



EQXIOxx

10x I/O Expansion Module for EQSP32 IIoT PLC Controller



The [EQXIO10](#) is a compact, user-friendly DIN-rail I/O expansion module designed to enhance the functionality of your [EQSP32 Micro-PLC](#) Industrial IoT controller. Each EQXIO module adds **10 additional digital inputs and solid-state power outputs**, providing expanded control capabilities for a range of industrial and automation applications.

With its **DIN-rail mountable** design, the EQXIO10 fits neatly into control cabinets, enabling organized and efficient wiring for automation projects. This compact approach makes it an ideal solution for clean, professional installations in industrial environments.

Designed to integrate seamlessly, the EQXIO10 is **automatically detected by the EQSP32** upon power-up, functioning as a native peripheral. This plug-and-play capability simplifies setup, allowing users to expand their system with minimal configuration.

The EQXIO10 features a **software watchdog** that ensures safety in case of communication loss with the EQSP32. If the connection is compromised, the watchdog automatically disables all outputs, **placing the system in a safe state** to prevent unintended operations.

The solid-state PWM outputs of the EQXIO10 are equipped with built-in **flyback diodes**, ensuring protection when switching inductive loads such as relays and solenoids. The system also includes **short circuit, over-voltage, and over-current protection**, alongside **thermal shutdown** for the PWM outputs. These safety features ensure reliable operation even in challenging environments, adding an extra layer of durability and resilience to the module's performance.

Keeping the EQXIO10 up-to-date is simple with its front-facing USB-C port, which allows for **easy firmware updates**. This ensures access to the latest features and improvements, maintaining optimal performance throughout its use.

Supported by the **EQ-AI generative AI model**, users can easily generate the necessary code by describing their setup and functionality needs. This approach enables quick integration of the EQXIO10 into new or existing EQSP32-based automation systems, minimizing the need for extensive programming knowledge.



