



RTU CONTROLLER · MODBUS RTU

6Oi6Ro

6 Opto-Isolated Inputs · 6 Relays · Modbus RTU

INPUTS	6 opto-isolated · 5–30 V DC · polarity-insensitive
RELAYS	6 × Omron · 16 A @ 250 V AC
BUS	RS-485 Modbus RTU · up to 247 devices
POWER	9–30 V DC · DIN-rail · –40 to +55 °C

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1 Introduction

The **FoxIoT 6Oi6Ro** is a DIN-rail Modbus RTU controller with **6 opto-isolated digital inputs** and **6 relay outputs**, built for clean signal reading and industrial switching in noisy electrical environments. Each input is galvanically isolated and polarity-insensitive, each output is a high-quality Omron relay rated 16 A. It communicates over RS-485 using Modbus RTU and integrates easily with PLCs, SCADA, BMS, and automation platforms.

A built-in **rule engine** runs internal automation independently of the Modbus master — for example switching relays on input changes for lighting — so critical functions continue even if the communication link fails. Firmware updates are delivered in-field over Modbus, and a coil-voltage-reduction mode lowers power while relays are active. All input and communication pins are protected against wiring mistakes and voltage spikes (the RS-485 lines tolerate accidental connection of up to 30 V).

1.1 Key features

- 6 opto-isolated, polarity-insensitive digital inputs, 5–30 V DC, 3750 Vrms isolation.
- 6 × Omron relays, 16 A @ 250 V AC, with coil-voltage-reduction mode.
- RS-485 Modbus RTU, 300–115200 bps, up to 247 devices.
- Built-in rule engine (up to 8 rules) for standalone automation and safe fallback.
- Front-panel configuration and manual relay switching, remote configuration over Modbus.
- Wide –40 to +55 °C range, protected I/O and bus pins.

1.2 Typical applications

- **Industrial automation** — read clean digital signals from PLCs, sensors, or other controllers and switch machinery or actuators.
- **Building automation (HVAC & lighting)** — switch lights, fans, or heating from wall switches or motion sensors via internal rules, or directly from a Modbus master.
- **Energy management & VPP** — switch contactors and other local equipment on commands from the VPP platform, return outputs to a default state if master communication is lost.
- **Agriculture & greenhouses** — read float switches, motion sensors, or climate systems and activate fans, heaters, or irrigation.
- **Remote / distributed sites & interlocks** — local rules keep critical functions running when the network is unreliable.

About this manual. This is the hardware product manual for the 6Oi6Ro — installation, configuration, and operation. For the full Modbus register definitions, communication examples, and rule configuration, see the [Modbus Register Map](#).

Related documents

Document	Link
Datasheet / product overview	foxiot.eu/products/rtu-controllers/6oi6ro
Modbus Register Map	PDF · XLSX
Connection schematics (wiring)	PDF

2 Safety

Read and understand this manual before installation or maintenance. The following guidance protects personnel and equipment.

2.1 General safety guidelines

- Only qualified personnel should install, wire, or service the device.
- Use appropriate personal protective equipment when working with electrical components.
- Do not operate the device if it appears damaged or has been exposed to moisture.
- Ensure all wiring and connections comply with local regulations and standards.
- Keep the working area clean and free of conductive materials.

2.2 Electrical installation safety

Electrical hazard — risk of severe injury or death. Relay outputs may switch mains voltage (e.g. 230 V AC). A lethal shock is possible if terminals are touched during operation. **Always disconnect power before any installation or maintenance**, including circuits connected to the relays. Mains wiring must be performed only by qualified personnel in accordance with local electrical regulations.

- **DIN-rail mounting** — ensure the controller is fully engaged on the rail inside an electrical cabinet, with the mounting clip locked to prevent movement.
- **Low-voltage wiring** — use appropriate low-voltage wire for power and inputs, do not route low- and high-voltage wiring together (may be prohibited locally).
- **Modbus data line** — use twisted-pair cable with controlled impedance ($\approx 120 \Omega$) on the RS-485 lines to reduce interference.
- **Relay wiring** — use properly rated wiring, especially when switching high-voltage equipment.
- **Labels** — follow terminal markings, polarity indicators, and voltage ratings on the device.
- **Moisture and dust** — install in a dry, dust-free place, or inside a suitable protective enclosure.

