

BOXKIT-PHM

Predictive Maintenance DemoBox



Features

- Closely aligned with industrial application scenarios and project cases, highly practical
- Capable of configuring and simulating equipment failures to generate abnormal vibration signals
- Comprehensive application of EdgeAI knowledge and skills, covering data acquisition, wireless networking, gateway and edge computing, and agent development
- Compact structure for easy deployment in classrooms, labs, and diverse settings

Overview

This training kit is designed based on an industry solution for predictive maintenance in smart factory equipment. It consists of a device fault simulation unit, wireless sensors, a gateway, and edge computing service software, enabling equipment health monitoring based on the ISO-10816 protocol. Suitable for teaching, research, and testing focused on predictive maintenance in smart manufacturing, automation, and artificial intelligence disciplines.

Solution Highlights

Industry-Aligned:

The solution architecture and training content are designed around typical smart manufacturing-equipment predictive maintenance scenarios, offering strong practicality and close alignment with industry demands.

Comprehensive and Advanced Functionality:

The product features rich functionality, incorporating advanced edge AI technology and industrial agent development techniques to meet diverse learning and practical needs.

Extensive Expansion Interfaces:

Equipped with communication and power expansion ports, it facilitates easy data acquisition from vibration sensors or simulation devices, supporting customized scenario training.

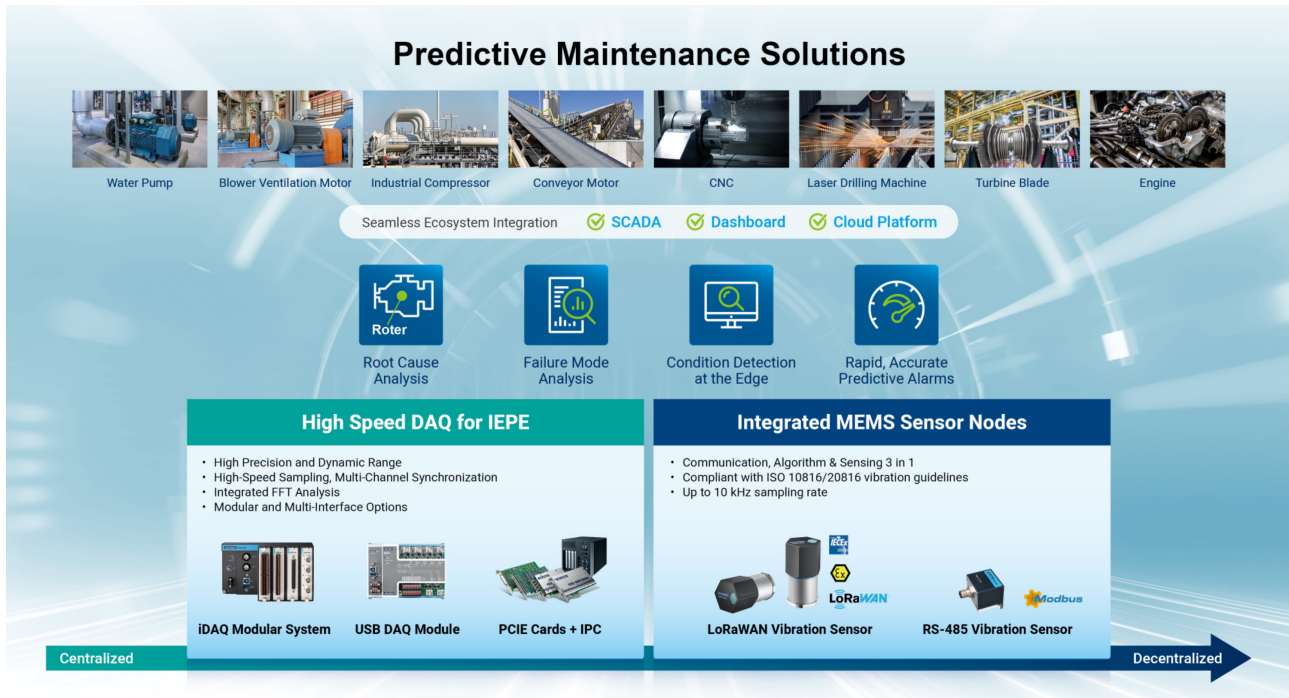
Multi-Platform Compatibility:

Supports both cloud-based learning via Advantech's Industrial Cloud Platform and optional agent development platform for hands-on industrial agent creation.

Portable and Compact Design:

Its compact and lightweight form factor makes it ideal for carrying to training labs, academic exchanges, and solution demonstrations, enabling learning and practice anytime, anywhere.

Technical Architecture



Practical Case

Semiconductor:

HVAC Fan Fault Diagnosis

Vishay Semiconductor

Background: Semiconductor manufacturing demands extreme stability in production environments. Failures in plant utility systems (e.g., fans, pumps, cooling tower motors) can cause production interruptions and significant economic losses.

