WHITEPAPER

MAINTMASTER IOT

MAINTMASTER®

TABLE OF CONTENTS

WELCOME

At MaintMaster we believe that maintenance makes a difference for productivity, sustainability, and safety.

Ensuring that you have accurate information at the right time enables you to make quicker and more intelligent decisions.

This document is intended to familiarise you with MaintMaster IoT, our solution for collecting, analyzing and acting on data received from your operating environment and equipment.

As MaintMaster IoT constantly evolves, any information in this document is subject to change.

SUMMARY

MaintMaster IoT:

- Can measure vibration, temperature, air pressure, air humidity (and battery level).
- Is seamlessly integrated with your existing MaintMaster CMMS system.
- Can be configured to automatically create work orders, based on sensor values.
- Enables you to follow trends and react on changes in the data (not to be confused with an alarm system)
- Lets you view live data for the ongoing hour in sampling intervals down to 1.5 seconds (depending on data point), with up to 5 minutes of delay.
- Provides you with aggregated data (max, min, average, median) after the completion of every hour, available indefinitely.
- Enables you to measure in locations, where you would normally have to stop production to measure, and with much shorter intervals.

INTRODUCING MAINTMASTER IOT

The promises of Industry 4.0 are intriguing. Smart Maintenance plays an important role in this revolution, where data-driven decisions are instrumental; it is an area where we at MaintMaster now have the tools you need to enhance your capability within preventive maintenance.

MaintMaster IoT aims to empower your data-driven decision-making, providing you with all the necessary information to make smart decisions when it comes to the maintenance and operation of your equipment.

A MaintMaster IoT package comes with:

- A set of wireless sensor tags. Small devices containing multiple sensors within a single tag, that measure a wide array of parameters.
- An IoT Gateway. Responsible for receiving, processing, and packaging data from the sensors and sending the data to the cloud & MaintMaster.

Our sensor tags can capture:

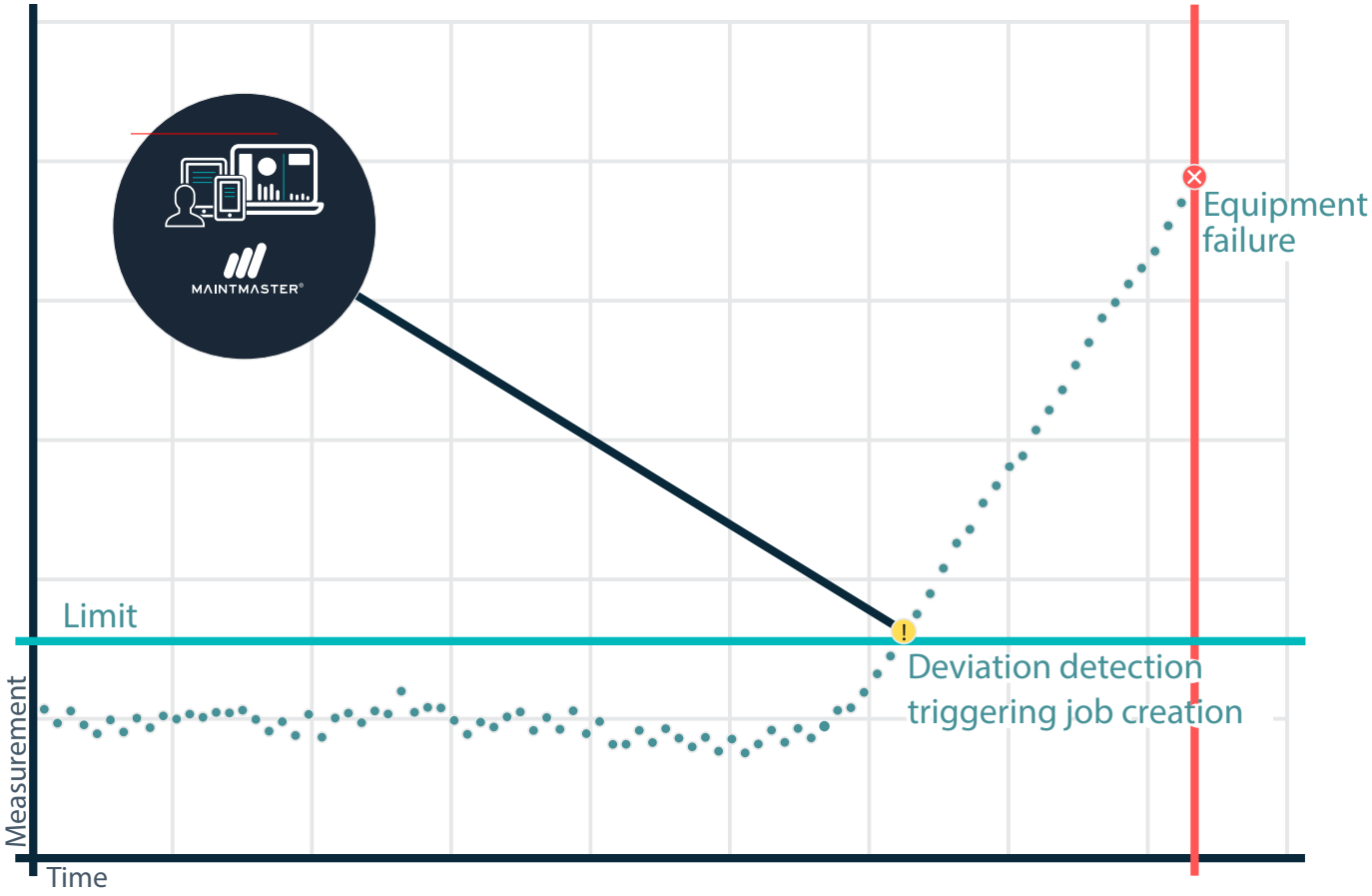
- Temperature
- Acceleration (movement/vibrations)
- Humidity
- Pressure