Relay output limits

Each of the six relays is rated up to **250 V AC / 16 A (resistive)**, and **24 V DC / 16 A** for DC loads. The 16 A rating applies to purely resistive loads — do not exceed rated voltage or current. Relays are suitable for lighting circuits, heating elements, motors, and general-purpose loads.

- **Motors and inductive loads** switch at lower usable current (e.g. 200,000 operations at 8 A, 250 V AC, $\cos\phi = 0.4$).
- **High-inrush capacitive loads** (LED drivers, power supplies) can exceed safe switching limits and weld contacts — use an inrush limiter or an external contactor rated for such loads.
- **Separate power sources** — if low-voltage control power and relay-switched power come from different sources, keep them isolated to prevent cross-connection.

Disclaimer. FoxIoT OÜ is not responsible for damage, injury, or loss resulting from improper installation, misuse, or unauthorized modification of this device. Use of the device in ways not specified by FoxIoT OÜ may impair its safety features and void the warranty.

2.3 Handling, storage & environment

Handle with care to avoid mechanical shock. Do not press hard on the front-panel buttons. Store in the original packaging in a clean, dry place within the rated temperature range, and protect the product from vibration and impact during transport. The device is for indoor cabinet use, outdoor installation is possible only inside a suitably rated weatherproof enclosure (IP65 or higher). Avoid excessive humidity/condensation, direct sunlight or radiant heat, and corrosive gases, dust, or vibration. For altitudes above 2000 m or non-standard environments, consult FoxIoT.

3 Quick Start

A minimal path to get the controller powered, addressed, and talking Modbus. **Read the Safety section first.**

1. **Mount** the unit on the DIN rail inside the cabinet, lock the clip.
2. **Wire power** — 9–30 V DC to the power terminals (observe polarity).
3. **Wire RS-485** — A (+) to master A (+), B (–) to master B (–), terminate the bus ($\approx 120\ \Omega$) if needed.
4. **Set the address & serial parameters** — factory defaults are address 1, 9600 bps, 8E1. To change them, power on, then within 10 s hold Buttons 1 + 2 to enter configuration mode (see [Configuration](#)).
5. **Verify communication** — the green Traffic LED blinks on valid Modbus activity. You are ready to read inputs and switch relays.

4 Specifications

4.1 Electrical

Parameter	Value
Nominal voltage	12 V or 24 V DC
Operating voltage range	9–30 V DC
Idle power consumption	0.2 W @ 12 V / 0.3 W @ 24 V
Power (all relays on, coil reduction enabled)	1.8 W @ 12 V / 2.1 W @ 24 V
Power (all relays on, coil reduction disabled)	3.0 W @ 12 V / 3.3 W @ 24 V
Reverse-voltage protection	Up to 30 V

4.2 Inputs & outputs

Parameter	Value
Inputs	6 digital, optocoupler-isolated (LTV-354T-A)
Polarity	Bidirectional — polarity-insensitive
Isolation voltage	3750 Vrms (input to logic side)
Input protection	TVS diode: ± 30 kV ESD (IEC 61000-4-2), EFT (IEC 61000-4-4)
Input resistors	$2 \times 2.7 \text{ k}\Omega$ in series (5.4 k Ω total)
Minimum guaranteed activation voltage	$\geq 5 \text{ V DC}$
Max input voltage	30 V DC
Typical input current	$\sim 2.0 \text{ mA @ } 12 \text{ V}$ / $\sim 4.2 \text{ mA @ } 24 \text{ V}$
Software debounce filter	50 ms
Relays	6 $\times$ Omron G2RL-1-E (SPDT, NO + NC)
Relay rating	250 V AC / 24 V DC, max 16 A
Mechanical life	20 million operations
Electrical life	30,000 ops @ 16 A 250 V AC, 200,000 ops @ 8 A 250 V AC ($\cos\phi$ 0.4)
Coil voltage reduction	Software-controlled (enabled by default)

4.3 Buttons & LEDs

Parameter	Value
Buttons	6 — relay control, and configuration at start-up
Relay status LEDs	6 yellow (off / on / blinking)
Input status LEDs	6 green
Status LED	1 red — device operational status
Traffic LED	1 green — Modbus communication activity