Equipment Name: Fresh Air Unit P1 Fan
Equipment Type: Modular Air Handling Unit
Measurement Point Locations: Motor + Fan Drive End H and Non-Drive End H

Equipment Name: Process Cooling Tower Fan No. 6
Equipment Type: Cooling Tower Fan
Measurement Points: Motor + Fan Drive-End H and Non-Drive-End H + Speed Sensor

iMachine PHM

- Alarm Level: Level 2
- Alarm Feature: Vibration value exceeds threshold
- Data Manifestation: Vibration values at the non-drive end of the motor exceeded limits, triggering a Level 2 warning
- Fault Analysis: High effective value of non-drive end speed. Primary frequency in speed spectrum is 1x rotational frequency. No other periodic frequencies detected in acceleration or envelope spectrum.
- Fault Location: Structural loosening fault present in the motor

Outcome: Following the recommended on-site inspection, the company discovered damage to the foundation vibration dampers. Subsequent replacement of the dampers restored the equipment to stable operation.

Alarm Level 2

Obvious Fault

Practical Case 1 Using HVAC fan fault diagnosis in the semiconductor industry as an example, the training kit simulates excessive vibration values at the non-drive end of the P1 fan in the fresh air unit and the No. 6 fan motor in the process cooling tower. Combining an edge AI system enables fan fault diagnosis, while the Advantech Industrial Cloud Platform facilitates data visualization and alarm notifications.

Steel: Bearing Failure Diagnosis for Dust Collector Fans

A Steel Mill

Background: Dust extraction fans in blast furnaces operate continuously in high-dust, high-load environments. Bearing failures are often difficult to detect, making timely identification through traditional inspections challenging.

Equipment Name: Dust Removal Fan for No. 2 Blast Furnace Iron Tapping Yard
 Equipment Type: Double-support fan
 Measurement Point Location: Fan drive end H

- ☑ Alarm Level: Level 3
- ☑ Alarm Characteristics: Acceleration, Envelope
- ☑ Data Manifestation: Acceleration and envelope amplitude at the fan drive end show rising trends with rapid escalation; periodic impact characteristics at the fan rotational frequency of 16.5Hz are visible in acceleration and envelope waveforms; prominent 113.125Hz and harmonic components appear in the envelope spectrum, accompanied by sidebands at the rotational frequency.
- ☑ Fault Analysis: The frequency is close to the fault frequency of the inner ring of bearing 6232 at the fan drive end.
- ☑ Fault Location: Fault present in the inner ring of bearing 6232

Outcome: The company immediately conducted an on-site inspection as recommended and scheduled a major overhaul to replace the bearings. During this period, the equipment was monitored and returned to stable operation.

Alarm Level 3
Critical Fault

Practical Case 2 Simulates a bearing inner ring failure in a dust removal fan at a blast furnace iron tapping area in the steel industry. This failure causes periodic impact characteristics in the fan's rotational frequency, as reflected in acceleration and envelope waveforms. The edge AI system diagnoses the fan fault and issues an immediate on-site inspection alert.

