EPSON

Monitoring Application for Vibration Measurement System - User's Guide

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Revision History

Rev. No.	Rev. Date	Page	Rev. Contents
20250331	2025/3/31	ALL	First edition Corresponding to the release of MSG005-001a_v1.0.0
20250731	2025//7/31	---	Corresponds to MSG005-001a_v1.0.1 release. Corrected description due to missing transfer files. Modified service definition file due to missing startup settings at OS boot.
20251130	2025/11/30	---	Corresponds to MSG005-001a_v1.1.0 release. Added descriptions related to the support for “Machine Condition Monitoring System based on ISO 20816.” Added Trend screen to support the summary application. Modified design and screen names of existing UI. Updated source code structure and revised setup procedures.

1. Related Document

1. “Setup Manual for Vibration Measurement System Using Raspberry Pi Products” Rev.20250731
2. “Operation Manual for Vibration Measurement System Using Raspberry Pi Products” Rev.20250731
3. “VC Evaluation Vibration Measurement System – User’s Guide” Rev.20250331
4. “Machine Condition Monitoring System based on ISO 20816 – User’s Guide” Rev.20251130

2. Introduction

This user guide provides an overview of the Vibration Monitoring System Web Application (hereafter referred to as “the application”), covering the following topics:

- Specification
- Setup procedures
- Execution instructions
- Developer guide

The **"Vibration Measurement System Monitoring Application"** (hereinafter referred to as "this application") is a web application that runs on a Raspberry Pi equipped with either the **"Vibration Measurement System using Raspberry Pi products"** or the **"VC Evaluation Vibration Measurement System"**(collectively referred to as "measurement applications").

This application receives messages via an **MQTT broker**, which acts as an intermediary for messages sent from the measurement applications and their associated **hardware status monitoring tools**. It displays the measurement status, the status of connected vibration sensors, VC evaluation results, and more on a web interface.

Additionally, it receives MQTT messages from the “**Machine Condition Monitoring System Based on ISO 20816”** (hereinafter referred to as “summary application”), which also runs on Raspberry Pi, and displays the aggregated results of past measurement data collected by the measurement applications on the web interface.

By accessing the Raspberry Pi from a PC using a web browser, users can view the web application interface.

