EQX EXPANSION MODULE · EQXIOxx FAMILY

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

1 Description

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 for more than 200 ms, 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, overvoltage, and overcurrent 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.

© 2026 Erqos Technologies P.C. · erqos.com

2 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 (36 mm), DIN-rail mount enclosure with 12 screw terminals
- IP20 Protection
- −20 °C to +55 °C operating ambient temperature

3 Applications

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

4 Ordering Information

Part number	Description	I/O	Enclosure
EQXIO10	10x I/O Expansion Module for EQSP32	10 × digital input / PWM output	2SU (36 mm) DIN-rail, IP20

Product page and ordering: erqos.com/product/eqxio10

© 2026 Erqos Technologies P.C. · erqos.com

Contents

1 Description....1
2 Key Features....2
3 Applications....2
4 Ordering Information....2
5 Block Diagram....4
6 Specifications....5
6.1 System Specifications....5
6.2 Absolute Maximum Ratings....5
6.3 Recommended Operating Conditions....5
7 Connecting EQXIO....6
8 Visual Indications....7
8.1 LED Indications....7
9 Pinout....8
9.1 X1 – Screw Terminal Connector 1....8
9.2 X2 – Screw Terminal Connector 2....9
10 Power Distribution....9
11 Digital Inputs and Power PWM Outputs – DIO....10
11.1 Equivalent DIO Circuit....10
11.2 DIO Modes Overview....10
11.3 Digital Input (DIN)....10
11.4 Power PWM Output (POUT)....11
12 Boot Button and Firmware Update....14
12.1 Boot Button....14
13 Mechanical Dimensions....15
14 Notices....16
15 Revision History....16

