# Demo Board 4

General

This demo board does vibration monitoring. It measures small movements in 3 dimensions: X, Y and Z. It calculates if a motor needs maintenance or not.

Vibration can be expressed in metric units (m/s^2) or units of gravitational constant g, where 1 g = 9.81 m/s^2. Gravitational units (g) are the acceleration produced by Earth's gravity and expressed as a ratio.
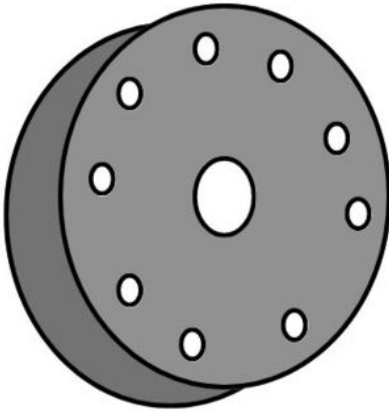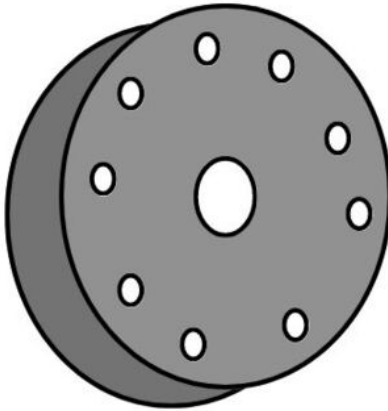
Schematics
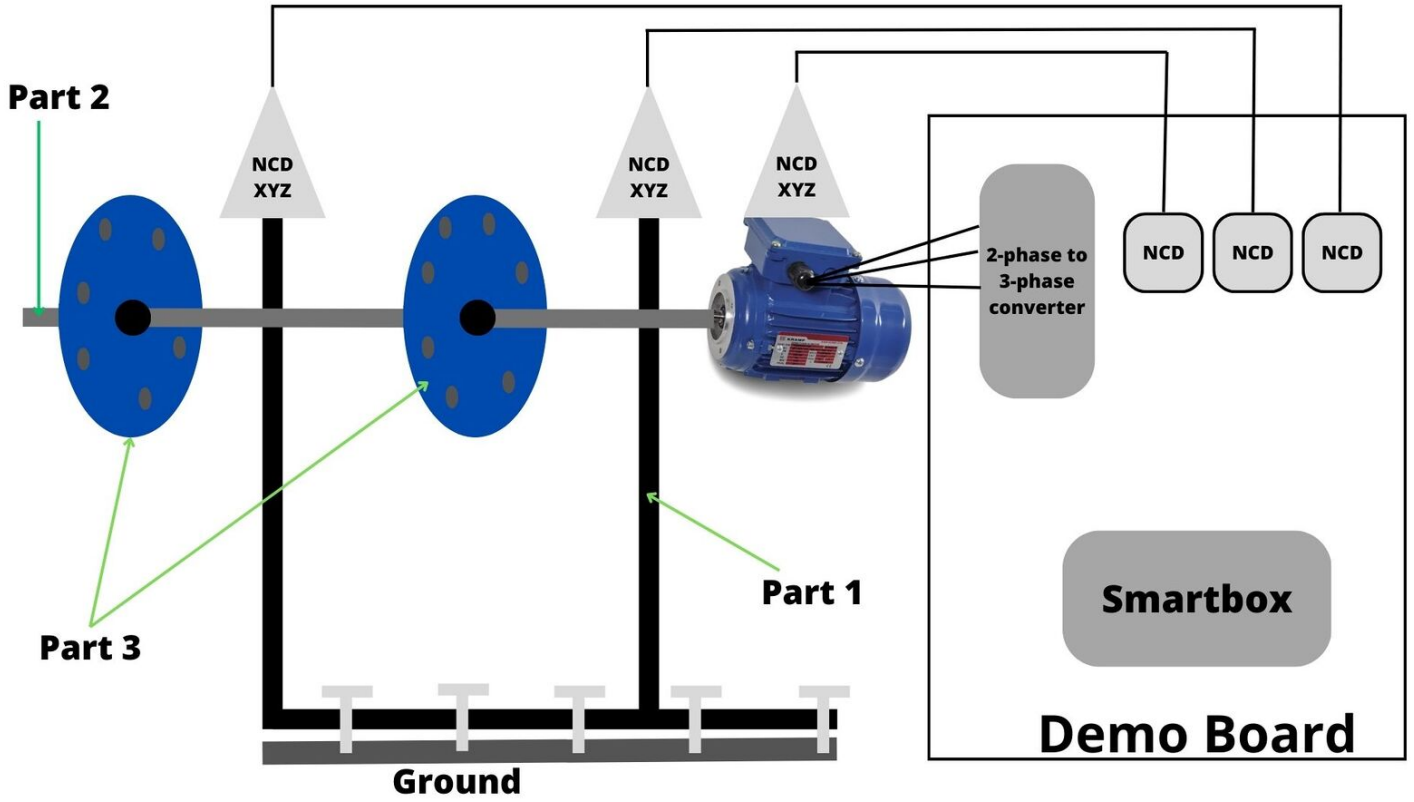
Part 1
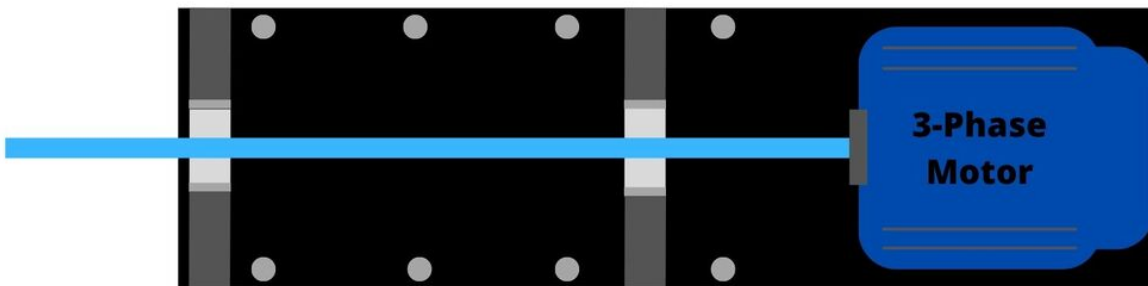
Part 2