(Sensors available vary depending on the sensor tag model)

The sensor tags are intended to be placed throughout your operating environment and on your equipment to feed the desired data into your MaintMaster system. Sensor tags may beneficially be placed in places that are hard or dangerous to reach. Our sensor tags are also well suited for placement in harsh environments.

Our sensor tags use MiraMesh network, which enables our sensor tags to act as routers, forwarding messages from other sensor tags, as well as collecting data. This allows for sensor tags to be placed further away from the IoT Gateway, as long as they can connect to the IoT Gateway via other sensor tags.

Using the ability to automatically create jobs in your MaintMaster system and to provide you with live data, MaintMaster IoT can make you aware of problems quickly and to predict failures before they happen.



While MaintMaster IoT provides you with, at a glance status through the live data, the real power comes from aggregating and observing trends in your data.

MaintMaster IoT is not designed to be an early warning, or alarm system. The purpose of the solution is instead to provide you with information for longer term equipment monitoring and to leverage this for preventive maintenance.

We at MaintMaster believe that this is condition-based maintenance at its best.

As always with MaintMaster technology, MaintMaster IoT is easy to use and easy to configure. We want your return on investment to be immediate and high.

LIVE DATA

With MaintMaster IoT, you may view live data as it is being delivered to your MaintMaster system. This enables minute-by-minute monitoring of your equipment.
Monitoring your equipment just got a lot easier.

Live data has a limited lifetime. As aggregations are performed hourly, processed live data is removed, once it has been aggregated.

AGGREGATED DATA

To truly be useful and understandable the many, many data points coming in to the MaintMaster system, need to be processed and aggregated.

MaintMaster performs this aggregation, after the completion of each hour of the day. The aggregated data is available indefinitely in the MaintMaster system.

Aggregation calculates and stores the minimum, maximum average, and median for all data points during the hour.

JOB TRIGGERS

Using MaintMaster IoT allows you to configure limits for sensor values in your MaintMaster system. When these limits are breached, jobs can be automatically created for you to act on any condition.

USE CASE EXAMPLES

Example 1

Assume you have placed a sensor at a location where the normal temperature is 20 °C. You could configure MaintMaster to create a maintenance job when the temperature reaches 25 °C alerting you of the condition and prompting an investigation of the situation.

Example 2

Imagine that you have placed a sensor tag on an electric engine. Using the data from MaintMaster IoT, you can observe the level of vibration the sensor is reporting continuously.

