



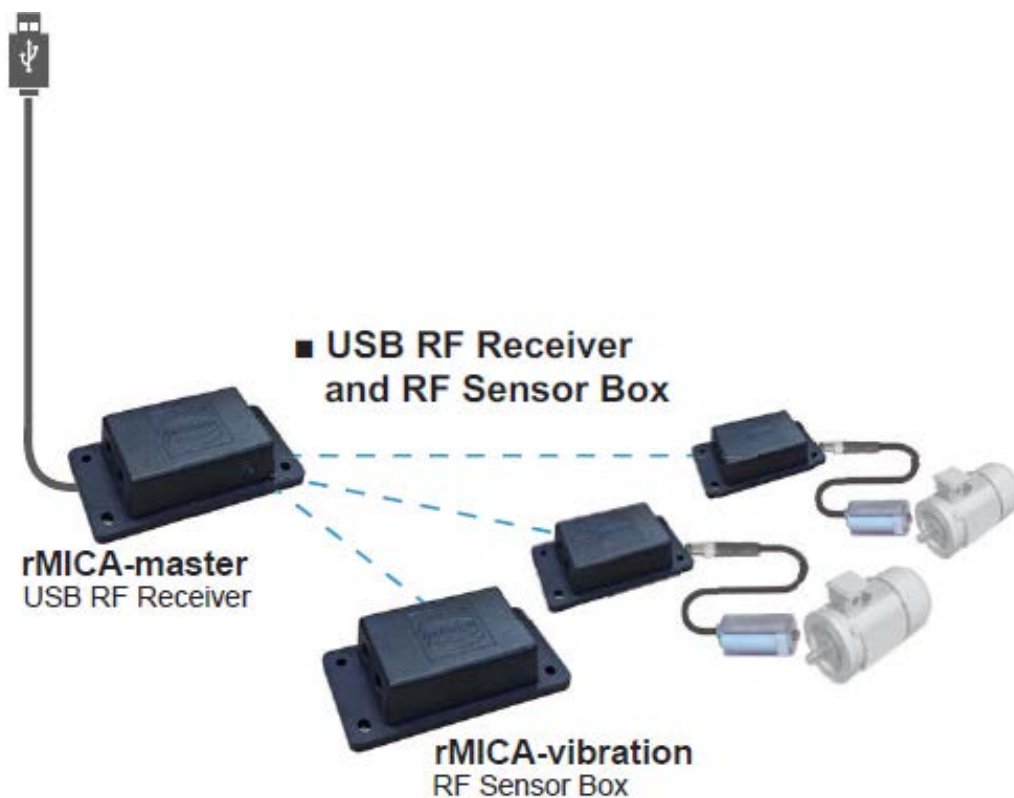
Pushing Performance

Motor Condition Monitoring System

User Manual (wireless hardware, US model)

USB wireless base station, wireless sensor box, acceleration sensor
rMICA-master, rMICA-vibration, sMICA-ACC

Ver. 2.0: December 12, 2020





For safety:

For safety use, please read and observe the following contents.

■ The intended users

This product has been developed for who in charge of building and maintaining production line. We ask that those have the experience in installing and using the industrial equipment to set up and use this product.

■ Disassembly of product

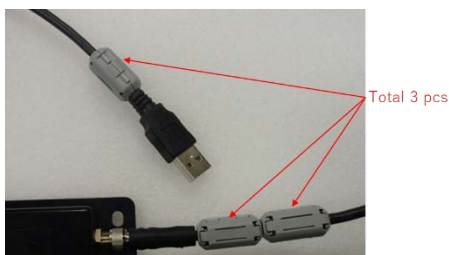
Please never disassemble or process this device case. Not only the waterproof & dustproof performance will be impaired, but it may also cause failure or malfunction.

■ Battery

The wireless sensor box (rMICA-vibration) contains the primary battery. Drilling a hole in the case or damaging the case with a sharp tool can damage the battery or cause a short circuit which is extremely dangerous. In addition, the battery cannot be charged, so please do not charge it.

FCC CAUTIONS:

- This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
 - i. This device may not cause harmful interference, and
 - ii. This device must accept any interference received, including interference that may cause undesired operation.
- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- Dedicated HARTING USB cables with three ferrite cores must be used for rMICA-master connection to a host computer in order to meet FCC emission limits. The ferrite core model and positions are as follows:
 - Mfr/Model: TDK/ZCAT1325-0530A
 - Position: 2 pcs at nearest position from r-MICA-master, 1 pcs at nearest position from host PC (see below photo)



- Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
- This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.
- This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 23cm or more away from person's body.