This an axle that is directly connected to the 3-phase motor.

Part 3

These are 2 cylinders with holes in them. In these holes we can put weights to simulate different circumstances that could happen in production.

Cylinder 1	Cylinder 2

Components

- 1x 3-phase motor (https://www.kramp.com/shop-nl/nl/p/elektromotor-0-09-kw--EM56A2B3300IE1AKR)

- 1x 2phase to 3phase converter (https://www.indiamart.com/proddetail/delta-vco-bop-2-vfd-22497029188.html)

- 3x NCD vibration sensors (https://store.ncd.io/product/industrial-wireless-vibration-and-temperature-sensor/)

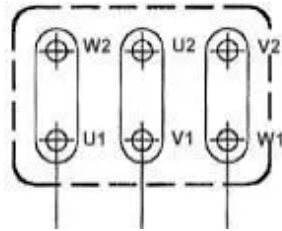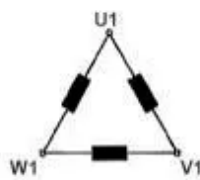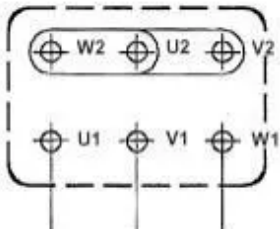- 1x NCD USB modem (https://store.ncd.io/product/industrial-wireless-usb-modem/)

- 1x Smartbox

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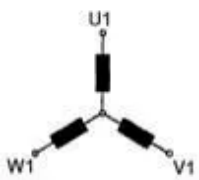
Motor

Delta or Wye connection.

Measuring vibration

During Power-Up, this vibration sensor learns "normal" base-line vibration from the monitored device. This base-line vibration is subtracted from regular sampled vibration readings to improve relevant vibration data. Ideally, the monitored device should be off while the sensor is learning. Once the sensor stabilizes and starts sending data, the device/machinery being monitored can be powered on.

This Industrial IoT wireless vibration sensor samples 3-axis of Vibration data for 900ms and then calculates RMS, Maximum, and Minimum vibration readings.

Analysis

Vibration is a periodic movement or, say, back-and-forth movement of the particles present in the body, which has the feature of elasticity(rms). Vibration Analysis is a process for monitoring vibration signals' levels and patterns within a component, machinery, or structure; Vibration Analysis is used to detect abnormal vibration events and know the test object's overall condition.

RMS calculation

RMS (Root Mean Square) vibration is calculated by measuring the peak amplitude and multiply by .707 to obtain the RMS (Root Mean Square) value. Lastly, divide by .707 to get the Peak Value.

