Datasheet

ESP32 MiniPLC

Part No.: MiniPLC-R1

Manufacturer: ISYSTEMS AUTOMATION S.R.L.

Hardware Version: V1.0

Architecture: Modular (MCU Board + RelayBoard + USB Board)

Controller: ESP32-WROOM-32U

Functional Overview

The HomeMaster MiniPLC is a professional, open-source DIN rail controller built around the ESP32 platform, designed for robust and scalable smart automation in residential, commercial, and light industrial environments. It combines extensive onboard I/O—including relays, digital and analog inputs, temperature sensors, and a user interface—with native Home Assistant integration via pre-installed ESPHome.

Engineered for reliability and flexibility, the MiniPLC supports multiple power input options (24V DC or wide-range AC/DC) and features an isolated RS-485 Modbus interface for expansion with a wide range of compatible I/O modules. Its local processing capability ensures continued operation even when network or cloud connectivity is lost, making it suitable for mission-critical applications.

This controller operates as a complete standalone automation system using its comprehensive onboard I/O, while also offering seamless expansion via the RS-485 bus to connect HomeMaster smart modules for energy metering, lighting control, security, and more. It provides a versatile, ready-to-integrate platform for HVAC control, energy management, security systems, lighting automation, and custom industrial applications.

The system is implemented using three hardware boards:

Board	Function
MCU Board	CPU, analog acquisition, Ethernet, USB
Relay Board	Power supply, relays, digital inputs
USB Board	USB-C and SD storage

Technical Specifications

Specification	Details
Microcontroller	ESP32-WROOM-32U (dual-core)
Power Input	24 V DC nominal (V+ / 0V) OR 85–265 V AC (L / N)
Digital Inputs	4 × isolated 24 V DC discrete inputs (DIx + GNDx), supporting dry-contact closure protected by per-channel PTC fuse, TVS surge suppression, and EMI filtering.
Relay Outputs*	6 × SPDT dry-contact relays
Rated Load (System Limit)	3 A @ 250 VAC (resistive contact rating)
Max Load @ 250 VAC	750 VA (system limit)
Max Load @ 30 VDC	90 W (system limit)
Relay Component Rating (Informative Only)	Relay components are rated up to 16 A @ 250 VAC (resistive); however, this rating does not apply to the complete module
Analog Inputs	4 × 0–10 V, 16-bit (ADS1115)
Analog Output	1 × 0–10 V, 12-bit (MCP4725)
Temperature Inputs	2 × RTD (PT100/PT1000 via MAX31865), 2 × 1-Wire (DS18B20 compatible)
Display	128 × 64 OLED (SH1106)
User Interface	4 buttons, 16xLEDs(Power, 3 user LEDs, 1 status LED, RX, TX, 6xRelay, 4xDI) onboard buzzer (GPIO2, PWM)
Wi-Fi	Wi-Fi (ESP32)
Ethernet	Optional Ethernet (LAN8720 PHY)
RS-485	RS-485 Modbus RTU (MAX485, half-duplex) with TVS surge protection, PTC fuses, EMI choke, and fail-safe biasing
Storage	MicroSD card (SPI interface, power-switched 3.3 V rail)
USB	USB-C (ESD protected, CC detection, data to ESP32)
RTC	PCF8563 with battery backup

*Relay outputs are **not internally fused**. External overcurrent protection must be provided in accordance with applicable standards and installation requirements. Use appropriately rated fuses or circuit breakers and consider external contactors for loads exceeding 3 A or for inductive and high inrush loads.

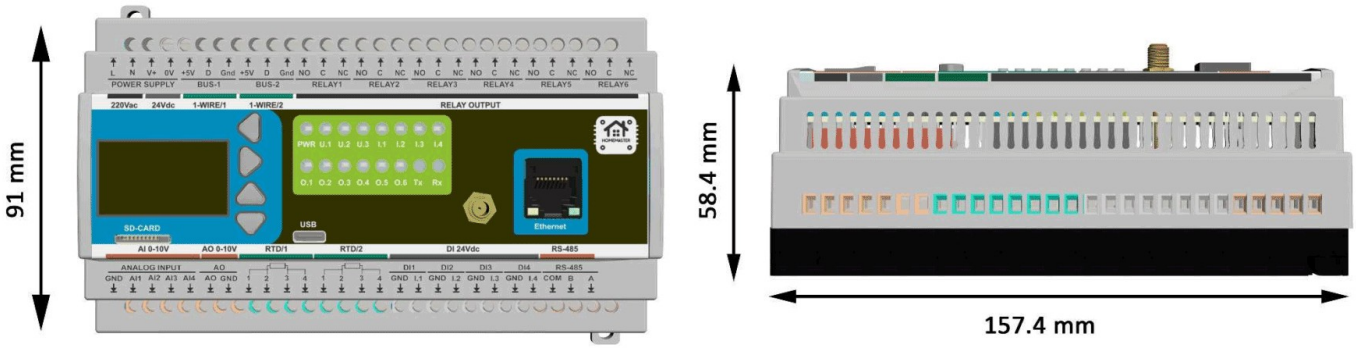
Installation, Environmental & Mechanical

