general rotating machine, Target RPM: 600 to 3600 min^{-1}, Bearing diagnosis is rolling bearing)

Diagnosis item	Frequency	Vibration measurement	Judgment item	Judgment standard
Rotating machine vibration	Low (10 to 250 Hz)	Velocity [mm/s]	Root mean square	Absolute evaluation based on vibration evaluation standard(ISO 10816-1)
		Displacement [μm]	Overall(O/A), Rotating speed element(n), electromagnetic element(2f)	Relative evaluation
Bearing vibration	High (1 k to 10 kHz)	Acceleration [G]	Root mean square	Relative evaluation
			Q value (bearing diagnosis evaluation value)	Bearing absolute evaluation using Fuji original standard

※To meet various site conditions, the threshold can change by user side

Specification of Wireless Vibration Sensor

Wireless specification*1	specific low power wireless of 433 MHz band communication distance is approx. 30 m(it may vary depending on the installation environment)
Measurement specification	low frequency : 10 to 250 Hz, but measurement scope is over 1 μm high frequency : 1 k to 10 kHz option : sensor of rotating machine surface temperature is available
Dust proof/Water proof	conform to IP53
Operating temperature	main part : 0 to 60 degreeC, sensor part : 0 to 100 degreeC
Measuring cycle	recommend once per week or once per day
Battery lifetime	approx. 2 years by measuring once per day (practical reference value) ※uses special battery
Attachment	① screw mounted type (M6 threaded hole is necessary in rotating machine) ② magnetic type
Coverage	corresponding as required
Appearance	

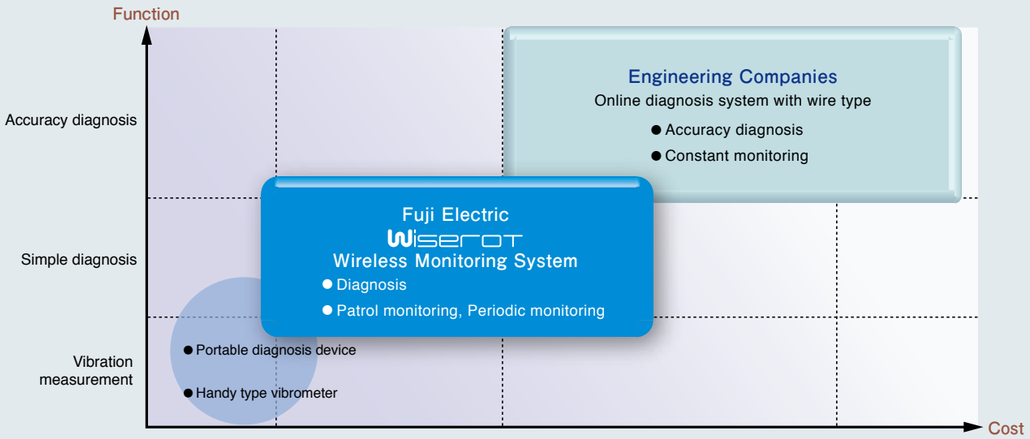
*1 : It is necessary that wireless frequency band comply with the communication standard of the country of use

System Function Introduction

Function		Function introduction
Data collection/ Diagnosis	Basic measurement screen	show the rotating machine list by facility unit start command, data collection and diagnosis of rotating machine diagnosis
	Event history screen	show the vibration measurement situation list in accordance with search condition(period, facility etc)
	Diagnosis trend management	time series indication of diagnosis data (velocity RMS, displacement, N element displacement, and 2N element displacement etc) color-coded indication the diagnosis situation of specified the date and time (good, caution, and danger) by each diagnosis items spectrum analysis indication of the date and time(cursor location specify) specified on graph
	Low frequency spectrum analysis	show the analysis result(velocity RMS and displacement O/A etc) of low frequency vibration graph indication of acceleration spectrum, velocity spectrum, and displacement spectrum of low frequency vibration
	High frequency spectrum analysis	"common mode"graph indication of acceleration spectrum, velocity spectrum, and displacement spectrum of high frequency vibration "setup mode"setup the carrier noise removal parameter
Judgment basic value registration		available the setup registration of low frequency vibration judgment standard or high frequency vibration judgment standard
Vibration measurement results output		printout the vibration measurement results of specified contents from diagnosis trend screen
Automation diagnosis schedule		setup the diagnosis term of each rotating machine at automation diagnosis interval time can setup to 2 types, so can setup the diagnosis term by unit of plant, facility, and rotating machine