Formule: RMS = | peak_max - peak_min| * 0.707

RMS velocity

The RMS velocity is the average speed of an object or particle in any given direction. The average velocity is the total distance travelled divided by the total time spent travelling that distance.
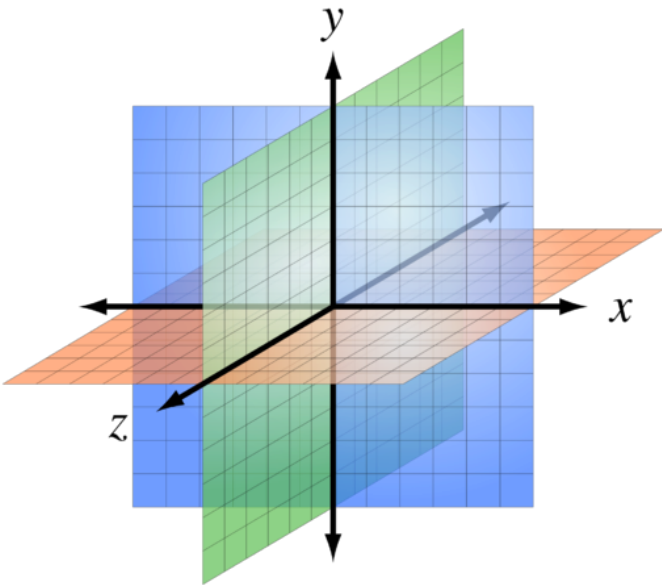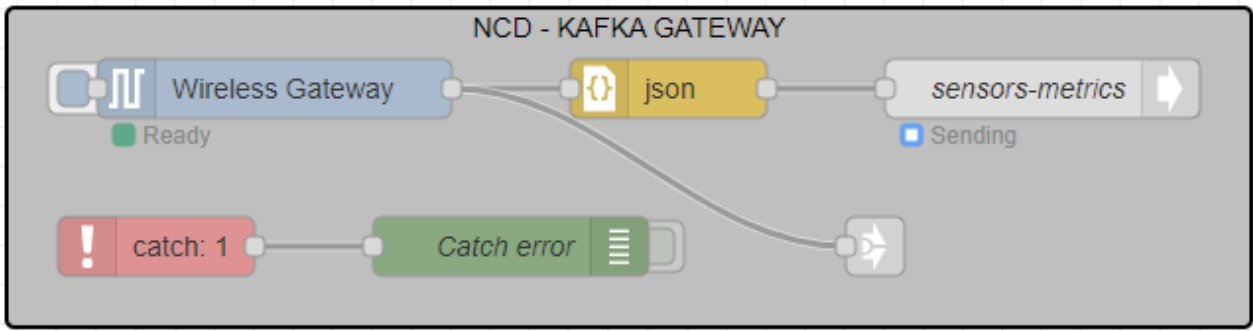
RMS acceleration

Vibration guidelines	
Vibration	**Condition**
0.01g >	Excellent
0.35g >	Good
0.5g >	Fair
0.75g >	Little Rough
> 0.75g	Rough
> 1g	Very Rough
> 1.5g	Danger
> 2.5g	SHUT DOWN

Node-Red

Gateway

A gateway to access the USB modem and connect to the sensor.