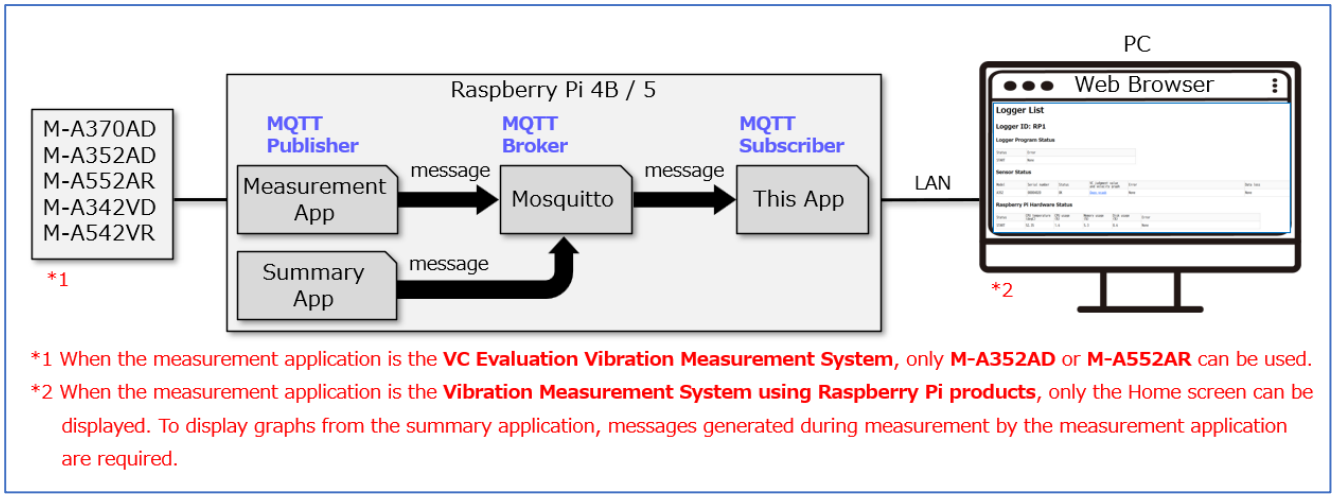


Figure 2-1 Application Diagram

3. Specifications

3.1. Verified Operating Environment

This application has been tested and confirmed to operate on the following Raspberry Pi models:

- Raspberry Pi 4B
- Raspberry Pi 5

It has also been verified to work with the following web browsers:

- Google Chrome
- Microsoft Edge

3.2. Input Specifications

This application receives messages from the following tools:

- Vibration Measurement System using Raspberry Pi products
- Hardware Status Monitor included with the above system
- VC Evaluation Vibration Measurement System
- Machine Condition Monitoring System based on ISO 20816

For detailed message specifications, please refer to the related documents 2, 3 and 4.

3.3. Output Specifications

As this is a web application, the output is presented via web pages. The application consists of two main web screens.

3.3.1. Home Screen

This screen displays the status of the logger and vibration sensors connected to the measurement application via the MQTT broker. It updates every second based on messages received from the measurement applications.

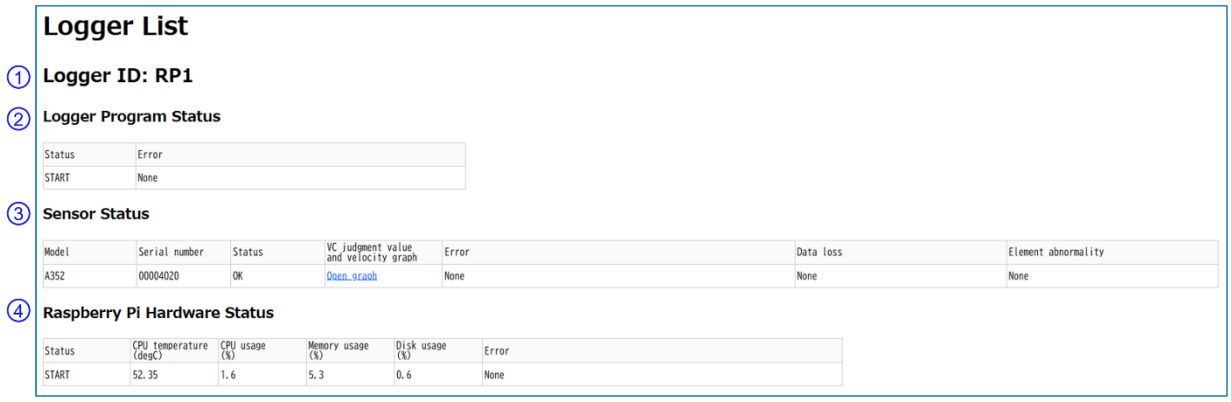


Figure 3-1 Home Screen

1. Displays the ID of the connected logger
2. Shows the status of the connected logger
3. Displays the status of vibration sensors connected to the logger

- In the “VC graph” and “Trend graph” columns, a link labeled “Open graph” will appear when the required data for each graph is available. Clicking the link will open the corresponding graph screen.
- The background color of the “Trend graph” column changes depending on the warning status received from the summary application.
  (Trip warning active Alarm warning active)