Pushing Performance

Motor Condition Monitoring System Manual: Wireless Hardware

1 Device configuration

Wireless motor condition monitoring system consists of the following devices.

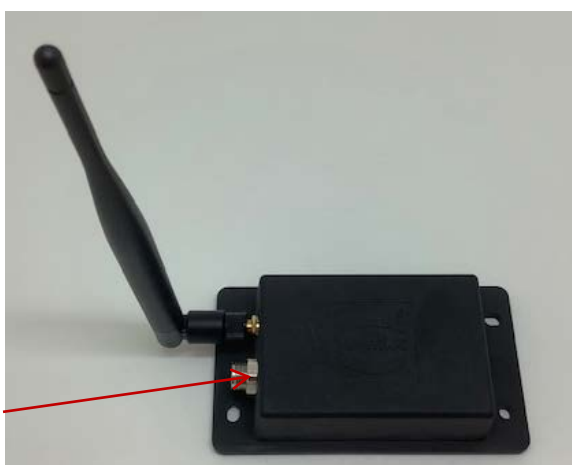
- i. Acceleration sensor probe: sMICA-ACC
- ii. sMICA-ACC has two built-in MEMS accelerometers (1 axis high frequency + 3 axis) and temperature sensor. The probe is installed directly on the object to be measured (Motor, etc.). sMICA-ACC supplies power and sends sensor signals via a dedicated M8 connector cable (2m). Sensor cable is shielded to minimize the effects from the electromagnetic noise. The range of the accelerometer sensor is $\pm 50g$, but in order to increase the resolution, only the $\pm 12.5g$ portion is acquired by the microcontroller ADC. Please contact us if you need a wider range of acceleration.



Remarks: High performance high frequency acceleration measurement axis
General acceleration measurement axis

- iii. Wireless sensor box: rMICA-vibration

Sensor connector



rMICA-vibration consists of a 32-bit microcomputer STM32 and a 920MHz wireless module, a long-life large capacity battery. One sMICA sensor and the dedicated sensor are connected to rMICA-vibration. rMICA-vibration starts

measurement at the time set on the host computer WEB GUI (up to 10 times/day). In the measurement, the 16384 sets of acceleration is continuously acquired with a sampling interval of $50\mu s$ (2kHz) to transmit the data to rMICA-master. It takes about 5s to send all data. Depending on the signal condition, it may take longer to resend the data. If the transmission of all data is not completed within 30s, the transmission operation will be skipped and the data file for that timing will not be created.

By setting the trigger acceleration on the WEB GUI, you can also wait until the measurement target starts moving. If the acceleration value does not reach the trigger acceleration before timeout, the measurement and data transmission is skipped and the data file is not created. In addition, by setting an offset delay time, the measurement is started after a certain period of time after trigger acceleration is detected. The acceleration value is a relative acceleration with the average of the measured data as the 0 point. Therefore, it is not necessary to consider the effect of the gravitational acceleration due to the installation of the acceleration sensor.

iv. USB wireless base station: rMICA-master

rMICA-master has a built-in 920MHz wireless module and connects to a host computer such as MICA-R via USB2.0. Power (5V) is supplied from the host computer and connect a dedicated antenna to the antenna terminal of the RMA connector.

A rMICA-master can accommodate at least 60 rMICA-vibration. More rMICA-vibration can be connected by setting different measurement time to each rMICA-vibration. rMICA master can only communicate with rMICA-vibration at 1 time, so you should be aware of the restrictions on communication time. It takes 5-10s to transmit data for 1 rMICA-vibration. If more than three rMICA-vibration send at the same timing, some of rMICA-vibration may fail to transmit the data.

USB cable connector



v. Host computer

We offer the following products as the host computer for this Motor Condition Monitoring System. Web GUI application is already installed in offered host computer products.

- Industrial Raspberry Pi MICA-R series
- Industrial box PC

Both products are customizable. Please feel free to contact us.

