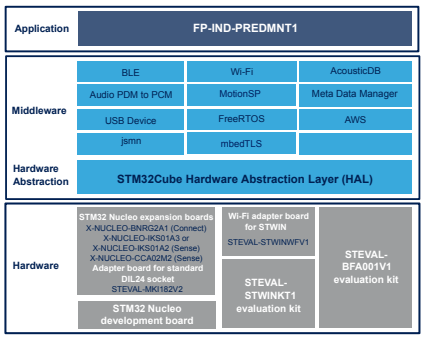
FP-IND-PREDMNT1

Data brief

STM32Cube function pack for multisensor nodes with signal processing to enable predictive maintenance



STM32 Open Development Environment

STM32 Cube

Product summary	
STM32Cube function pack for multisensor nodes with signal processing to enable predictive maintenance	FP-IND-PREDMNT1
STWIN SensorTile Wireless Industrial Node development kit and reference design for industrial IoT applications	STEVAL-STWINKT1
Wi-Fi adapter board for STWIN	STEVAL-STWINWFV1
Predictive maintenance kit with sensors and IO-Link capability	STEVAL-BFA001V1B
ISM330DLC adapter board for a standard DIL24 socket	STEVAL-MKI182V2
BLE expansion board based on the BLUENRG-M2SP module for STM32 Nucleo	X-NUCLEO-BNRG2A1

Features

- Complete firmware to develop a sensor node for condition monitoring and predictive maintenance applications, featuring digital or analog microphone, environmental and motion sensors, and performing real-time monitoring of parameters and equipment status via:
  - user terminal by UART (available for the STEVAL-IDP005V1 evaluation board included in the STEVAL-BFA001V1B kit)
  - Wi-Fi connectivity (available for the STEVAL-STWINKT1 with the STEVAL-STWINWFV1 Wi-Fi board)
  - BLE connectivity (available for the NUCLEO-F446RE development board and the STEVAL-STWINKT1 kit)
- Signal processing (MotionSP) middleware for vibration analysis in time domain (speed RMS and acceleration peak) and frequency domain (FFT with programmable size, averaging, overlapping and windowing)
- PDM to PCM and sound pressure level (SPL) middleware for digital microphones (for NUCLEO-F446RE and STEVAL-BFA001V1B)
- Acoustic FFT Analysis for NUCLEO-F446RE and STEVAL-BFA001V1B
- Ultrasound FFT Analysis for STEVAL-STWINKT1
- Configurable alarm and warning thresholds for key parameters
- Data logging capability through mobile app or PC serial terminal
- Compatible with STBLESensor application for Android/iOS, to perform sensor data reading, audio and motion algorithm feature demo, and firmware update over the air (FOTA) (feature available only when using NUCLEO-F446RE and STEVAL-STWINKT1 with BLE connectivity)
- Compatible with DSH-PREDMNT web-based predictive maintenance dashboard for monitoring sensor data and device status (feature available only when using the STEVAL-STWINKT1 with the STEVAL-STWINWFV1 Wi-Fi adapter)
- Sample implementation available for the STEVAL-BFA001V1B and STEVAL-STWINKT1 kits
- Sample implementation available for X-NUCLEO-CCA02M2, X-NUCLEO-IKS01A3 or X-NUCLEO-IKS01A2, STEVAL-MKI182V2 (DIL24 based on ISM330DLC) and X-NUCLEO-BNRG2A1 connected to a NUCLEO-F446RE board
- Easy portability across different MCU families, thanks to STM32Cube
- Free, user-friendly license terms

Description

FP-IND-PREDMNT1 is an STM32Cube function pack including dedicated algorithms for advanced time and frequency domain signal processing and analysis of 3D digital accelerometers with flat bandwidth up to 5 kHz.

The package includes pressure, relative humidity and temperature sensor monitoring, and audio algorithms for acoustic emission (AE), up to 20 kHz, and ultrasound emission analysis up to 80 kHz.