4.4 Communication

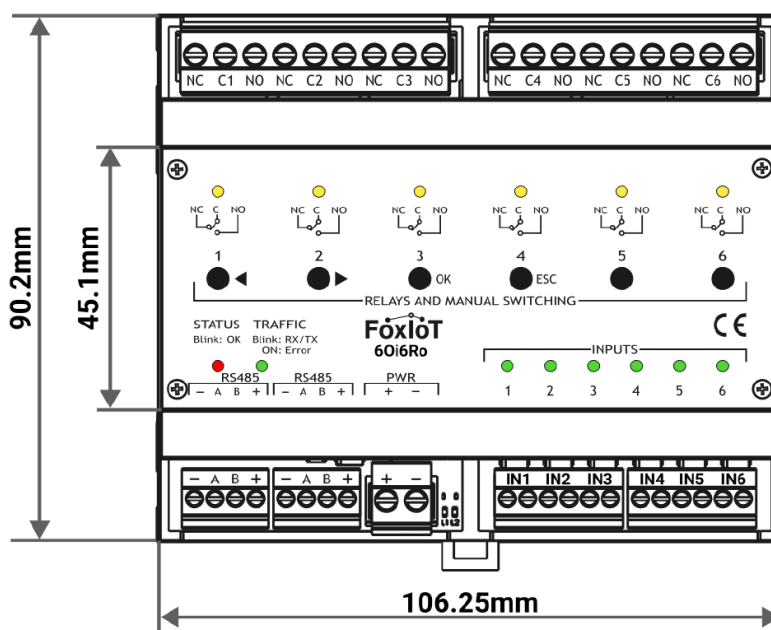
Parameter	Value
Interface	RS-485, Modbus RTU slave
Baud rates	300 / 600 / 1200 / 2400 / 4800 / 9600 / 19200 / 38400 / 57600 / 115200
Data format	8N1 / 8N2 / 8E1 / 8O1
Factory default	Address 1 · 9600 bps · 8E1
Modbus address (via Modbus / buttons)	1–247 / 1–62
Bus pin protection / ESD	±30 V / ±16 kV HBM
Fail-safe receiver	Open-circuit, short-circuit, idle-bus
Network capacity	Up to 247 devices (reduced-load driver)
Common-mode range	–20 V to +25 V

4.5 Processor

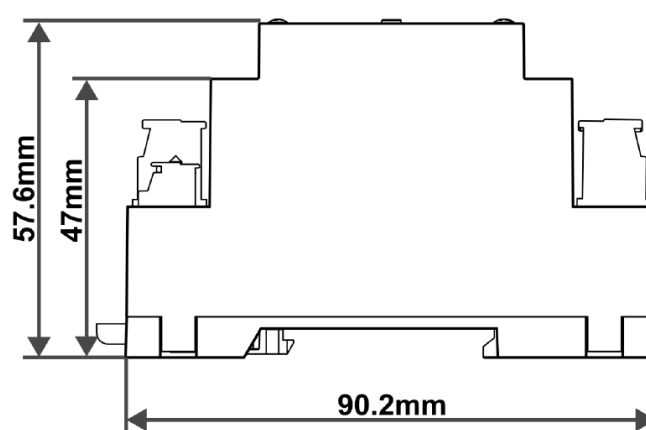
Parameter	Value
Type	32-bit ARM Cortex-M33
Clock	Up to 76.8 MHz

4.6 Mechanical

Parameter	Value
Mounting	DIN-rail (TH35, EN 60715)
Module size	6M (6 × 17.5 mm slots)
Dimensions (L × W × H)	106 × 90 × 58 mm
Weight	265 g
Connectors	Pluggable terminal blocks: inputs 2 × 6-pin, RS-485 & power 2 × 4-pin ($\leq 1.5 \text{ mm}^2$), external power 1 × 2-pin, relays 6 × 3-pin ($\leq 2.5 \text{ mm}^2$)



6Oi6Ro front panel and dimensions (mm)



6Oi6Ro side view dimensions (mm)

4.7 Environmental & certifications

Parameter	Value
Operating temperature	−40 to +55 °C
Storage temperature	−40 to +60 °C
Relative humidity	<90 %, non-condensing
Altitude	Up to 2000 m
CE compliance	2014/30/EU (EMC), 2014/35/EU (LVD)

5 How It Works

5.1 Input channels

The 6 inputs are digital only, each electrically isolated with a bidirectional optocoupler. They detect DC signal levels from switches, relay contacts, sensors, or controller outputs — dry contacts (with an external supply), open-collector outputs, and active-high logic signals. Each input is **polarity-insensitive** and activates reliably from **5 V to 30 V DC**. TVS diodes protect every input (IEC 61000-4-2 ESD, IEC 61000-4-4 EFT), and a 50 ms software debounce filter prevents false triggering from contact bounce.