4. Displays Raspberry Pi system metrics such as CPU usage

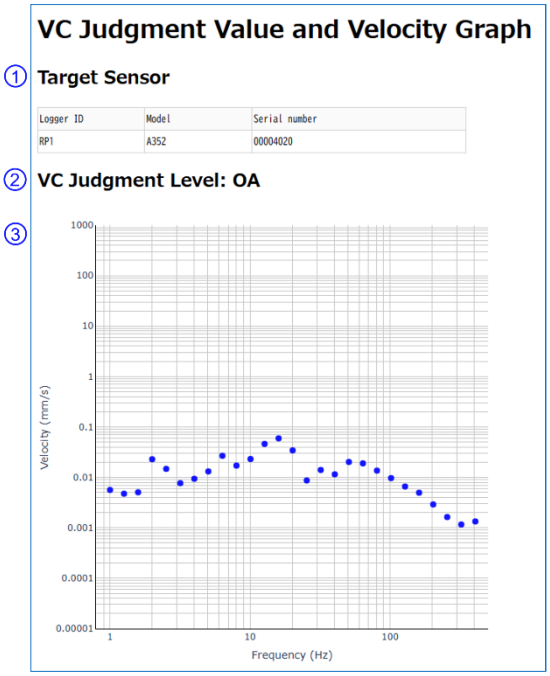
Note: To display the link for “VC graph,” the VC Evaluation Vibration Measurement System must be running.

Note: To display the link for “Trend graph,” the system must be receiving status messages for the corresponding sensor from the **measurement application** and also receiving aggregation messages for that sensor from the **summary application**.

3.3.2. VC Graph Screen

This screen displays the VC evaluation values and velocity graphs of the connected vibration sensors.

Messages sent from the “VC Evaluation Vibration Measurement System” are reflected on the screen every



second..

Figure 3-2 VC Graph Screen

1. Display information about the vibration sensor currently being graphed
2. Shows the VC evaluation value of the vibration data measured by the sensor
3. Displays a velocity graph of the vibration data measured by the sensor

3.3.3. Trend Graph Screen

This screen displays the trend values and change in magnitude graphs aggregated by the **summary application**. Messages sent from the summary application are reflected on the screen at one-minute intervals.