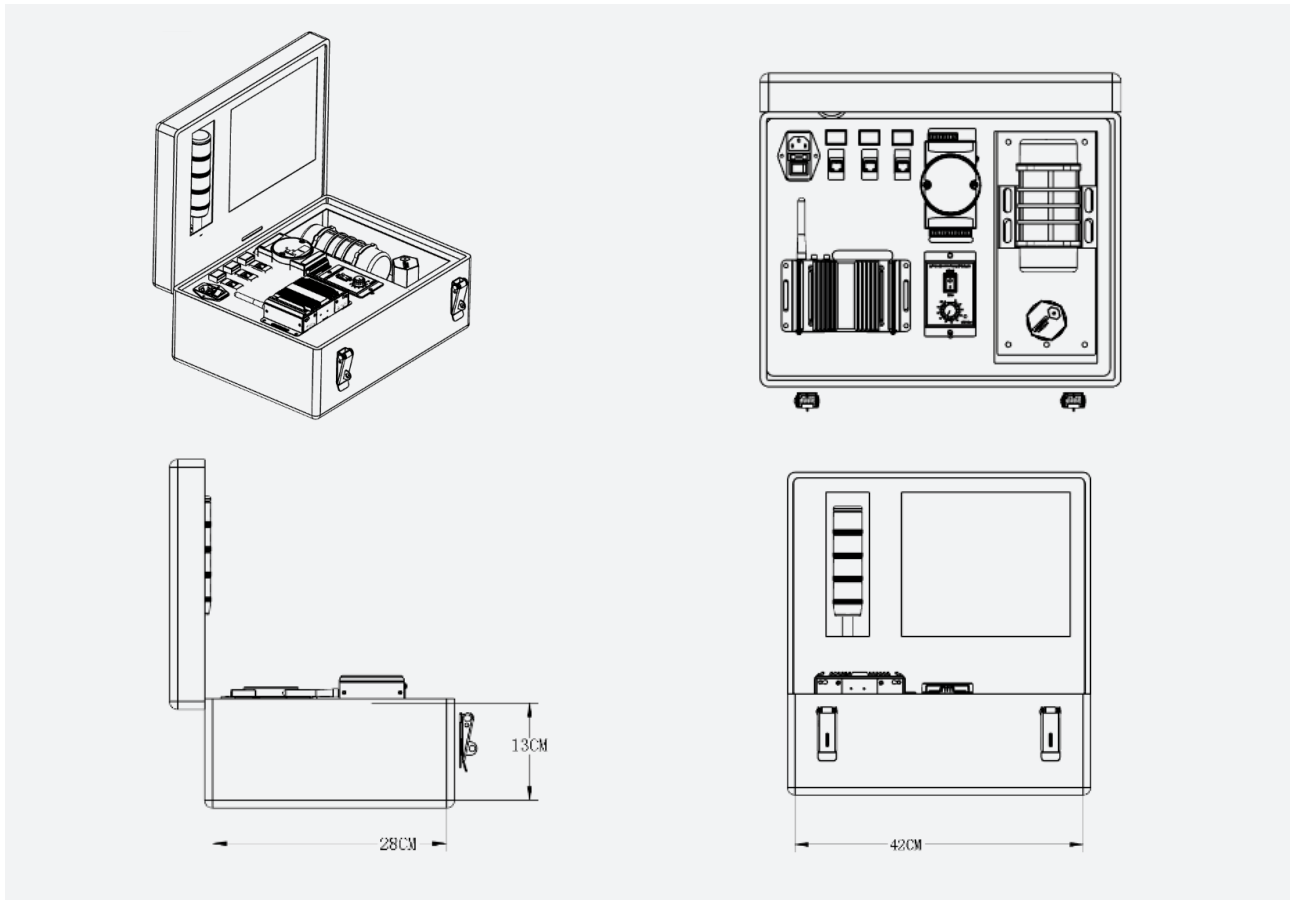
Module Functionality

No.	Name	Model and Function	No.	Name	Model and Function
01	Vibration Sensor	WISE-4012; Collects vibration signals	01	Control Module	ADAM-6050; Edge Control
02	Wireless Gateway	WISE-6610; Protocol Conversion	02	Speed Controller	Adjusts motor speed
03	Three-color indicator light	24V; three-color; displays health status	03	Motor	220V AC; Monitoring equipment
04	Buzzer and indicator light	24V; Audible Alarm	04	Edge Computing Software	IoT-Edge; Data Acquisition, Processing, and Visualization

Demobox integrates extensive hardware and software resources. For detailed functionality, refer to the specific user manual, including but not limited to:

- Power & Interfaces: Power socket, pass-through Ethernet port, terminal blocks
- Indicators and Display: LED indicators, tri-color indicator
- Control Components: Speed controller, data module
- Sensors: Vibration sensor
- Industrial Cloud Platform: IoT Edge (Required), IoT Suite (Optional), AI AgentBuilder (Optional)

Dimensions and Appearance



Hardware Module Functionality List

No.	Training Content
1	Vibration Sensor Installation and Configuration
2	LoRa Gateway Configuration and Wireless Networking
3	RTU Configuration and Communication Testing
4	Edge Computing Software Installation and Data Acquisition
5	ISO-10816 Vibration Monitoring Program Design
6	Monitoring Interface Dashboard Development and Design
7	Health Alarm and Interlock Setup and Testing
8	Data Upload to Cloud and Visual Monitoring on Cloud/Mobile Endpoints (Optional)
9	Industrial AI Agent Development (Optional)
10	Industrial AI Agent Device Diagnostic Application Testing and Optimization (Optional)

Ordering Information

Product	Specifications	Description
Industrial Intelligence (Predictive Maintenance) Training Kit	Standard Edition	Rapidly establish practical case studies for predictive maintenance scenarios in smart manufacturing equipment.
IoT Edge Device Networking and Edge Computing Services	Standard Edition	Deployable at the edge to collect device data locally, manage devices, and perform data analysis, processing, forwarding, and visualization.
IoT Suite (Optional) Advantech Industrial IoT Platform	Standard Edition	IoT Suite is a comprehensive industrial IoT platform delivering integrated cloud-edge-device practical experiences for teaching and training. By integrating core industrial IoT applications such as industrial process automation, energy monitoring, and workplace environment monitoring, the platform creates immersive learning environments for students.
AI Agent (Optional) Advantech AI Agent Development Platform	Standard Edition	Advantech's AgentBuilder platform delivers rich industrial agent use cases for teaching and training, covering scenarios like equipment maintenance, production management, environmental safety and health management, and supply chain optimization. By integrating Advantech's factory best practices, it empowers university teaching and training through scenario-based solutions. With zero-code or low-code configuration, it enables knowledge base Q&A, data analysis, and intelligent equipment control, significantly lowering the barrier to industrial agent development and supporting the cultivation of industrial AI talent in higher education.