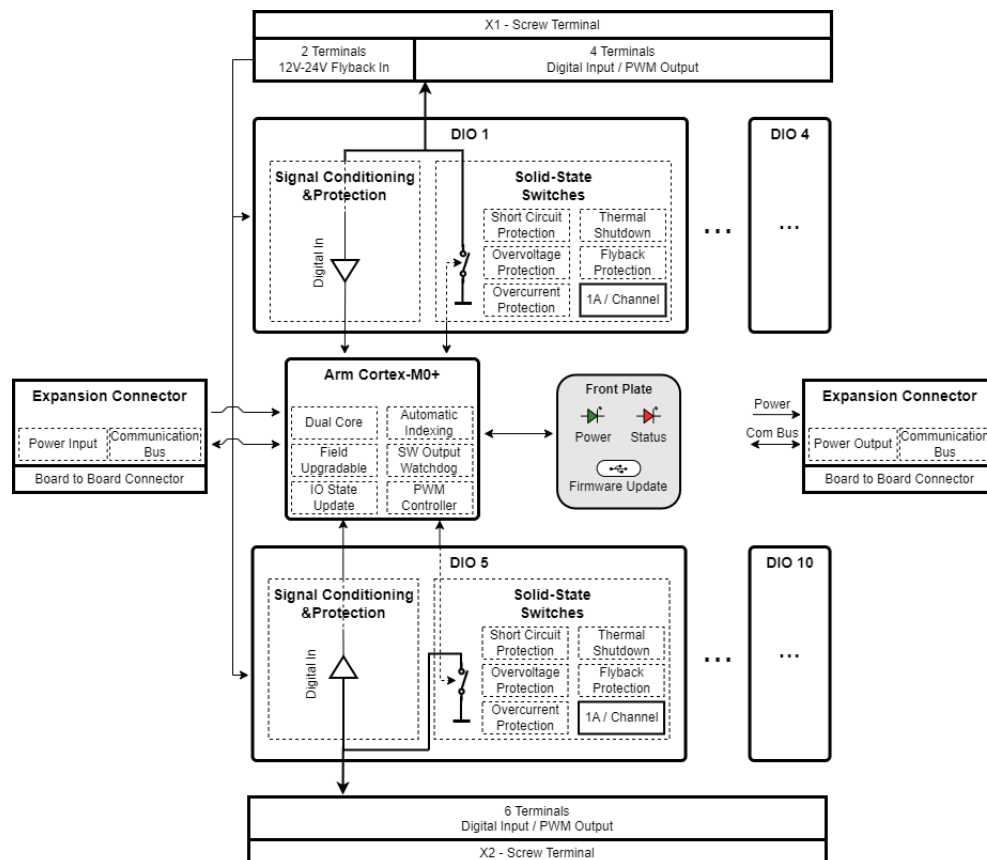
KEY FEATURES

- 10x digital inputs and solid-state PWM Outputs
- Compact DIN-Rail cabinet design for neat and organized installations
- Automatic module detection by EQSP32
- LED indicator for power and module status
- Front-facing USB-C connector for firmware update
- Protected, 24V tolerant Inputs
- 1A max per Open Collector Output
- Current limited and thermally protected Output drivers
- Short circuit protected Output drivers
- Flyback diodes on each Output for safe and efficient switching of Inductive loads
- Generative AI Coding Assistant trained with EQSP32 Library and EQXIO features.
- Compact, 2SU-wide (36mm), DIN-rail mount enclosure with 12 screw terminals
- IP20 Protection
- -20 Min to 55o Max Ambient temperature

APPLICATIONS

- Home Automation
- Industrial Control
- Environmental Monitoring
- Agricultural Applications
- Healthcare Monitoring
- Retail and Inventory Management
- Robotics and Automation
- Educational Projects
- Entertainment and Art Installations

BLOCK DIAGRAM





SYSTEM SPECIFICATIONS

Section	Features
Power Management	Supplied by the board-to-board connector
I/O Terminals	10 x Digital Inputs and Solid-State Outputs 24V Tolerant Inputs
Power PWM Output	10 x 1A power open-collector PWM outputs Externally supplied up to 26V for more flexibility Integrated flyback diodes to VIN for inductive loads (like solenoids & relay coils) Short circuit, over current, over voltage and over temperature protection Overvoltage protection
Indications	Green LED for power indication Red LED for device status
Enclosure	Easy standard DIN rail push-fit mounting with spring mechanism IP20
Expandability	Push fit expansion module mounting Automatic module detection and characterization
Firmware Update	Front-facing USB-C for easy firmware upgrades
Environment	-20°C to 55°C

ELECTRICAL SPECIFICATIONS

Absolute Maximum Values

Pin	Type	Min.	Typ.	Max.	Unit
Supply In + to GND	Power In			28	V
DIO to GND	In/Out	-0.5		VIn (*)	V
	Out			1.3	A

Warning:

() DIO voltage should never exceed the VIN voltage of EQSP for steady states, or else the flyback diodes will conduct continuously!*

Recommended Operating Conditions and Typical Values

Pin	Type	Min.	Typ.	Max.	Unit
Supply In +	Power In	7	12 to 24	26	V
DIO	High (1)	3.3	5 to VIN	VIn (*)	V
	Low (0)	-0.5	0	1.3	
	Power PWM			1	A

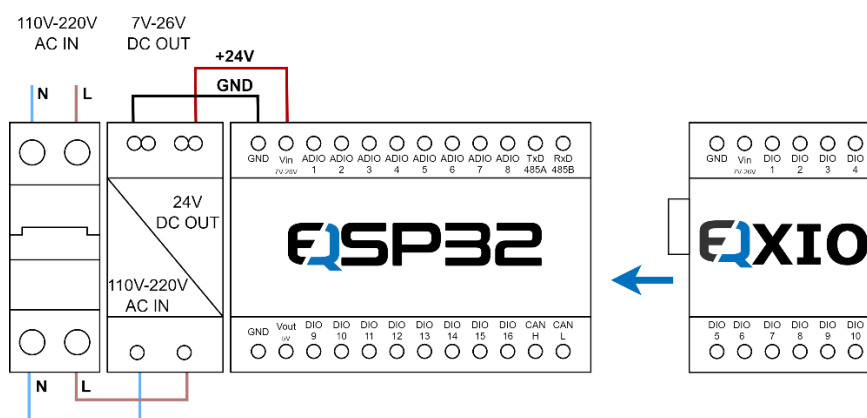
CONNECTING EQXIO

To use the EQXIO I/O expansion module, mount it next to the EQSP32 controller on the DIN rail and simply slide it until the board-to-board connector is fully inserted into EQSP32.