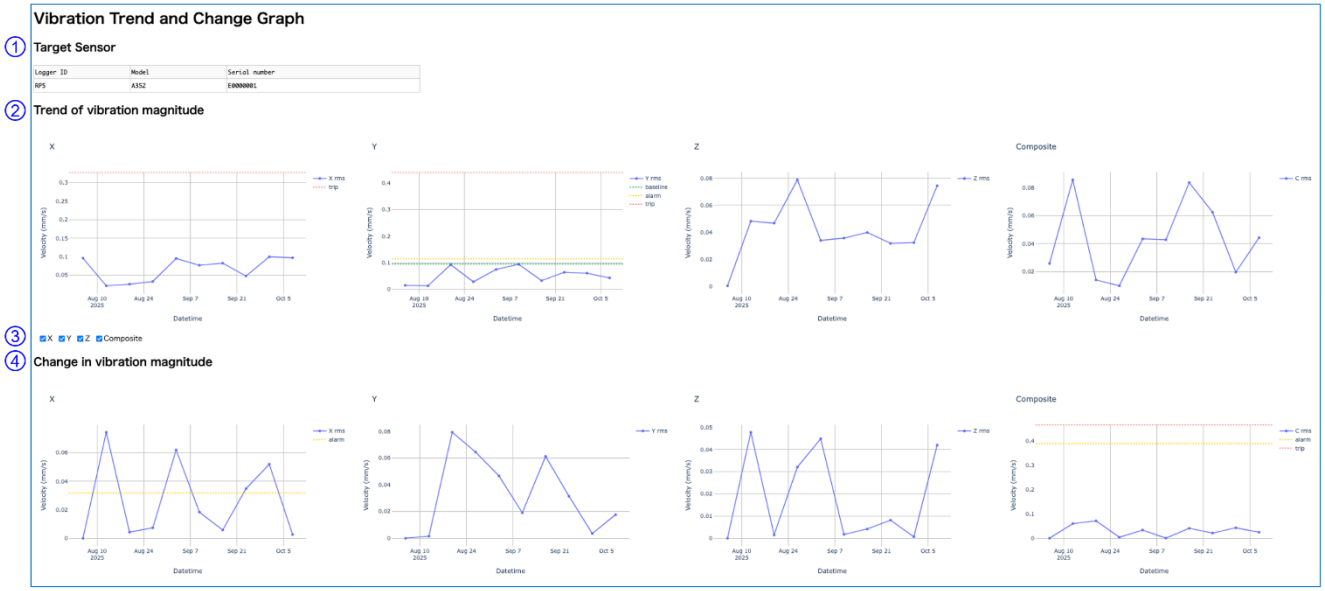


Figure 3-3 Trend Graph Screen

1. Displays information about the vibration sensor shown in the graph
2. Displays the aggregated trend values for each axis: X, Y, Z, and Composite
3. Axis selection checkboxes apply to both trend values and variation values
4. Displays the aggregated variation values for each axis: X, Y, Z, and Composite

3.4. Configuration Parameters

The application reads its configuration from a ".env" file located in the setup directory. The following parameters can be configured.

Table 3-1 Application Configuration Items

Parameter Name	Description	Default Value	Notes
LOG_LEVEL	Log output level	INFO	
APP_HOST	Hostname for accessing the application	192.168.1.52	Specify the hostname used to access via browser
APP_PORT	Port number for accessing the application	8050	
MAX_MESSAGE_COUNT	Number of entries to retain for multi-value data	3	Number of error entries to retain
MQTT_BROKER_HOST	Hostname of the MQTT	localhost	
MQTT_BROKER_PORT	Port number of the MQTT broker	1883	

4. Setting Up on Raspberry Pi

This section explains the steps to set up the application on a Raspberry Pi.

4.1. File and Folder Structure

Extracted Folder Structure:

```
Extracted Folder
├──── pyproject.toml          # Python project definition file
├──── sandbox                 # Folder for test and investigation programs
├──── src / raspi_web         # Source code of the application
│     ├──── data              # Data definitions used in the app
│     ├──── infra             # Code for handling messages from the MQTT broker
│     ├──── ui                # Code for building the web UI
│     └──── util              # Utility code used across multiple components
└──── tests                   # Test code for the application
```

Figure 4-1 File and Folder Structure

4.2. Preparation

Before starting the setup, refer to Related Documents1 and 3 and complete the following preparations:

- Connect the Raspberry Pi and PC to the same network
- Ensure the Raspberry Pi has internet access
- Install the measurement application on the Raspberry Pi
- Install the MQTT broker (Mosquitto) on the Raspberry Pi
- Enable message transmission to the MQTT broker in the measurement application settings

The following instructions assume:

- Raspberry Pi username : `pi`
- Static IP address assigned to Raspberry Pi : `192.168.1.52`

If you are using a different username or IP address, please adjust the commands accordingly.

4.3. Transferring the Program to Raspberry Pi

Run the following commands to transfer the necessary files to the Raspberry Pi:

1. Create the target directory on the Raspberry Pi:
   - `ssh pi@192.168.1.52 "mkdir -p /app/MSG005-001a"`
2. Transfer the program files:
   - `scp -r bin src pyproject.toml .env.default pi@192.168.1.52:/app/MSG005-001a`

4.4. Building the Runtime Environment on Raspberry Pi

Log in to the Raspberry Pi:

- `ssh pi@192.168.1.52`

4.4.1. Creating a Python Virtual Environment

Move to the application directory and create a virtual environment:

- `cd /app/MSG005-001a`
- `python -m venv --upgrade-deps venv`
- `source venv/bin/activate`

4.4.2. Installing Required Packages

Install the required packages in the virtual environment:

- `pip install .`

4.4.3. Application Configuration

Copy the default configuration file and create a working .env file:

- `cp .env.default .env`

Edit the .env file to adjust configuration values as needed. Refer to section 3.43.4 Configuration Parameters for details.

