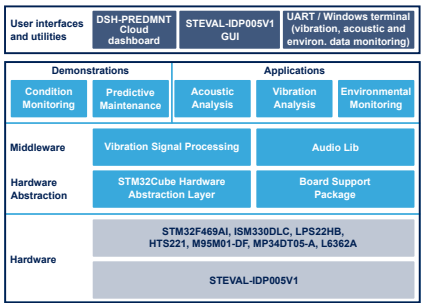
STSW-BFA001V1

Data brief

Software package for STEVAL-BFA001V1B



Features

- Set of firmware examples to build applications for condition monitoring and predictive maintenance based on 3D digital accelerometer, environmental and acoustic MEMS sensors
- Middleware including algorithms for advanced time and frequency domain signal processing for vibration analysis
  - Programmable FFT size (512, 1024 or 2048 points)
  - Programmable FFT averaging and overlapping
  - Programmable windowing (Flat Top, Hanning, Hamming)
  - Speed RMS moving average, acceleration max peak
- Middleware integrating microphone algorithms for:
  - PDM to PCM
  - Sound pressure
  - Audio FFT
- Firmware package developed for STM32F469AI with easy portability across different MCU families
- PC data monitoring through any free terminal emulator
- Sample demonstration firmware to communicate with STEVAL-IDP004V1 IO-Link-master-capable multi-port evaluation board and dedicated PC GUI
- Special STSW-BFA1PREDMNT condition monitoring firmware configured to interact with STSW-IDP4PREDMNT and allow data upload to Cloud via STM32MP157C-DK2 gateway.

Product summary	
capacitive digital sensor for relative humidity and temperature	HTS221
iNEMO 6DoF inertial module for Industrial Applications. Ultra-low power and high accuracy	ISM330DLC
ultra-compact piezoresistive absolute pressure sensor, 260-1260 hPa, digital output barometer, full-mold, holed LGA package (HLGA)	LPS22HB
1-Mbit SPI bus EEPROM with high-speed clock	M95M01-DF
MEMS audio sensor omnidirectional digital microphone, 64 dB SNR, -26 dBFS sensitivity, top-port, 122.5 dBSPL AOP	MP34DT05-A

Description

The firmware package is designed to help you develop industrial predictive maintenance solutions based on condition monitoring.

The software runs on the STM32F469AI microcontroller and includes drivers for sensor devices HTS221, LPS22HB, ISM330DLC (support for accelerometer only), MP34DT05-A and M95M01-DF.

The package integrates complete middleware with algorithms for accelerometer data signal processing to enable monitoring of rotating equipment such as motors, pumps and fans in time and frequency domains, up to the maximum bandwidth function of the accelerometer output data rate (up to ODR/2=3.3kHz).

The package includes audio lib middleware to perform acoustic emission analysis.

You can monitor environmental, acoustic and vibration data through a terminal emulator.

The software comes with different demonstrations and applications to monitor sensor data and output algorithm results. One demonstration is based on programmable thresholds for warning and alarm conditions in the time domain and in spectral bands.

The package is IO-Link capable (IO-Link stack is not included) with a demonstration that includes communication with the STEVAL-IDP004V1 IO-Link-master-capable multi-port evaluation board.

Product summary	
IO-Link communication transceiver device	L6362A
High-performance advanced line, ARM Cortex-M4 core with DSP and FPU, 2 Mbytes Flash, 384+4 kB of RAM, DMA controller, up to 17 timers	STM32F469AI
STM32 MPU OpenSTLinux expansion pack for Predictive Maintenance applications	X-LINUX-PREDMNT
Applications	Condition Monitoring / Predictive Maintenance

The scenario can be further extended so that STEVAL-BFA001V1B and STEVAL-IDP004V1 data can be collected and processed to some extent in an Edge gateway consisting of an STM32MP157C-DK2 discovery kit running X-LINUX-PREDMNT software, which includes the AWS Green Grass service and gathers all the data on an official ST Dashboard tool for monitoring, alerting and control purposes.