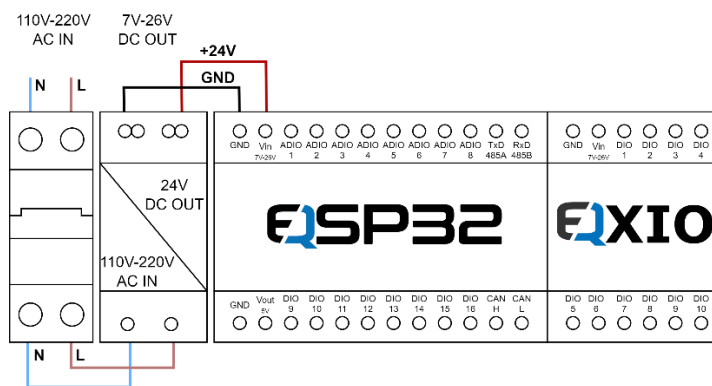
The expansion module is powered by the board-to-board connector and does not require external power supply.

When adding additional modules, it is recommended that the power is disconnected from the system. After adding the expansion modules and powering up the system, EQSP32 will start the automatic detection and indexing process.

For safety and ease of use, it is strongly recommended that a main circuit breaker is used to completely isolate the AC/DC from the grid.



Slide EQXIO to connect on EQSP32



Connected EQXIO on EQSP32

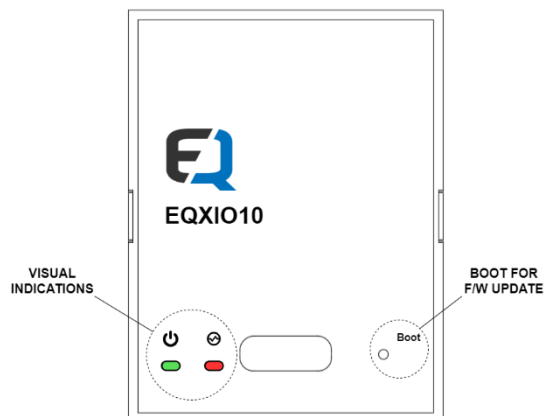
Warning: Make sure that the appropriate ground fault circuit breaker, fuses or circuit breakers and any other necessary protective components are used if there is any risk of user electrocution.

VISUAL INDICATIONS

When the module is connected and the system is powered on, the POWER LED should light up solid green.

If the STATUS LED is solid red after the automatic detection, it means that the EQXIO module has encountered an internal issue.

During data exchange between the main EQSP32 unit and the EQXIO module, the STATUS LED will be flashing for each transaction.



Power LED

On - Powered On



Off - No Power



Status LED

Off - No errors, no communication



Flashing - Data exchange



On - Communication error

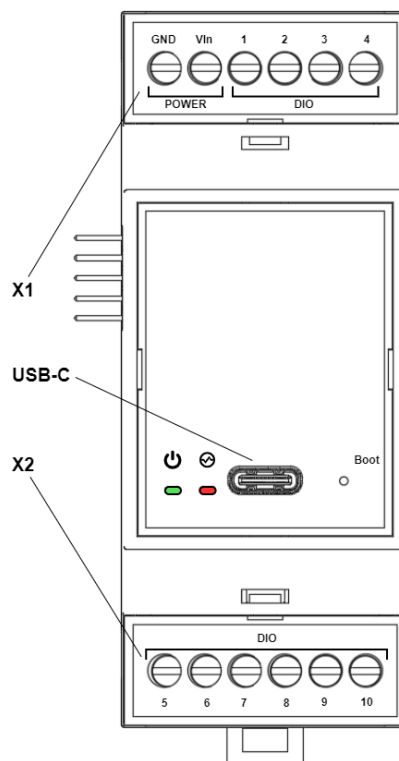


PINOUT

X1 – Screw terminal connector 1

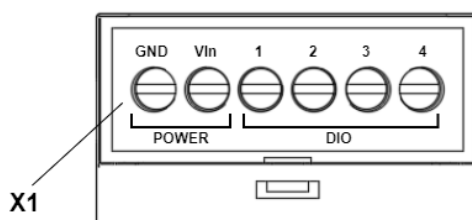
USB-C – Firmware update port

X2 – Screw terminal connector 2



X1 – Screw terminal connector 1

X1 connector accommodates the power input for the flyback diodes and 4 digital inputs and power PWM output pins.