4.4.4. Installing the Service Registration File

Install the service registration file with the following command:

- `sudo cp bin/logger_monitor.service /etc/systemd/system`

Note: The service file assumes the Python virtual environment is located at /app/MSG005-001a/venv. If your environment is in a different location, update the following line in the service file accordingly:

- `ExecStart=/app/MSG005-001a/venv/bin/python -m raspi_web`

To enable the application to start automatically on Raspberry Pi boot:

- `sudo systemctl enable logger_monitor`

5. Running the Application

5.1. Preparation

Before running the application, refer to Related Documents1 and 3 and complete the following preparations:

- Connect the Raspberry Pi and PC to the same network
- Connect the accelerometer to the Raspberry Pi

5.2. Starting the Application

If you have followed the steps in Section 4.4.4 Installing the Service Registration File and configured the application to start automatically on OS boot, the web application will launch using the host and port specified in the configuration file (APP_HOST, APP_PORT).

- `Example: http://192.168.1.52:8050`

If the application is not set to start automatically, you can start it manually with the following command:

- `sudo systemctl start logger_monitor`

Note: When starting the application, the following warning may appear in the logs:

"`WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.`"

This indicates that the internal web server is intended for development use only. Avoid using it in publicly accessible network environments.

To access the application, open a web browser on your PC and enter the following URL:

- `http://192.168.1.52:8050/`

Note: If You Cannot Access the Application, please log in to the Raspberry Pi, enter the following command and check the log output to investigate the issue.

`systemctl status logger_monitor`

5.3. Measuring Vibration

Once the application is running, you can start the measurement application to begin vibration measurement. The monitoring application will display the status of the measurement application and the connected accelerometers.

For details on how to perform measurements, refer to Related Documents 2 and 3.

5.4. Running the Hardware Status Monitoring Tool

By running the hardware status monitoring tool, you can view system metrics such as CPU and memory usage of the Raspberry Pi within the application.

For instructions on how to run the tool, refer to Related Document 2.

5.5. Running the Summary Application

By running the summary application in this state, you can view the aggregated results of past measurement data collected by the measurement application within this application.

For details on how to run the summary application, please refer to Related Documents 4

6. Appendix : Developer Guide

This section provides technical information for developers who wish to extend or modify the application.

- Program Structure
- Running Locally
- Running the Program

6.1. Program Structure

The application consists of the following three main modules:

- `Subscriber class` (Path: `./src/raspi_web/infra/subscriber.py`)
- `DataManager` class (Path: `./src/raspi_web/infra/data_manager.py`)
- `Dash` application (Path: `./src/raspi_web/__main__.py`)

Additionally, the application defines a data structure class:

- `DataSet class` (Path: `./src/raspi_web/data/data_set.py`)