2 Installation and wiring

i. sMICA-ACC

Using the M6 screw hole drilled in the center of the probe to connect the sMICA-ACC sensor probe to the measurement point. We also offer a special magnet, but it's not recommendable if you need to capture high frequency over 5000Hz. By installing the probe directing the cylindrical center of the probe to the center of the rotating object, the sensor obtain the most ideal acceleration waveform.



ii. rMICA-vibration

rMICA-vibration wireless sensor box is installed on a pillar or a control panel with good visibility (the place where the rMICA-master can be seen). The case has holes at 4 corners, so use these to fix by M4 screw. The cable length from the sensor probe to the wireless sensor box is 2m. if there is excess, bundle it with a minimum bending radius of 15cm or more. Connect the antenna to the antenna connector and tighten it until the ring does not turn. If you want to install the antenna away from the box case (such as at a high place or on the top of the panel), please contact us for custom made of an antenna extension cable. Do not connect the sensor connector to rMICA-vibration until the measurement starts. When the connector is connected, the power of rMICA-vibration is turned on and the battery is consumed. Tighten the connector until the ring does not turn. rMICA-vibration is operated by battery, so no external power supply is required.



iii. rMICA-master

rMICA-master sensor base station is also installed in a place with good visibility to rMICA-vibration. Installing the base station at a high place stabilizes the radio wave condition. Connect the antenna to the antenna connector and tighten it until the ring does not turn. If you want to install the antenna away from the box case (such as at a high place or on the top of the panel), please contact us for custom made of an antenna extension cable. Connect to the host computer with the dedicated 2m USB cable. rMICA-master does not require an external power supply.

3 Startup

After connecting the rMICA-vibration and rMICA-ACC connector to start the measurement and data transmission. MICA-R, HARTING standard industrial PC with specified application installed creates sequential measurement data files. Various measurement conditions can be changed on the web GUI application. Please refer to the Web GUI manual for details.

4 Wireless module and antenna

i. Wireless module

A DIGI Xbee SX900 RF module is built-in in both rMICA-vibration and rMICA-sensor. It uses ISM band of 902-928MHz. With frequency hopping, user do not need to set RF channel. For more detail about the performance of the RF module itself, please refer to DIGI website.

ii. Antenna

A 5dBi undirected antenna is included. The antenna cannot be replaced by the customer due to the restriction from telecom certificate. If the antenna direction is the same between rMICA-master and rMICA-vibration, the communication distance will be maximized.

iii. Wireless range

With a communication speed of 100kbps, the maximum transmission distance is 100m outdoor and 50m indoor. With obstacles between rMICA-master and rMICA-vibration, the distance could be significantly reduced.



5 Battery

rMICA-vibration has a special built-in large capacity and long-life battery. It is primary battery and cannot be charged. We also provide the replacement batteries as option parts.

The lifetime of battery is depending on measurement frequency and environmental condition greatly. We can calculate an approximate life value. 0.3mAh in one measurement, then up to 1100mAh in one year standby, annual consumption capacity is (the number of annual count) x 0.3mAh + 1100mAh

Assuming that the effective battery capacity is half of the nominal battery capacity of 13,500mAh, 5 measurements per day (1825 times a year) will result in about 4.2 years.

6 Specifications

i. Acceleration sensor probe: sMICA-ACC

- Acceleration range: -12.5 to 12.5G
- Acceleration frequency: 0 to 11kHz
- Acceleration straightness: $\pm 0.5\%$
- Noise: $25 \mu g/\sqrt{Hz}$
- Temperature sensor range: -40~125°C(usable temperature cannot be used)
- Temperature sensor accuracy: 0.5°C
- Temperature sensor resolution: 0.25°C
- Mounting: M6 screw hole
- Sensor cable length: 2m
- Sensor connector: M8 8pin Male
- Protection: IP67
- Probe material: Aluminum die-cast
- Size: $\phi 22.5 \times 30.5(mm)$
- Operating temperature: -40 to 100°C

ii. Wireless sensor box: rMICA-vibration

- Microcomputer: 32bit STM32-L4, 80MHz, 12bit ADC
- Sensor connector: M8 8pin Female
- Wireless standard: ISM902-928MHz (FCC certified)
- Wireless channel: Automatically selected
- wireless output(Module): 20mW
- Antenna: Non-directional 5dBi, RMA Male



- Battery: 3.6V, 13.5Ah
- Mounting: 4 x M4 screw
- Housing: ABS Flame retardance
- Protection: IP65
- Size: W122 x H31 x D 69.5(mm)
- Operating temperature: -10 to 60°C

iii. USB Wireless receiver: rMICA-master

- Wireless standard ISM902-928MHz (FCC certified)
- Wireless channel: Automatically selected
- wireless output(Module): 20mW
- Antenna: Non-directional 5dBi, RMA Male
- Host connection: USB2.0 (type A)
- Mounting: 4 x M4 screw
- Housing: ABS Flame retardance
- Protection: IP65
- Size: W122 x H31 x D 69.5(mm)
- Operating temperature: -10 to 60°C

(End of Document)