The green input LED lights when the input is active (≥ 5 V). Besides the plain on/off state, each input has a counter register that tracks activations, recent changes (30 s flag), single clicks, double clicks, and long presses (> 2 s), so a master polling slowly still catches every event. Details are in the Modbus Register Map.

The inputs do not support analog voltage, 4–20 mA current loops, or NTC sensors. For those, use the **6Ai6Ro** controller.

5.2 Relay outputs

Six Omron G2RL-1-E SPDT relays, each with NO and NC contacts, switch resistive, motor/inductive, and (with care) capacitive loads up to 16 A — see [Safety](#) for load limits. Each relay is controlled over Modbus or by the internal rules, and a timer register can switch a relay on for a set number of seconds. Relay states are shown on the yellow LEDs and can be read over Modbus.

The software-controlled **coil voltage reduction** lowers the coil voltage after the relay has switched, reducing power consumption and heat and improving long-term relay durability.

5.3 Communication & power

A single RS-485 interface (two parallel terminal blocks for daisy-chaining) speaks Modbus RTU as a slave to PLCs, SCADA, BMS, or a gateway. A reduced-load driver allows up to 247 devices on one bus. ± 30 V fault protection prevents damage if, for example, 24 V is accidentally connected to A or B, and a fail-safe receiver keeps behaviour correct when the bus is idle, open, or shorted. Address, baud rate, and serial format are set over Modbus or with the front-panel buttons.

The device is powered from 9–30 V DC (12 V or 24 V nominal) with reverse-voltage protection up to 30 V.

5.4 LEDs, buttons & rule engine

Front-panel LEDs show relay status (6 yellow), input status (6 green), device status (1 red), and Modbus traffic (1 green).

The six **buttons** are used for on-site configuration at start-up (see [Configuration](#)) and, in normal operation, for local relay control — manual override, safety lockout, or local-only operation. Their behaviour is set over Modbus:

- **Disabled** — buttons do nothing.
- **Enabled** (default) — each button toggles its relay.
- **Offline** — buttons toggle relays only when no Modbus master has queried the controller for 60 s.
- **Relay disable** — a button press switches its relay off and blocks Modbus control of it (relay LED flashes), a second press restores the relay to the state in its Modbus register. Cleared on reboot.

The built-in **rule engine** runs up to **8 rules** at the same time, continuously and locally, regardless of Modbus communication. Each rule is independent and can control one or more relays:

Rule	What it does
Toggle relay	Each selected input toggles its own relay (input 1 → relay 1, ...), as a toggle switch or push button — typically lighting.
Flexible switch	Several inputs control several relays via bitmasks, each input a toggle switch or push button, with an optional countdown timer that switches the relays off and restarts on new input events — room lighting and scenes.

To change a rule, disable it, write the new parameters, and enable it again — changes take effect when the rule is re-enabled. Rule parameters and examples are in the Modbus Register Map.

6 Installation

- 1. Unpack and inspect** the device for transport damage and check the model and ratings. If it is damaged or incomplete, do not install it — contact FoxIoT support. The package contains the 6Oi6Ro controller (pluggable connectors attached) and a sticker with a QR code linking to the online documentation.
- 2. Mount** upright on a 35 mm TH35 DIN rail (EN 60715) inside an electrical cabinet, so the LEDs stay visible: tilt the top toward the rail, hook the upper part of the clip over it, and press the bottom in until the clip locks. To remove, release the bottom clip with a small flat-head screwdriver, then tilt and lift.
- 3. Wire** inputs, relays, RS-485, and power using the pluggable terminal blocks.

For terminal assignments and wiring diagrams, see the [Connection Schematics \(Wiring Instructions\)](#).

Disconnect all power before wiring. Do not route low- and high-voltage wiring together. Double-check polarity and that every connection is secure before powering on — loose connections can cause malfunction or damage.

7 Configuration

7.1 Quick setup via front-panel buttons

You can configure the **Modbus address, baud rate, and serial format** on-site with the front-panel buttons — no software needed. See the front-panel drawing in [Specifications](#) for button and LED positions.