According to the designer's needs for connectivity and sensors, different options are available and selectable by changing parameter settings.

Product summary	
Motion MEMS and environmental sensor expansion board	X-NUCLEO-IKS01A2/ X-NUCLEO-IKS01A3
Digital MEMS microphone expansion board based on MP34DT06J for STM32 Nucleo	X-NUCLEO-CCA02M2
BLE sensor application for Android and iOS	STBLESensor
Web-based predictive maintenance board	DSH-PREDMNT

With the NUCLEO-F446RE development board and the STEVAL-STWINKT1 kit with BLE connectivity, you can monitor and log the algorithm output and sensor data using the STBLESensor app.

The STEVAL-IDP005V1 included in the STEVAL-BFA001V1B evaluation kit allows connecting a PC via USB to monitor and log the algorithm output, sensor data and equipment status.

By using the STEVAL-STWINKT1 kit with Wi-Fi connectivity, you can connect the device to the dedicated DSH-PREDMNT web-based dashboard to monitor and log the algorithm output, sensor data and equipment status.

The FP-IND-PREDMNT1, together with the suggested combination of STM32 and ST devices, can be used to develop specific industrial predictive maintenance applications for early detection of warning signs of potential failure.

The software runs on the STM32 microcontroller and includes all the necessary drivers for the STM32 Nucleo development board and expansion boards, as well as for the STEVAL-IDP005V1 and STEVAL-STWINKT1 evaluation kits.

1 Detailed description

1.1 What can you do with STM32Cube function packs?

STM32Cube function packs leverage the modularity and interoperability of STM32 Nucleo and X-NUCLEO boards together with STM32Cube and X-CUBE software to create function examples for some of the most common use cases of different application technologies.

These software function packs are designed to exploit the underlying STM32 ODE hardware and software components as much as possible to best satisfy the requirements of final user applications.

Moreover, function packs may include additional libraries and frameworks that are not present in the original X-CUBE packages, thus enabling new functionalities allowing real and usable system for developers.

1.2 What is STM32Cube?

STM32Cube is a combination of a full set of PC software tools and embedded software blocks running on STM32 microcontrollers and microprocessors:

- STM32CubeMX configuration tool for any STM32 device; it generates initialization C code for Cortex-M cores and the Linux device tree source for Cortex-A cores
- STM32CubeIDE integrated development environment based on open-source solutions like Eclipse or the GNU C/C++ toolchain, including compilation reporting features and advanced debug features
- STM32CubeProgrammer programming tool that provides an easy-to-use and efficient environment for reading, writing and verifying devices and external memories via a wide variety of available communication media (JTAG, SWD, UART, USB DFU, I2C, SPI, CAN, etc.)
- STM32CubeMonitor family of tools (STM32CubeMonRF, STM32CubeMonUCPD, STM32CubeMonPwr) to help developers customize their applications in real-time
- STM32Cube MCU and MPU packages specific to each STM32 series with drivers (HAL, low-layer, etc.), middleware, and lots of example code used in a wide variety of real-world use cases
- STM32Cube expansion packages for application-oriented solutions

1.3 How does this function pack complement STM32Cube?

This software is based on the STM32CubeHAL. It extends STM32Cube by providing a board support package (BSP) for the BLE, sensor and microphone expansion boards and middleware components for communication with other BLE devices.

The package contains signal processing library for vibration analysis in time and frequency domain.

It also provides some sample applications to demonstrate the use cases related to industrial predictive maintenance.

Revision history

Table 1. Document revision history

Date	Version	Changes
22-Feb-2019	1	Initial release.
07-May-2019	2	Updated cover page features.
09-Jul-2019	3	Updated cover page image, product summary table, features and description.
11-May-2020	4	Added X-NUCLEO-BNRG2A1 and X-NUCLEO-CCA02M2 expansion board compatibility information.