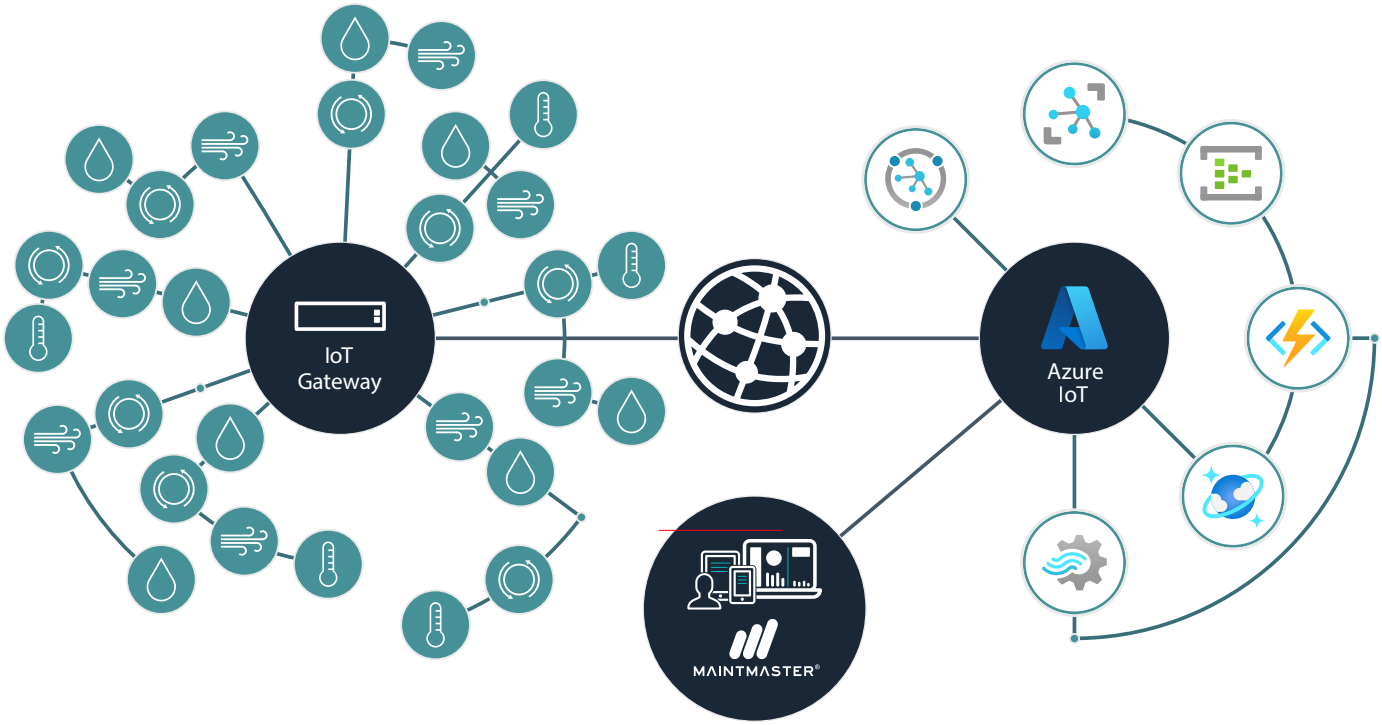
At some point in time, you either observe or are automatically alerted to the fact that the level of vibration is slowly but steadily increasing, indicating a degraded component.

Thanks to the data received from MaintMaster IoT, you can act before the component breaks. Planning maintenance of the equipment allows you to avoid an unexpected halt in production.

HOW DOES IT WORK

Sensor tags placed at your location feed their data to the IoT Gateway. The data is packaged into chunks, limited either by a configurable timeframe or by the size of the package.

The packaged data is then sent over the internet to our Azure IoT-powered services where data is enriched and further propagated to your MaintMaster system as live data, while also triggering maintenance jobs for any breached limits.



Sounds simple right? That's because it is!

POWERED BY THE MICROSOFT AZURE IOT ECOSYSTEM

To enable secure and reliable operation and communication between your IoT Gateway and your MaintMaster system, we use the Azure IoT ecosystem of services.

With Azure IoT we have a tried and trusted platform for IoT applications. Adding the MaintMaster IoT combination of services makes for a secure and reliable, as well as feature rich, service that adds clear value for our customers.

TECHNICAL DATA

IoT Gateway

The IoT Gateway is the edge computing device located at your facility. The IoT Gateway receives messages from the Tags, and processes them (aggregating, packaging, and sending them to the cloud for further processing).

As the IoT Gateway essentially is a small computer, it requires an environment where it will not be exposed to:

- Large amounts of dust and particles
- Condensation or excessive humidity
- Temperatures deviating far from normal room temperature

IoT Gateway specification/requirements

Operating temperature	0...~60 °C (The device will throttle at an internal temperature of 80 °C. In an ambient temperature of ~20 °C the device operates at ~40 °C under normal load)
Power supply	230V (adapter) or USB-C 5.1V/3.0A
Internet connection	Ethernet or WiFi
Outbound connections	mmwesteurope-dps-prod-01.azure-devices-provisioning.net Port: 443 mm8-api.maintmaster.com Port: 443 mmwesteurope-iothub-prod-01.azure-devices.net Port: 8883, 5671, 443 8.8.8.8, 8.8.4.4 (google.dns) ICMP

Sensor Tags

We offer three different types of sensor tags, with different sensor options and IP classifications. Availability of the different type may vary.

- 4in1 - Measures temperature, vibration, humidity, and pressure.
- 3in1 - Measures temperature, vibration and humidity.
- 2in1 – Measures temperature and vibration.

Operating temperature	-40°C to +85°C (Individual components may have a wider temperature operating range)
Battery	1000 mAh Li/MnO2 CR2477T (user replaceable)
Battery Life	1.5-2 years (Sensor tags routing large amounts of messages coming from other devices, will have their battery life adversely affected.)
Theoretical max range	30 m
IP-classification	IP67 IP68+IP69K
Mounting options	The tags come with two mounting screw holes, but may also be glued to a clean and flat surface.