© 2026 Erqos Technologies P.C. · erqos.com

5 Block Diagram

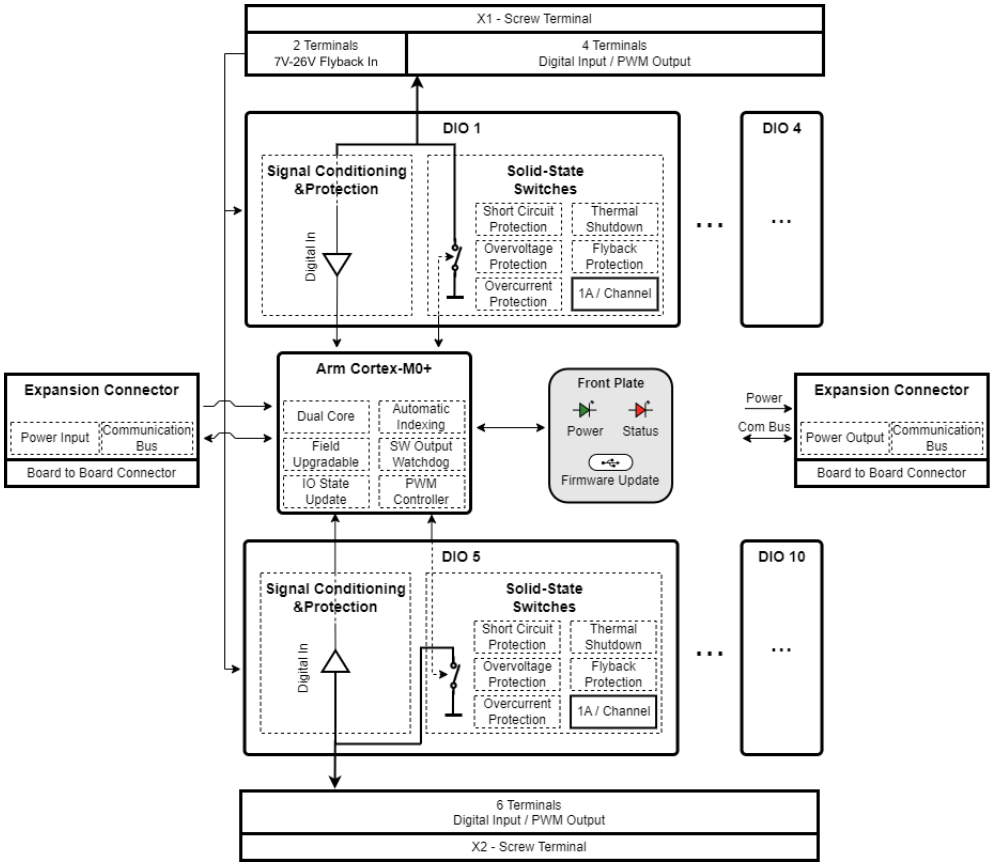

Figure 5-1. EQXIO10 block diagram

6 Specifications

6.1 System Specifications

Table 6-1. 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 VInput for inductive loads (like solenoids & relay coils) Short-circuit, overcurrent, overvoltage and overtemperature 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

6.2 Absolute Maximum Ratings

Table 6-2. Absolute Maximum Ratings

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!

6.3 Recommended Operating Conditions

Table 6-3. Recommended Operating Conditions

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

© 2026 Erqos Technologies P.C. · erqos.com

7 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 an 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.

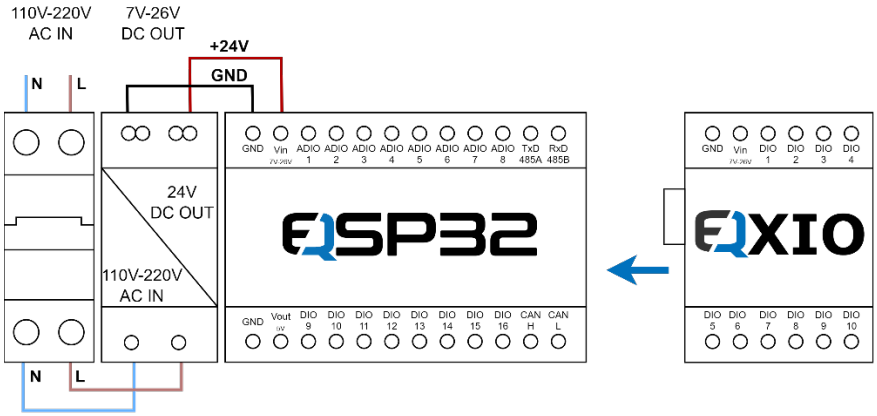

Figure 7-1. Slide EQXIO to connect on EQSP32

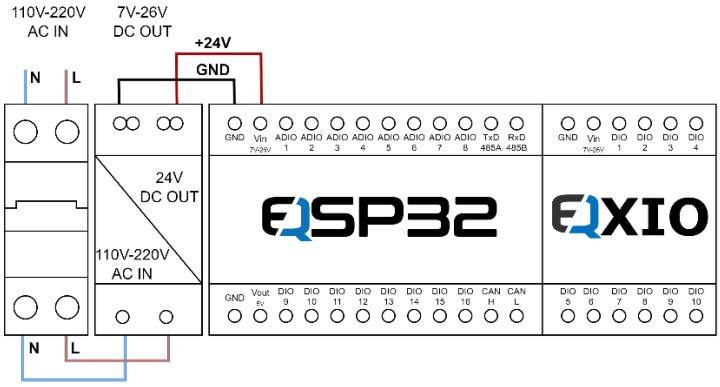

Figure 7-2. Connected EQXIO on EQSP32

> **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.

8 Visual Indications

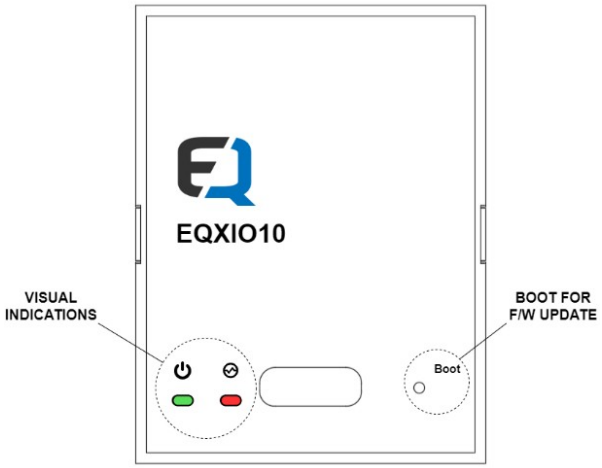

Figure 8-1. Front panel: LEDs and Boot button

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 is not communicating with the EQSP32.