NCD - KAFKA GATEWAY

X values

Y values

Y values

Y: 226.98 min_y: 0 max_y: 237.9

Good

Z values

Z values

Z: 934.41 min_z: -950.86 max_z: 0

Very Rough
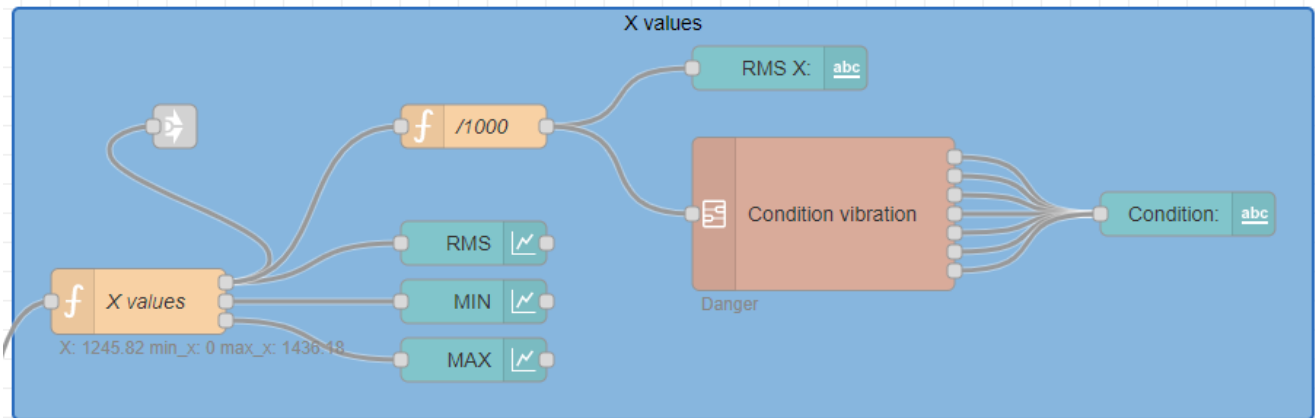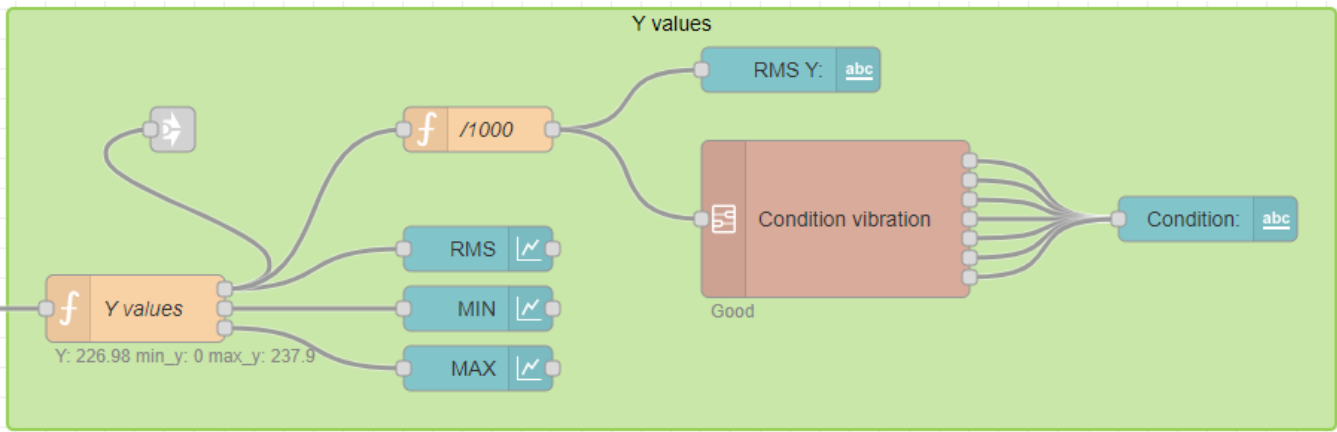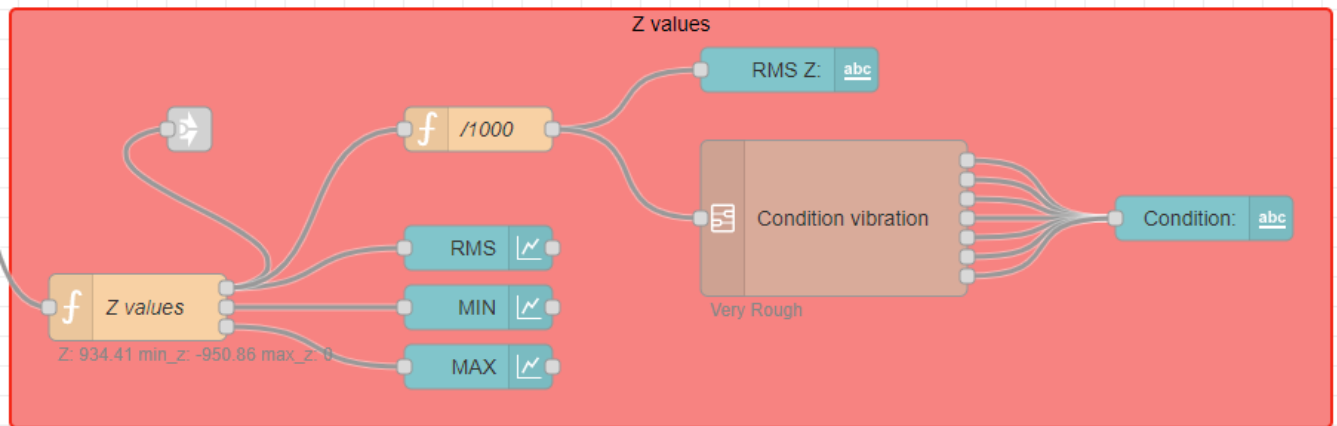
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