* This system is not for continuous measurement and monitoring * This system is not an accuracy diagnosis tool

Placement of Fuji's wireless diagnosis system for rotating machine

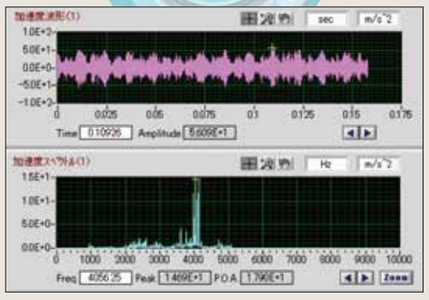


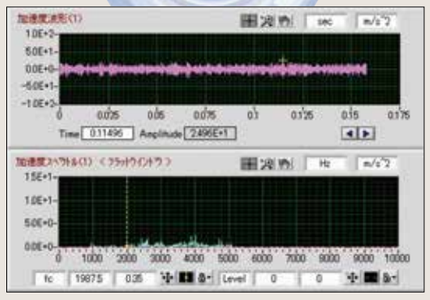
Example of the removal of vibration noise by inverter carrier(Fuji electric original function)

Diagnosis of original mechanical vibration of rotating machine, which operate with inverter, is to be difficult because the carrier vibration noise of inverter add to mechanical vibration of rotating machine. Analysis of original mechanical vibration of rotating machine is to be possible by cutting the carrier vibration noise.(patented)

Before remove the carrier noise.
Q Value (estimation value of bearing diagnosis)=64
acceleration effective value(RMS) = 2.8G

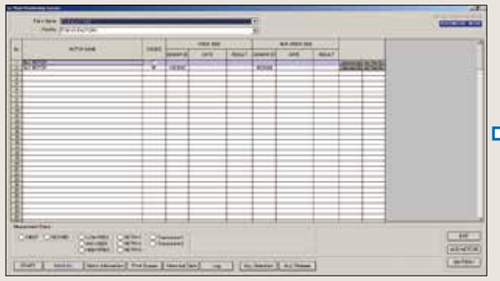
After remove the carrier noise.
Q Value (estimation value of bearing diagnosis)= 8
acceleration effective value(RMS) = 0.9G



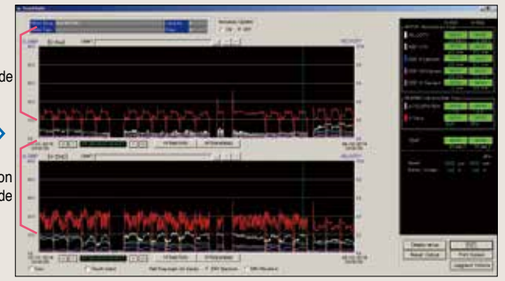


Function Formation (screen sample)

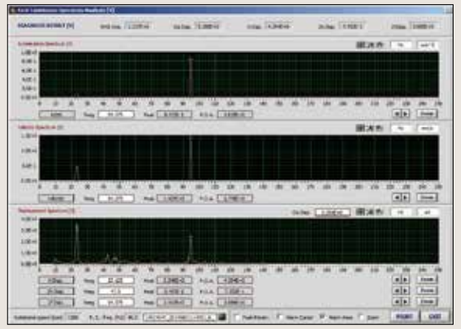
Basic measurement screen



Trend management screen of diagnosis

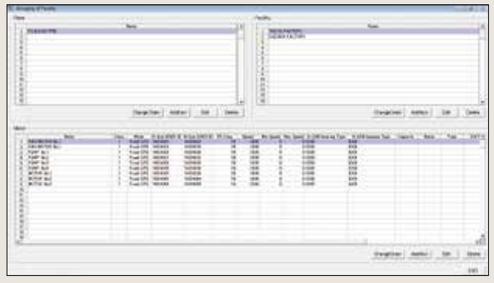


Mechanical vibration frequency analysis screen (low frequency vibrations)