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

8.1 LED Indications

Table 8-1. LED indications

State	Meaning	Pattern
Power LED		
On	Powered on	
Off	No power	
Status LED		
Off	No errors, no communication	
Fast Flashing	Data exchange	
On	Communication error	

9 Pinout

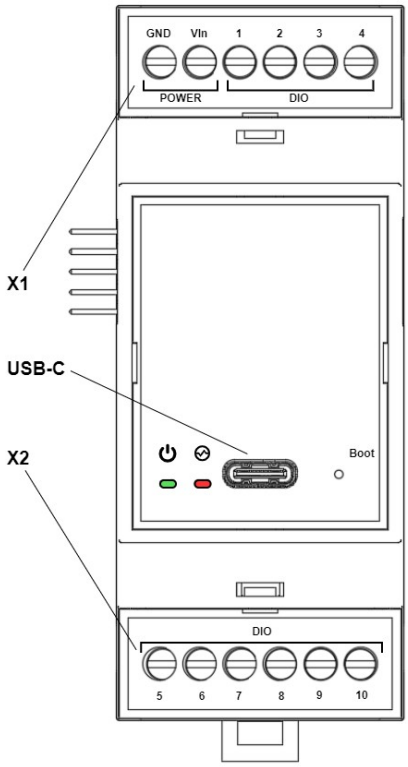

Figure 9-1. EQXIO10 terminals and front panel

X1 – Screw terminal connector 1

USB-C – Firmware update port

X2 – Screw terminal connector 2

9.1 X1 – Screw Terminal Connector 1

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

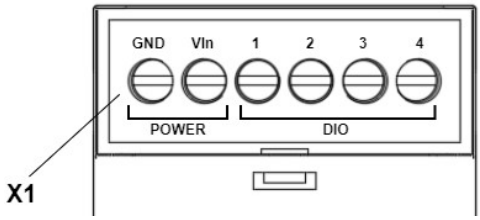

Figure 9-2. X1 terminals

Table 9-1. X1 – Screw Terminal Connector 1

Name	Pin	Function	Type
X1	GND	DC Power Input - (GND) (*)	POWER IN
	VIn	DC Flyback Input + (7V-26V) (**)	POWER IN
	1, ..., 4	Digital Inputs and Power PWM Outputs	DIO

> **NOTE**
> (*) 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.

9.2 X2 – Screw Terminal Connector 2

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

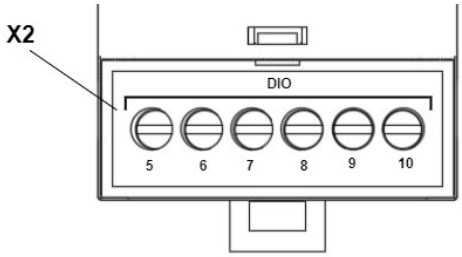

Figure 9-3. X2 terminals

Table 9-2. X2 – Screw Terminal Connector 2

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

10 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 I/O 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.