Category	Specification	Details
Terminal Specifications	Terminal type	Pluggable screw terminal blocks, 5.08 mm pitch
	Terminal pitch	5.08 mm
	Wire cross-section	0.2–2.5 mm² (AWG 24–12)
	Conductor type	Solid or stranded copper
	Stranded wire	Ferrules recommended

	Tightening torque	0.4 Nm (max)
Environmental Ratings	Operating temperature	0 °C to +40 °C
	Storage temperature	-10 °C to 55 °C
	Relative humidity	0–90 % RH, non-condensing
	Ingress protection	IP20 (inside cabinet)
	Installation	Indoor control cabinet only; not for outdoor or exposed installation
	Terminal protection	All wiring terminals must be protected against accidental contact
Mechanical & Packaging	Product dimensions	157.4 × 91 × 58.4 mm (6.2 × 3.58 × 2.3 in) (L × W × H)
	DIN units	9 division units (≈ 160 mm DIN rail mounting width)
	Mounting	35 mm DIN rail
	Net weight	300 g
	Gross weight	450 g
	Pack size	230 × 140 × 87 mm (9 × 5.5 × 3.4 in) (L × W × H)
	Mechanical drawing	Front + side views with DIN-clip depth (see below)
	Notes	All dimensions shown in millimeters unless stated otherwise

Install only inside a control cabinet with ventilation; the cabinet must include a protective front plate covering all module connection terminals and a closing protective door; not for outdoor or exposed installation.

All wiring terminals must be protected against accidental contact by an insulating front plate, wiring duct, or terminal cover. Exposed live terminals are not permitted.



Cable Recommendations & Shield Grounding

This section applies to **Analog (0–10V)**, **Temperature (RTD / 1-Wire)**, and **RS-485**. Use shielded, twisted constructions and bond shields correctly to reduce EMI and ground-loop issues.

General Routing Rules

- Route low-level signal cables (Analog/RTD/1-Wire/RS-485) separately from mains, relay outputs, contactors, VFD motor cables, and power wiring.
- If crossing power cables is unavoidable, cross at **90°**.
- Keep cable runs as short as practical and avoid parallel runs with high-current conductors.

Analog (0–10V) Cable

- **Construction:** twisted pair (Signal + GND) per channel
- **Shielding:** overall shield (standard) or individually shielded pairs (high-EMI)
- **Examples: J-Y(ST)Y** (overall shield) or **LI2YCY PIMF** (shielded twisted pairs; one pair per channel)

Temperature Cable

RTD (PT100/PT1000)

- **Recommended:** shielded multi-core for 2/3-wire; shielded pairs for best accuracy (4-wire)
- **Examples: J-Y(ST)Y** (overall shield) or **LI2YCY PIMF** (pairs; e.g. 2×2×0.50 for 4-wire)

1-Wire (DS18B20)

- **Recommended:** shielded 3-core (+5V / DATA / GND) for typical installations
- **High-EMI / long runs:** shielded pairs + overall shield (e.g. **LI2YCY PIMF 2×2×0.50**)
- **Topology:** daisy-chain (bus). Avoid star wiring.
- **Stubs:** keep sensor stubs ≤ **0.5 m**.
- **Pull-up (DATA):** **4.7 kΩ** typical; **2.2–3.3 kΩ** for long/heavy loads.

RS-485 Cable

- **Construction:** twisted pair for **A/B**
- **Characteristic impedance: 120 Ω** (recommended)
- **Shielding:** overall shield is recommended in cabinets; use individually shielded pairs + overall shield in high-EMI
- **Examples: J-Y(ST)Y 2×2×0.5 mm²** or **LI2YCY PiMF 2×2×0.50**
- Use one twisted pair for **A/B**. Use the second pair for **COM (0V reference)** or spare.

Shield Grounding

- **Default recommendation:** bond cable shield(s) to cabinet **PE/EMC ground at the PLC end only**.

- **Do not** connect shields to signal terminals (AI/AO/RTD/1-Wire/RS-485 A/B/COM).
- If both ends are in equipotential bonded cabinets, shields may be bonded at both ends using proper 360° clamps.

Compliance & Certifications

The HomeMaster MiniPLC is CE marked and designed to comply with the applicable European Union directives. The manufacturer, ISYSTEMS AUTOMATION (HomeMaster brand), maintains the technical documentation and a signed EU Declaration of Conformity (DoC).

EU Directives

EMC 2014/30/EU · LVD 2014/35/EU · RED 2014/53/EU · RoHS 2011/65/EU

Harmonised Standards

Area	Standards
EMC	EN 61000-6-1 (Immunity) · EN 61000-6-3 (Emissions)
Electrical Safety	EN 62368-1
Radio	EN 300 328 · EN 301 489-1 · EN 301 489-17
RoHS	EN IEC 63000

Radio

The product integrates a pre-certified ESP32 Wi-Fi radio module (2.4 GHz). Final product conformity with the Radio Equipment Directive is demonstrated by the maintained technical documentation and conformity assessment of the complete device.

Safety notice

L / N: hazardous voltage · 24 V DC: SELV · Qualified personnel only

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