Name	Pin	Function	Type
X1	GND	DC Power Input - (GND) (*)	POWER IN
	VIn	DC Flyback Input + (10V-24V) (**)	POWER IN
	1, ..., 4	Digital Inputs and Power PWM Outputs	DIO

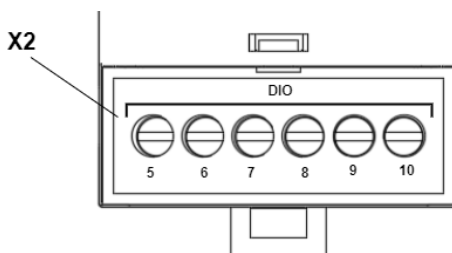
Notes:

(*) DC Power Input GND is common with the system's GND

(**) This is only necessary when inductive loads are driven by the power PWM outputs. When used it must be connected to the power source of the inductive loads.

X2 – Screw terminal connector 2

X2 connector accommodates 6 digital inputs and power PWM output pins.



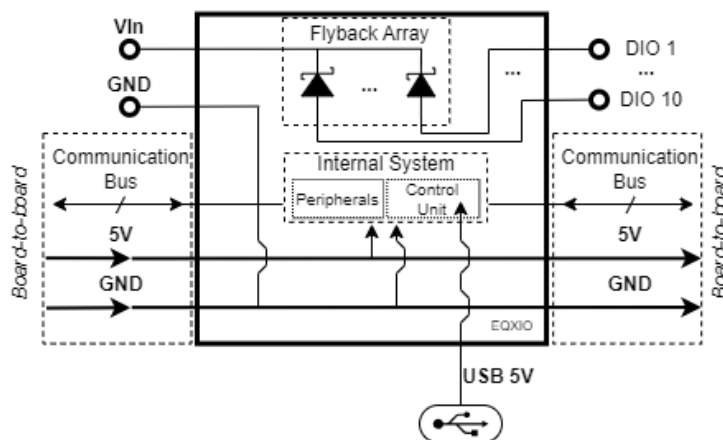
Name	Pin	Function	Type
X2	5, ..., 10	Digital Inputs and Power PWM Outputs	DIO

POWER DISTRIBUTION

EQXIO's internal systems are powered by EQSP32's power management unit via the board-to-board connector. The board-to-board connector carries the power lines for system operation and the communication bus for allowing the expansion modules to interact with the main EQSP32 unit.

EQXIO's control unit may also be powered by the front facing USB-C port. By connecting the IO expansion module via the USB port, the system's core will be powered on, allowing for easy firmware update without any external power supply.

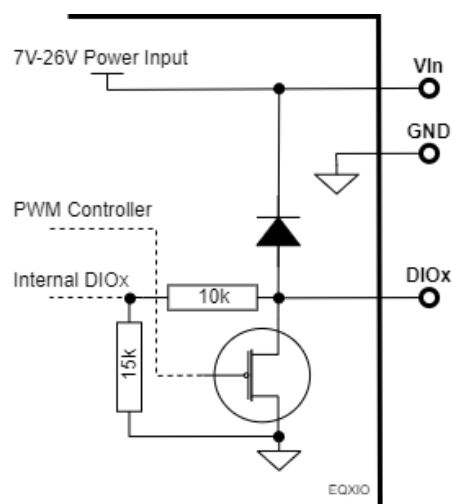
The USB-C port does not supply power to any of the other internal peripherals.



Power distribution

DIGITAL INPUTS & POWER PWM OUTPUTS – DIO

Equivalent DIO Circuit



Equivalent DIO Circuit

DIO Modes Overview

All DIO pins on X1 and X2 terminal support DIN and POUT modes.

Mode	Type	Function
Digital Input (DIN)	Input	Digital
Power PWM Output (POUT)	Output	PWM

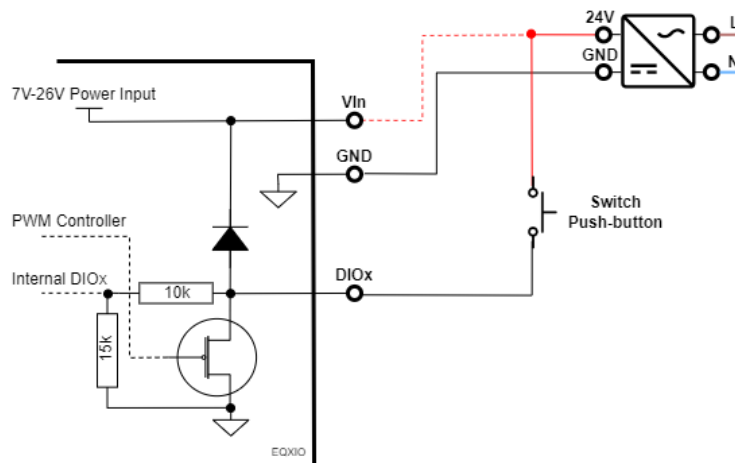
By default, all outputs are disabled, meaning that the PWM value for the solid-state switches is 0%. When the outputs are disabled, the digital input state reflects the externally applied voltage on the terminal.