Enter configuration mode: power off, power on, and **within 10 seconds press and hold Buttons 1 + 2** together (if you miss the window, power-cycle and try again). The Status and Traffic LEDs blink rapidly and Input LED 1 blinks slowly to confirm. A 60-second inactivity timer (reset by every button press) auto-exits and saves.

Button	In menu	While editing a value
1 ◀	Previous item	Decrease value
2 ▶	Next item	Increase value
3 OK	Select item	Save value
4 ESC	Exit menu	Cancel without saving

Menu LEDs: Input LED 1 = address, LED 2 = baud rate, LED 3 = serial format. Only one is active at a time — a **blinking** LED means you are navigating, a **solid** LED means that item is being edited.

Value readout: the value is shown in binary on the six yellow relay (output) LEDs. Add the weights of the lit LEDs:

LED	1	2	3	4	5	6
Weight	1	2	4	8	16	32

Examples: LED 1 = 1 · LEDs 1+2 = 3 · LEDs 1+3 = 5 · LEDs 2+4 = 10 · LEDs 1+3+5 = 21 · all LEDs = 63.

Setting the Modbus address

Navigate until Input LED 1 blinks → **OK** (LED 1 solid) → use ◀▶ to set the value (**1–62** from buttons, higher addresses via Modbus) → **OK** to save or **ESC** to cancel.

Setting baud rate & serial format

Navigate to LED 2 (baud) or LED 3 (format), press **OK** (LED solid), choose with ◀▶, then **OK** to save or **ESC** to cancel:

- **Baud:** 1=300, 2=600, 3=1200, 4=2400, 5=4800, 6=9600, 7=19200, 8=38400, 9=57600, 10=115200 bps.
- **Format:** 1=8E1 (even parity, 1 stop bit), 2=8N2 (no parity, 2 stop bits), 3=8N1 (no parity, 1 stop bit), 4=8O1 (odd parity, 1 stop bit) — all 8 data bits.

Press **ESC** repeatedly until all LEDs stop blinking to exit and apply settings.

7.2 Remote configuration (via Modbus)

All parameters — relay control, coil reduction, button mode, rule definitions, and communication settings — can be read and written remotely over Modbus RTU, suitable for automated setup and bulk management. For the full register list, see the [Modbus Register Map](#).

8 Operation

The 6Oi6Ro operates as a Modbus RTU slave over RS-485. All input/output data, configuration, and rule parameters are accessible via Modbus holding registers (function codes 03, 06, 16), so the controller integrates directly with PLCs, SCADA, and gateways. Write 1 to a relay register to switch it on and 0 to switch it off. For complete register definitions, communication examples, and rule configuration, refer to the [Modbus Register Map](#).

9 Firmware Update

The 6Oi6Ro supports in-field firmware updates over Modbus, allowing new features and fixes without physical access. Firmware is provided by FoxIoT and is written in blocks to a dedicated register, the controller reboots automatically 5 seconds after the last block. Do not disconnect power or communication during an update. After updating, verify the firmware version via its Modbus register and confirm settings are unchanged. The update procedure is documented in the [Modbus Register Map](#).

10 Troubleshooting

10.1 Status & traffic LEDs

LED	State	Meaning
STATUS	Blinking	Normal operation — powered and running
STATUS	Off	No power, or device failed to start
TRAFFIC	Short blink (50 ms)	Valid Modbus packet received on the bus (any address)
TRAFFIC	Long blink (300 ms)	Controller responded to a request addressed to it
TRAFFIC	Solid on	Communication error — check baud, parity, A/B wiring
TRAFFIC	Off	No communication activity

10.2 Common problems

Problem	Likely cause	Action
No power	Supply disconnected, low voltage, or reversed polarity	Verify 9–30 V DC, correct polarity, within range
No communication	Wrong address / baud / format, A-B wiring	Match master address, baud, parity and stop bits, A(+) $\rightarrow$ A(+), B(-) $\rightarrow$ B(-), check bus termination with multiple devices
Digital input not detected	Contact not closing, signal below 5 V, wiring, wrong register	Verify the contact closes and the signal provides ≥ 5 V DC, check wiring, check you read the correct input register, use the green input LED to confirm
Relay does not switch	Wrong command or damaged relay	Write 1=ON / 0=OFF, if the output LED is on but there is no click or output change, the relay may be damaged, check wiring and voltage at the relay terminals
Relay ignores button	Buttons disabled or other button mode set	Check the button mode in the configuration registers (see Modbus Register Map)

11 Maintenance

Disconnect all power sources — controller supply and any connected external circuits — before handling the device.