Sensors

Thermometer[1,2,3]

Measurement range	[-55] –40 … +85°C [+150°C]
Accuracy	±0,1°C
Output resolution	0.0078°C

Accelerometer[1,2,3]

Measurement range	±2g
Measurement frequency	1500 ms

Hygrometer[1,2]

Measurement range	0 … 100% relative humidity
Accuracy	20 … 80% relative humidity @ 25 °C
Output resolution	0.01% relative humidity

Barometer[1]

Measurement range	300 … 1200 hPa
Typical absolute accuracy	±1 hPa (or ±8 m)
Relative accuracy	±0,06 hPa (or ±0.5 m)
Output resolution:	±0,002 hPa

MIRAMESH NETWORK

Frequency range	2.4 GHz
Tag-to-tag range	30 m (clear line of sight and minimal radio interference)
Network tag capacity	~100 devices (Simulated)
Maximum hop count	~10 hops (Estimated) (In order to achieve a reliable network with optimal battery life, sensor tags should be placed in a mesh/web pattern)

[1] 4in1 Sensor Tag
[2] 3in1 Sensor Tag
[3] 2in1 Sensor Tag

INSTALLATION INSTRUCTIONS

Physical installation

IoT Gateway

The IoT Gateway does not have mounting screw holes or any other options for permanent installation, as delivered. The IoT Gateway requires a power source to operate.

A 230V power supply, for the IoT Gateway is delivered with MaintMaster IoT. Optionally, an alternative USB-C 5.1V/3.0A power supply may be used, if preferred.

Sensor Tags

Sensor Tags may be mounted using the two screw holes on the casing, alternatively they may be glued to a flat and clean surface. As the Sensor Tags are battery operated, no additional power supply is needed.

Network Configuration

The IoT Gateway needs to have a working internet connection for the device to be able to send data to the cloud.

Ethernet

If you intend to use an ethernet cable to connect the IoT Gateway to the internet, all you need to do is to connect the device to a network with a DHCP server.

WiFi

If you intend to use the device over WiFi, there is a little bit more to the process.

1. Connect the power to the device and wait for it to boot
2. The device will set itself up as a WiFi access point with a network SSID
3. Connect a device to this WiFi network
4. Using a web browser navigate to the address http://192.168.88.1
5. In the web page showing, select the WiFi network that you intend to use, enter the credentials, and click apply.
6. The device will restart and connect to the network you selected
7. If the configuration somehow failed the device will set itself up as a WiFi access point again after a short while.

MaintMaster Configuration

For you to be able to start using your MaintMaster IoT data in your MaintMaster system, the IoT Gateway needs to be connected to the MaintMaster system and you need to enable IoT-Sensors and the IoT-Sensors selection in your system.

Connecting the IoT Gateway to your MaintMaster system

Your MaintMaster project leader or MaintMaster support will help you connect your IoT Gateway to your MaintMaster system.

Enable IoT selection in MaintMaster system

To see the sensor tags in your MaintMaster system you need to enable IoT sensors and the IoT sensors selection.

- In the administrative MaintMaster windows desktop client, select the menu "Settings" and the menu option "System settings"
- In the tree view on the left select the IoT-sensors item
- Click the button "Activate IoT-sensors"
- In the drop down list select a Site Object where you want the IoT selection to be shown in your MaintMaster system (default "Site object card (system)")

Once that is done the initial configuration is completed.

To make full use of MaintMaster IoT configuring your sensor tags on site objects and setting limits for triggers will be necessary.

TROUBLESHOOTING

If sensor readings are not showing up in your MaintMaster system please verify the following:

- Verify that the IoT Gateway is powered
  The Gateway has a red power led, visible from the outside of the case, on the opposite side from the ethernet and USB connectors. If this LED does not show a constant red light the device is not powered.
- Verify that the IoT Gateway can connect to the internet
  If the device is powered and connected to your internal network and you can identify the IP address for the device. There is network diagnostic information available on a web page on the device http://X.X.X.X:5000 where the IP should be replaced with the actual IP of the device.
- Ask MaintMaster support or your MaintMaster project leader to Verify that your IoT Gateway is connected to your MaintMaster system.
- Verify that your sensor tags have battery power
  Under the IoT selection in your MaintMaster system, it is possible to view the current battery level of the sensor tags. Monitoring this information will allow you to foresee when sensors will run out of battery.

  It is also possible to read the current voltage of a sensor tag, using an NFC reader.
- Verify that your sensor tags are within range of the IoT Gateway or within range of another routing sensor tag

FREQUENTLY ASKED QUESTIONS

- Will MaintMaster IoT sensor tags work through reinforced concrete walls?
  It will depend on the thickness of the walls and other circumstances, but the short answer is: Yes! However, the range will be adversely affected.

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