No configuration is needed for setting the EQXIO's terminal pins in DIN (digital input) or POUT (power PWM output) modes.

For using a pin as DIN, set the output value to 0 (or leave as default). For driving a load, set the pin value to the desired power output value 0-1000 for 0% to 100%.

Digital Input (DIN)

When reading the digital input (DIN) state of the terminal, the returned value is 1 (HIGH) if a voltage of 3.3V-24V is applied or 0 (LOW), when 0V-1.3V is applied.



Example of push-button wired on the 24V

Library Reference	
Usage	
eqsp32.readPin(EQXIO(ii, nn) , mm)	Returns HIGH/LOW based on trigger mode ii: number (index) of EQXIO module on the chain (*) nn: EQXIO pin number mm: trigger mode (optional, default = STATE)

Note:

(*) For 2 EQXIO modules connected on the main unit, the first one (closer to the main unit) will have an index of 1, the second EQXIO index of 2 etc.

The index refers only to the same type of modules. Different types of modules will be indexed with their own type.

Power PWM Output (POUT)

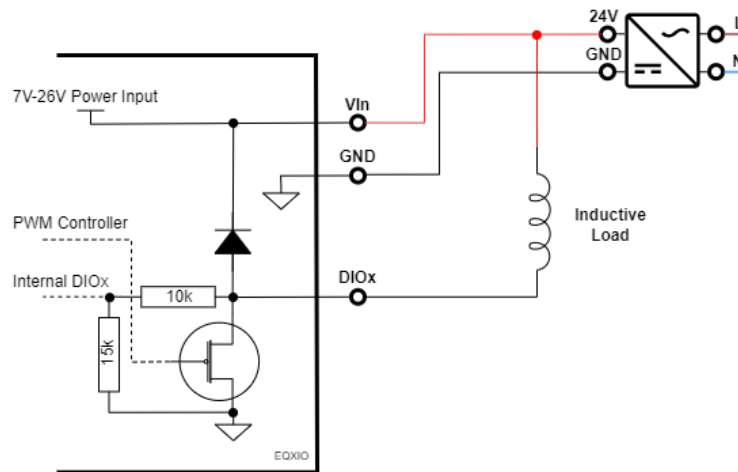
The power PWM output mode (POUT) is meant to be used to drive up to 1A loads per terminal. In this mode the terminal pin operates as an open collector PWM switch.

Inductive and Non-Inductive loads

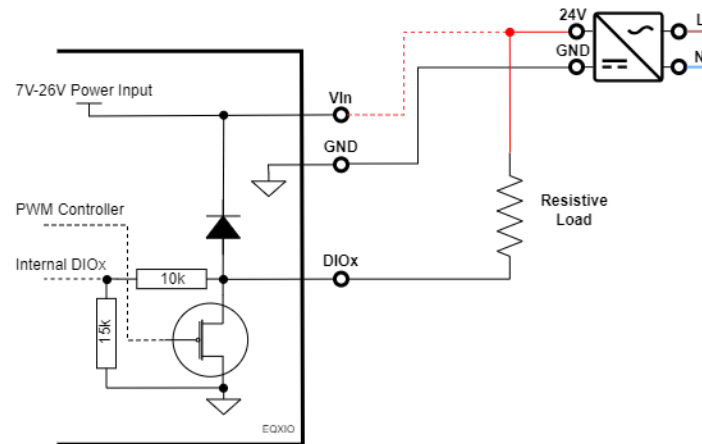
EQXIO incorporates flyback diodes for protecting the mosfets from the overvoltage spikes induced by the switching of relays or solenoids. Thus, inductive and non-inductive loads may be connected on the power PWM outputs in the same way.