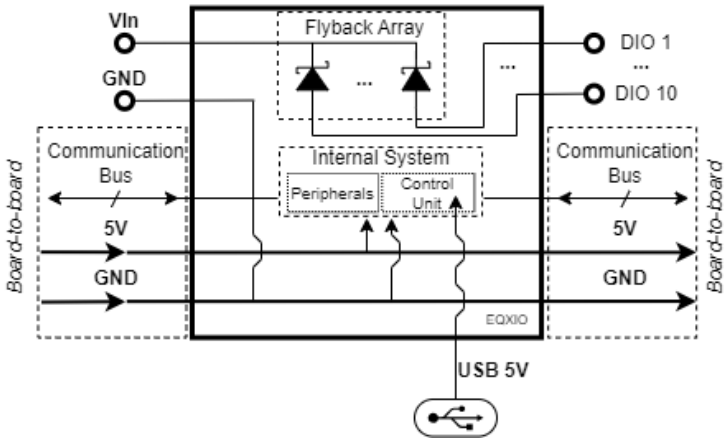

Figure 10-1. Power distribution

11 Digital Inputs and Power PWM Outputs – DIO

11.1 Equivalent DIO Circuit

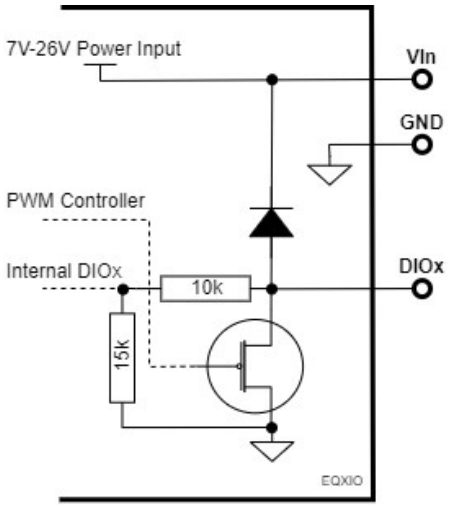

Figure 11-1. Equivalent DIO Circuit

11.2 DIO Modes Overview

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

Table 11-1. DIO Modes Overview

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%.

A pin can also be set to DIN or POUT with `eqsp32.pinMode()`. A pin set to DIN does not accept output values. Changing the mode of a pin switches its output off, and the output stays off until a new value is written. For a pin set to POUT, `eqsp32.readPin()` returns the output value last written.

If the module receives no communication from the EQSP32 for more than 200 ms, its communication watchdog switches all outputs off. The outputs stay off until new output values are written.

11.3 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.

© 2026 Erqos Technologies P.C. · erqos.com

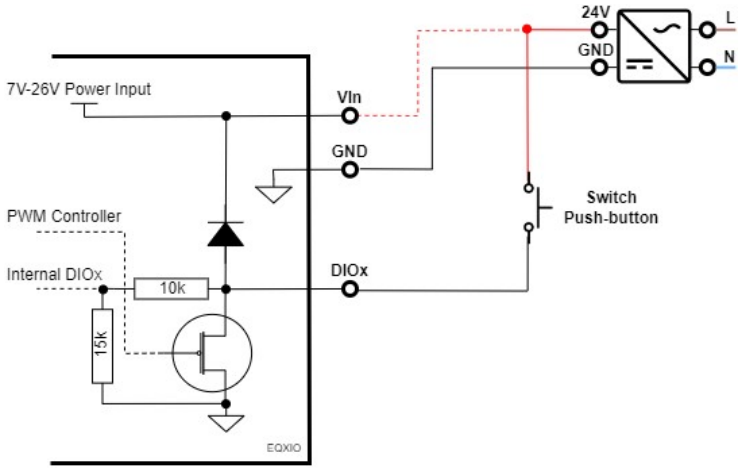

Figure 11-2. Example of push-button wired on the 24V

Table 11-2. Library reference: Digital Input (DIN)

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.

A module that is not connected reads as all inputs 0. Use `eqsp32.isModuleDetected( EQXIO(ii) )` to tell a disconnected module from inputs that are off.

11.4 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, it may be left floating, 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.