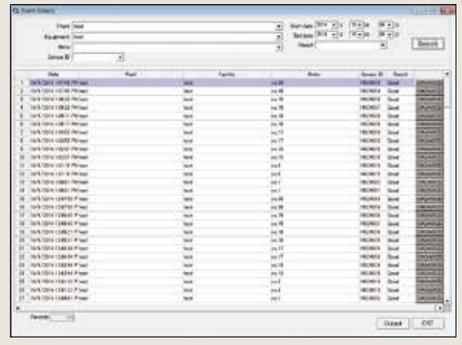


Bearing vibration frequency analysis screen (high frequency vibrations)

Equipment grouping screen



Event history screen



Explosion-proof WISEROT

The explosion-proof structure has a flameproof construction with Ex db II B+H_2 T4 Gb degree of protection, and is applicable within the scope of Class 1 and Class 2 hazardous locations. The body is cast aluminum, and polycarbonate is used for the top cover to facilitate wireless communication.

- **Explosion-proof certifications**
  - (1) IEC 60079-0/1/11
  - (2) EN 60079-0/1/11
  - (3) JNIOSH-TR-46-1, 2, 6: 2015

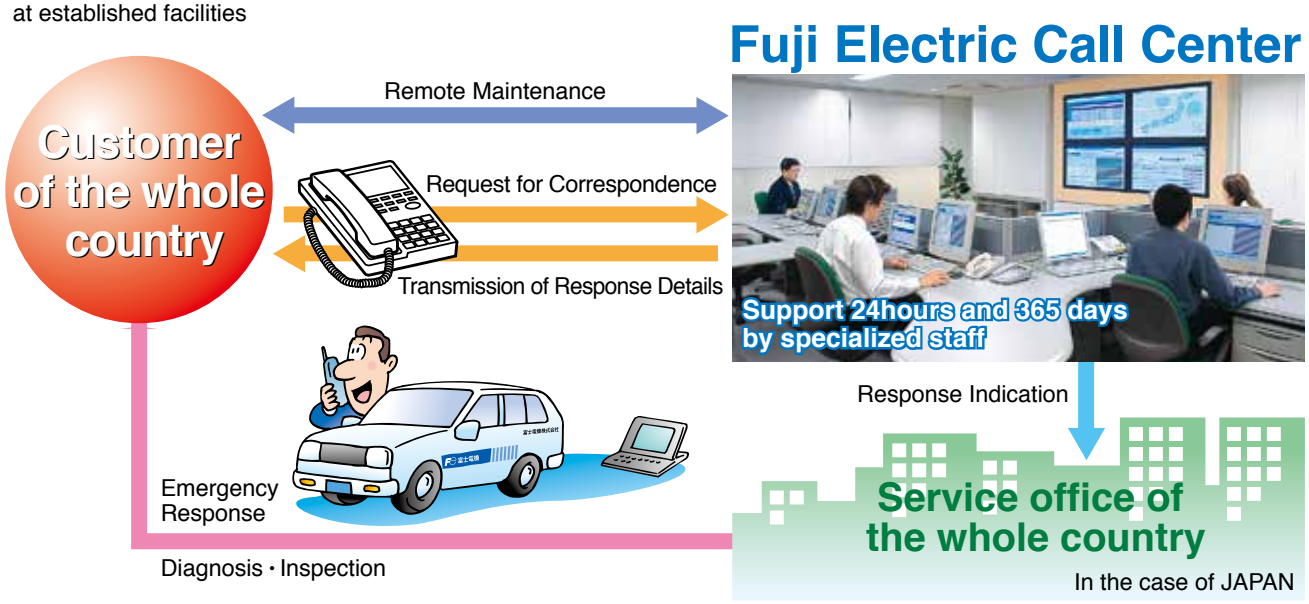
- **Explosion-proof structures**
  - Wireless sensor: Ex db [ia Ga] IIB+H_2 T4 Gb
  - Transceiver: Ex db IIB+H_2 T4 Gb

Wireless sensor

Transceiver

Service System of Fuji Electric Group

- Fuji constructs the maintenance network system by service office of the whole country
- Fuji has the system that specialist immediately visits to customer site when abnormality situation occurred at established facilities



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