Warning: When driving inductive loads, the Vin MUST be connected with the load's driving source for the flyback diodes to function and protect the system from the overvoltage spikes. For resistive loads may be left float but the GND pin should always be common with the load's power supply.

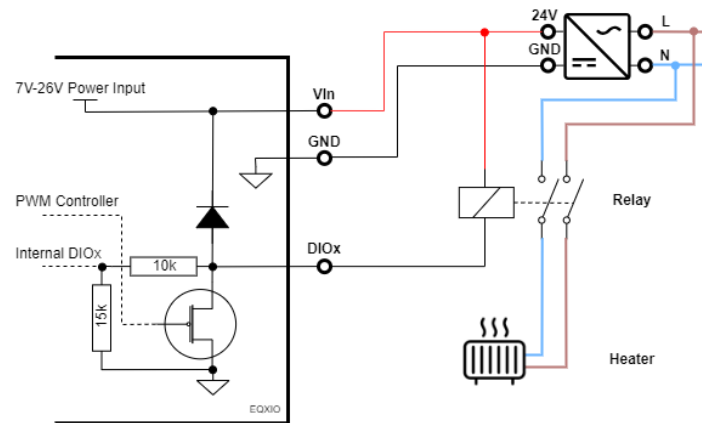
The following diagrams demonstrate various ways to use the DIO as power PWM output.



Example 1: Driving an inductive load, power supply connected on Vin



Example 2: Driving resistive loads, load's power supply connection to Vin is optional



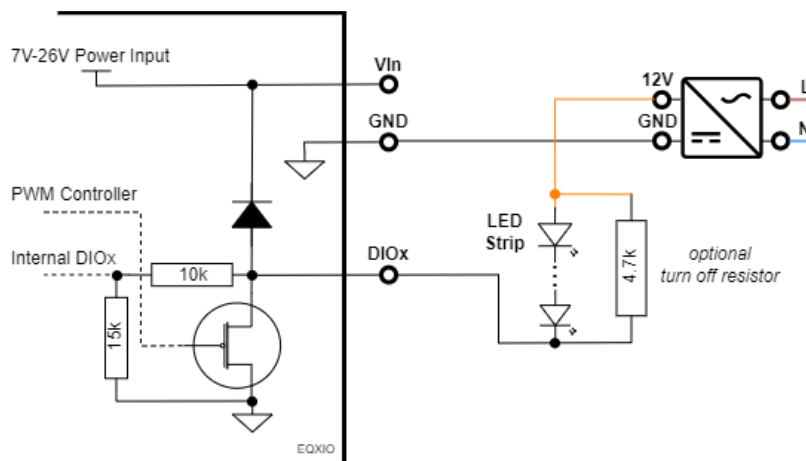
Example 3: EQXIO controlling a 24V Coil Relay to drive a 220V heater

Driving LED Strips

Due to LEDs lighting up with even a very small current, it is recommended that an optional external pull up is used between the anode and the cathode of the LED strip.

The value of the resistor depends on the efficiency of the LEDs, their number and other factors. Generally, an 1k, 0.5W resistor would be appropriate for most cases.

Example: In the following example a 4.7k resistor is used. Assuming our LED strip is rated for 12V, we will use an appropriate power supply.



Example 4: Driving a 12V LED strip

Library Reference	
Usage	
eqsp32.pinValue(EQXIO(ii, nn) , pp)	ii: number (index) of EQXIO module on the chain (*) nn: EQXIO pin number pp: power per 1000 (500 for 50%, 1000 is for 100%)

Note:

(*) For 2 EQXIO modules connected on the main unit, the first one (closer to the main unit) will have an index of 1, the second EQXIO index of 2 etc.

The index refers only to the same type of modules. Different types of modules will be indexed with its own type.



BOOT BUTTON & FIRMWARE UPDATE

Boot Button

The Boot button is only used for entering EQXIO module into firmware update mode (or maintenance mode). To enter maintenance mode, keep the boot button pressed while powering up the module.

Another option is to keep the boot button pressed while sending a reset command to the module via the serial terminal.

Once the module is in maintenance mode, it will be shown as a storage device. Drag and drop the desired .uf2 firmware file into the RPI-RP2 storage device and the update will be performed automatically.

Once the update is done, the unit will be automatically rebooted.

Power cycle the system to trigger the automatic detection procedure and the system will be ready for normal operation.

MECHANICAL DIMENSIONS

All dimensions are measured in mm with a ± 0.1 tolerance.