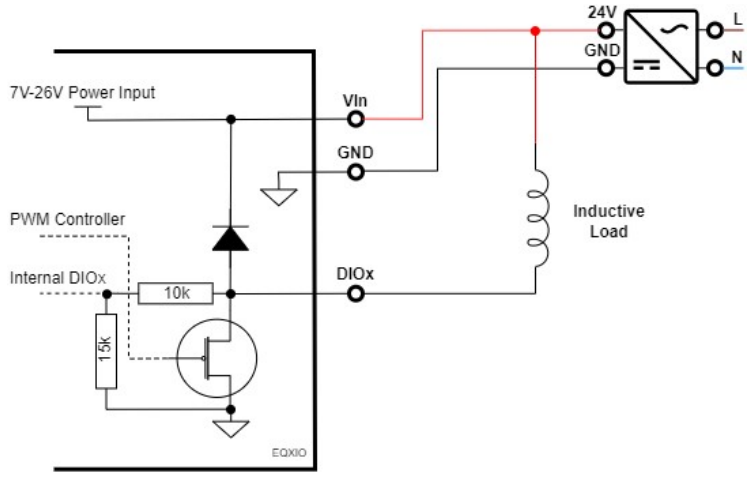

Figure 11-3. Example 1: Driving an inductive load, power supply connected on VIn

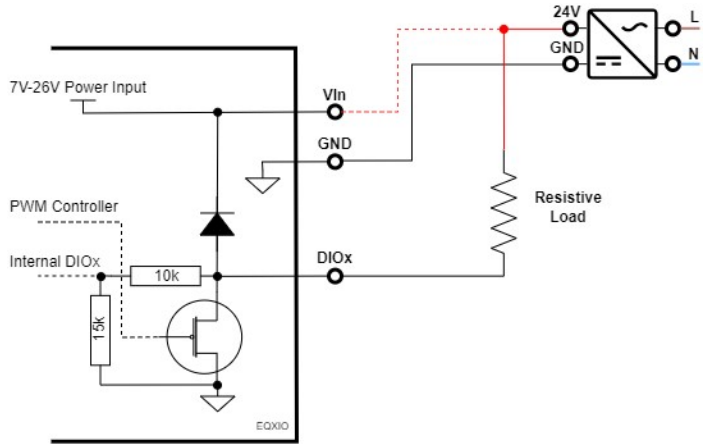

Figure 11-4. Example 2: Driving resistive loads, load's power supply connection to Vin is optional

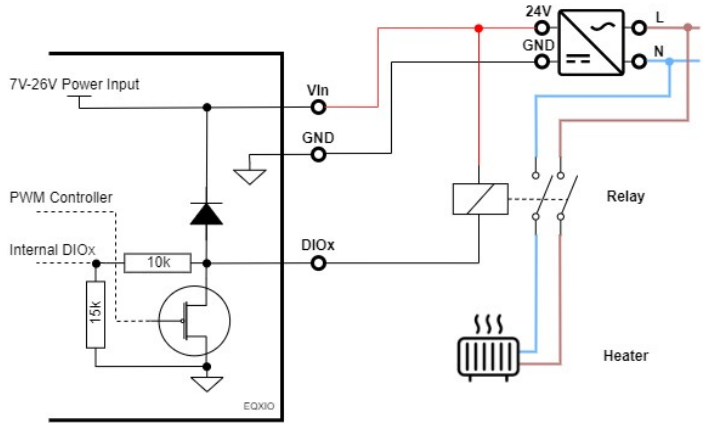

Figure 11-5. Example 3: EQXIO controlling a 24V Coil Relay to drive a 220V heater

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, a 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.

© 2026 Erqos Technologies P.C. · erqos.com

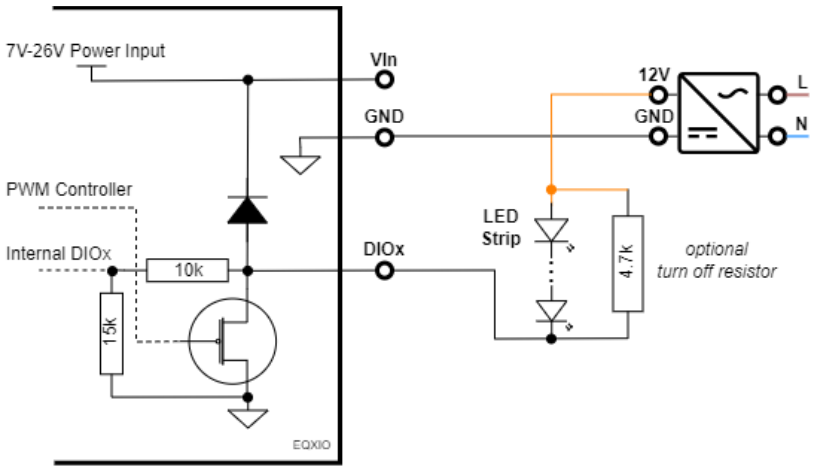

Figure 11-6. Example 4: Driving a 12V LED strip

Table 11-3. Library reference: Power PWM Output (POUT)

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%) A value above 1000 is ignored and the output keeps its previous value

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.