1 Predictive Maintenance application overview

The package includes applications for environmental parameter monitoring, and vibration and acoustic analysis. These also include a data logger application to monitor and store data to your PC so you can start experimenting with the code. You can use any freeware terminal emulator on your PC to monitor the data

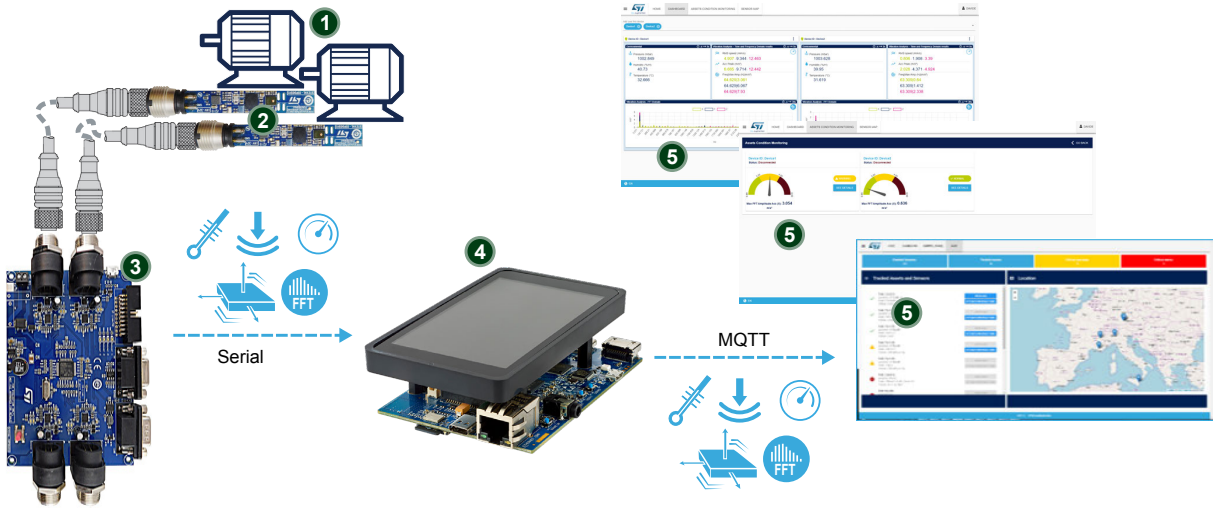
A sample demonstration to experiment with vibration analysis is provided on top of the vibration signal processing middleware. You can use it to monitor time and frequency domain vibration parameters and to set suitable thresholds in spectral bands and in time domains, to test the status of your own motor equipment.

The package includes a condition monitoring demonstration for the IO-Link capability (IO-Link stack is not included) and to connect the STEVAL-IDP004V1 IO-Link master with the sensor node included in the STEVAL-BFA001V1B kit. A dedicated GUI is included to display and store sensor data and algorithm output data.

The compiled binary is also provided in the STSW-BFA1PREDMNT package to establish communication between the IO-Link master capable STEVAL-IDP004V1 and sensor node in the STEVAL-BFA001V1B kit and the X-LINUX-PREDMTN software running on the STM32MP157C-DK2 discovery kit functioning as a gateway.

Figure 1. Condition monitoring and Edge to Cloud: from sensors to gateway to cloud dashboard

1. Industrial equipment
2. IO-Link capable sensor node(s): one or more STEVAL-BFA001V1B
3. IO-Link master: STEVAL-IDP004V1
4. Edge gateway: STM32MP157C-DK2 discovery kit
5. Cloud Dashboard application: DSH-PREDMNT



2 STM32Cube development environment

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

RELATED LINKS

Visit the ST website for more information on the STM32Cube Ecosytem

Revision history

Table 1. Document revision history

Date	Version	Changes
04-Jul-2018	1	Initial release.
25-Nov-2019	2	Updated Features and Description Updated Section 1 Predictive Maintenance application overview