The device is designed for indoor cabinet use and needs minimal maintenance.

- **Cleaning** — wipe the enclosure with a dry or slightly damp lint-free cloth, no solvents or abrasives.
- **Connectors** — periodically inspect power and communication terminals, clean oxidation/debris with electronics-approved contact cleaner or compressed air.
- **Environment** — keep the controller within its rated limits, excessive dust, moisture, or heat degrade performance and shorten its life.
- **Periodic inspection (every 12 months)** — check for mechanical damage, secure mounting, and loose/frayed cables, tighten terminals and mounting screws, verify LEDs and Modbus diagnostics (communication health, uptime).
- **Firmware** — periodically check foxiot.eu or FoxIoT support for firmware updates and confirm the device runs the recommended version.

Do not open the enclosure — there are no user-serviceable parts inside. Opening it voids the warranty.

12 Warranty, Support & RMA

12.1 Warranty conditions

FoxIoT OÜ provides a limited warranty for **36 months from the date of purchase**, covering defects in materials and workmanship under normal use, in accordance with this manual and the product's environmental specifications. During the warranty period FoxIoT will repair or replace defective units at no charge, provided the product has not been modified, misused, or subjected to adverse conditions.

- Valid only for original products from FoxIoT OÜ.
- Proof of purchase may be required.
- Warranty service is limited to repair or replacement.
- The warranty does not cover associated costs such as removal, reinstallation, or transportation.

Independent of the warranty period, FoxIoT provides security updates for at least **5 years** from the product's release, as required by EU CRA 2024/2847.

12.2 Warranty limitations

The warranty does **not** apply in the following cases:

- Physical damage from mishandling, impact, fire, or water exposure.
- Damage from improper installation, incorrect wiring, or operation outside the specified limits.
- Modifications or repairs by unauthorized personnel.
- Normal wear and tear.
- Software issues related to non-standard configurations.

The warranty is void if the product has been opened or tampered with in any way not approved by FoxIoT OÜ.

12.3 Technical support

Contact our support team through:

Email	support@foxiot.eu
Support hours	Monday–Friday, 10:00–16:00 EET (Estonian time)
Languages	English, Estonian

Have your device's serial number, firmware version, and a clear description of the problem ready when contacting support.

12.4 RMA process (Return Material Authorization)

To return a product for repair or replacement you must obtain a valid **RMA number** from support — devices returned without one are not accepted.

1. Contact technical support to report the issue.
2. Provide the serial number, a clear description of the issue, and proof of purchase.
3. Receive an RMA number and return instructions.
4. Package the product carefully to prevent shipping damage and include the RMA number.
5. Send the unit to the return address provided by support.

Returns through an authorized reseller or distributor must still be submitted to FoxIoT support to obtain an RMA number. The reseller manages end-customer logistics and documentation. Direct end-customer returns are accepted after support verifies the purchase channel and warranty eligibility.

13 Compliance & Disposal

This product is designed and manufactured to comply with applicable EU directives and standards for industrial electronic equipment.

Topic	Detail
CE — EMC	Directive 2014/30/EU (Electromagnetic Compatibility)
CE — Low Voltage	Directive 2014/35/EU (Low Voltage Directive)
RoHS	Directive 2011/65/EU (restriction of hazardous substances)
WEEE	Directive 2012/19/EU (waste electrical & electronic equipment)

Disposal (WEEE). Do not dispose of this device with household waste. At end of life, return it to a designated WEEE collection point or to FoxIoT OÜ for proper recycling — see [recycling & disposal](#). The crossed-out wheeled-bin symbol indicates separate collection within the EU.

For declarations of conformity and the latest compliance documents, contact support@foxiot.eu or see foxiot.eu.

Revision History

Version	Date	Notes
1.1	2026-09-30	Relay DC rating corrected to 24 V DC (Omron G2RL-1-E rated load 16 A @ 24 V DC). Manual rewritten in the FoxIoT document format.
1.0	2026-05-28	Initial release.