© 2026 Erqos Technologies P.C. · erqos.com

12 Boot Button and Firmware Update

12.1 Boot Button

The Boot button is only used for entering the 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 (`!RST=1`, 115200 baud).

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.

From EQSP32 library v1.2.0, the EQXIO needs firmware v2.0 or later. A module with firmware v1.0 is reported as not connected; update it as described above.

© 2026 Erqos Technologies P.C. · erqos.com

13 Mechanical Dimensions

All dimensions are measured in mm with a +/-0.1 tolerance.

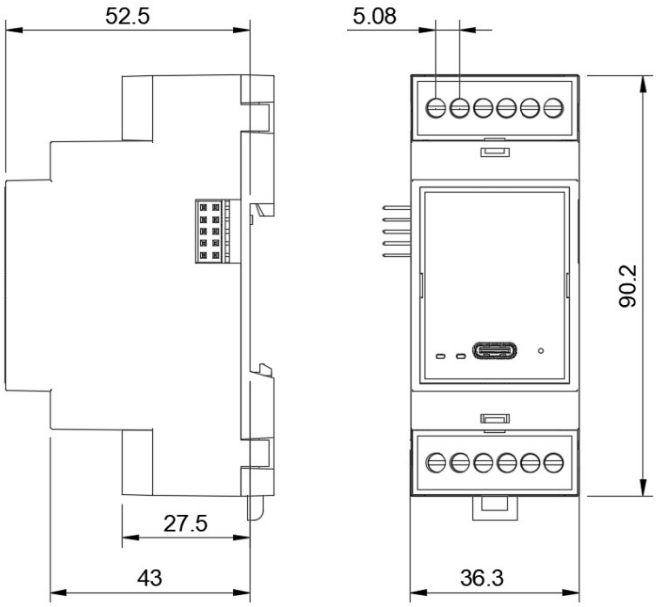

Figure 13-1. Mechanical dimensions: side and front views

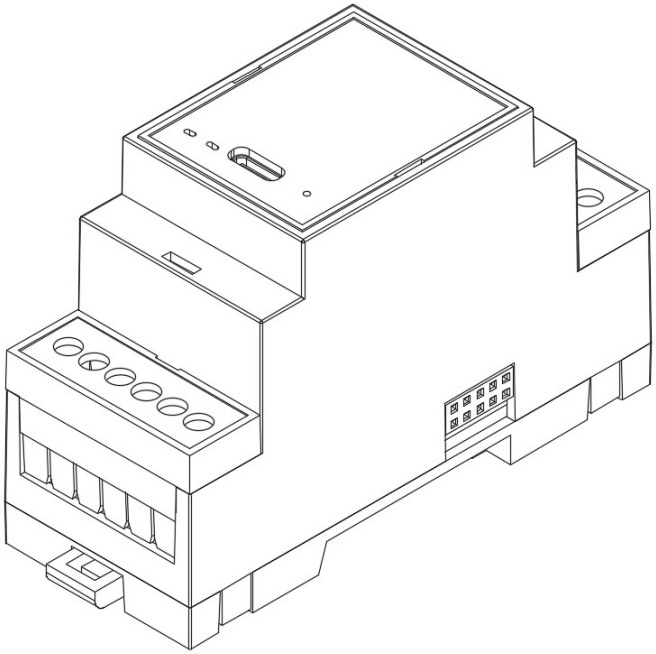

Figure 13-2. Mechanical dimensions: 3D view

14 Notices

Erqos Technologies P.C. may change products, specifications and this document at any time without notice. Always use the latest revision, available at erqos.com.

These products and this document are intended for qualified professionals. The information in this document is provided as is. Erqos Technologies P.C. assumes no liability for its use. Customers are responsible for designing and testing their own applications, including the protection of connected equipment and persons.

15 Revision History

VERSION	REVISION	STATUS
v1.1	**Rev102026**	**Released**

Table 15-1. Revision history

Version	Revision	Date	Status	Changes
v1.1	Rev102026	20 Oct 2026	Released	Updated for firmware v2.0; added the pin modes and watchdog timeout.
v1.0	Rev101926	19 Oct 2026	Released	First released version.

Erqos Technologies P.C.
Krinou 6, 194 00 Koropi, Greece
erqos.com