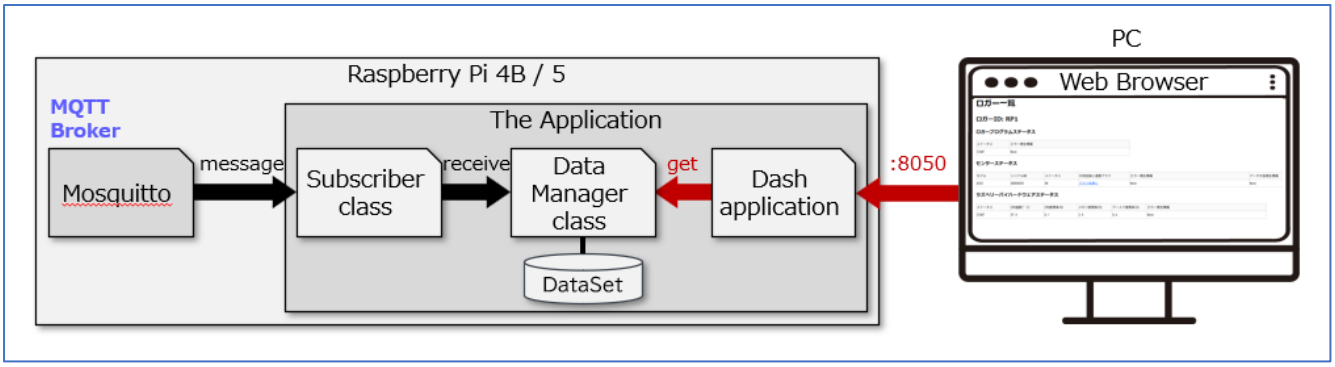


Figure 6-1 Program Structure Diagram

6.1.1. Subscriber class

Receives messages from the MQTT broker and passes them to the DataManager.

6.1.2. DataManager class

Parses messages received from the Subscriber based on their topics and stores data for display in the Dash interface. It also provides data retrieval methods for the Dash UI.

To add a new topic, update the `_init_topic_pattern_list()` method in the source code with the appropriate topic pattern and handler.

6.1.3. Dash application

Builds the web UI. It fetches data from the DataManager every second and updates the screen. Modify this module to add or change UI components.

6.1.4. DataSet class

Defines the data types used by DataManager and the Dash application.

6.2. Running Locally

When adding features or making modifications, development is typically done on a local PC. This section explains:

- How to set up the application locally
- How to run a local MQTT broker

6.2.1. System Requirements

To run the application locally, the following environment is required:

- Python 3.11
- Docker Desktop or another Docker-compatible environment
- Docker Compose v2 (verified with v2.31.0)

6.2.2. Setting Up the Local Environment

Extract the downloaded ZIP file to a folder of your choice on your local PC and set up the environment by following the steps below.

6.2.2.1. Creating Python Virtual Environment

On Windows (PowerShell):

- Launch PowerShell and execute the following command.
  - `py -3.11 -m venv --upgrade-deps venv`
  - `venv\scripts\activate.ps1`
- If `py` command is not found, please try the following alternatives.
  - `python3.11 -m venv --upgrade-deps venv`
  - `venv\scripts\activate.ps1`

On macOS/Linux (Terminal):

- Launch Terminal and execute the following command.
  - `python3.11 -m venv --upgrade-deps venv`
  - `source venv/bin/activate`

6.2.2.2. Installing Packages

Install required packages:

Common to all OS:

- `pip install -e .`

6.2.2.3. Starting the MQTT Broker (Mosquitto)

Use Docker to start the MQTT broker using the `./sandbox/mqtt/compose.yml` file.

On Windows:

- `cd sandbox\mqtt`
- `docker compose up -d`
- `cd ..\..`

On maOS/Linux:

- `cd sandbox/mqtt`
- `docker compose up -d`
- `cd ../..`

6.2.2.4. Creating the Configuration File

Copy the default configuration file and create a working `.env` file:

- `cp .env.default .env`

Edit the `.env` file and set `APP_HOST` to `localhost`. Modify other settings as needed.

6.2.3. Running the Program

6.2.3.1. Starting the Application

Start the web application with the following command:

- `python -m raspi_web`

Access the application in your browser at: `http://localhost:8050/`

6.2.3.2. Sending Sample Messages

A sample message sender script is available at `sandbox/mqtt/publish.py`.

Edit the following fields at the bottom of the script to match the message you want to send:

- `Logger_id`
- `model`
- `serial`
- `topic_type`

Then run:

- `python ./sandbox/mqtt/publish.py`

6.2.3.3. Deleting Sample Messages

Sample messages are sent with the "retain" flag enabled. To delete retained messages, use the script at `sandbox/mqtt/none_publish.py`.

Edit the same fields as above, then run:

- `python ./sandbox/mqtt/none_publish.py`

6.3. Reference Links

- Dash Python User Guider (https://dash.plotly.com/)
  - Official documentation for the Dash web application framework.

7. Contact Information

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Contact Information via the Internet

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