DATASHEET iCTRL-20 V1

Industrial Programmable I/O Controller

Date: 01/04/2026
Rev 1

1. General

The **iCTRL-20** is a modular, industrial-grade programmable I/O controller engineered for advanced automation, monitoring, and process control. Operating as a Modbus RTU slave over a robust RS-485 serial interface, it offers versatile configuration options via the dedicated DZVOLT UI software or direct Modbus register mapping. Its highly scalable architecture allows multiple modules to be seamlessly daisy-chained on a single RS-485 bus, providing a flexible and cost-effective solution for expanding I/O capacity.

2. Specifications

- **Manufacturer:** DZVOLT.
- **Model:** iCTRL-20 V1.
- **Power Supply:**
  - Rated value: 24 V_{DC}.
  - Permissible range, lower limit: 12V_{DC}.
  - Permissible range, upper limit: 30V_{DC}.
- **Max Power Consumption: 24 W.**
- **Safety & Protection:**
  - Reverse Polarity: Integrated protection on power supply.
  - Overvoltage & Transients: TVS-based transient protection (IEC 61000-4-2 compliant).
  - ESD Protection: Up to ±15 kV (Air) / ±8 kV (Contact) on communication and I/O ports.
- **Power Status:** Healthy / Failure.
- **Output safety interlock.**
- **(04) Digital Inputs:**
  - Rated voltage: 24 V_{DC}.
  - Response time: ≤ 3 ms (typical).
  - Sampling Rate: Every 10 ms.
- **(04) Digital Outputs:**
  - Output type: (SSR) Solid State Relay.
  - Rated voltage: 24 V_{DC}, 1.6A per output (max 2A).
  - Response time: ≤ 10 ms (typical).
  - Sampling Rate: Every 10 ms.
- **(08) Analog Inputs (Resolution 12 bits):**
  - (04) Inputs range: 0 – 10 V_{DC}.
  - (04) Inputs range: 4 – 20 mA.
  - Response time: ≤ 5 ms (typical).
  - Sampling Rate: Every 50 ms.
  - Analog Input accuracy: ±2 % FS (typical).
- **(04) Analog Outputs (Resolution 12 bits):**
  - Output range: 0 – 10 V_{DC}.
  - Min Load Impedance: ≥ 1 kΩ.
  - Response time: ≤ 3 ms (typical).
  - Sampling Rate: Every 50 ms.
  - Analog Output accuracy: ±2 % FS (typical).
- **Internal I/O processing cycle time:** ≤ 30 ms (typical), excluding communication latency (2 ms).
- **3.7 V Li-ion battery, ≈ 24h autonomy.**
- **Ambient temperature:** -10 °C to + 60 °C.
- **Cooling:** Natural convection.
- **Interference immunity:** zone B according to EN61131-2
- **Degree of protection:** IP20 according to IEC 60529
- **Storage:** Non-volatile memory.
- **Size:** 205x125x45 mm.
- **Weight (approx.):** 900 g.

3. Key Features

- Open architecture.
- Modular programmable industrial I/O controller.
- Autonomous operation.
- Modbus RTU slave communication over RS-485.
- Optional LAN connectivity using a web-based client-server architecture through DZVOLT UI.
- Up to 12 configurable internal functions.
- Configuration via DZVOLT UI software or Modbus registers.
- Compatible with PLCs, RTUs, DCS, and industrial gateways.
- Expansion up to 8 modules on a single RS-485 bus.
- Designed for control cabinet installation.
- Stainless steel top and bottom plates (open construction)
- Free Software & Configuration.
- R&D, education, and prototyping platforms.

4. Communication Interface

- Protocol: Modbus RTU.
- Physical layer: RS-485 and Micro-USB.
- Operating mode: Slave.
- Slave ID: Configurable via DIP switch.
- Baud rate: 9600 bps.
- Data format: 8 data bits, no parity, 1 stop bit (8N1).
- Maximum bus length: RS-485 up to 1200 m, USB max 5 m.
- Communication priority: RS-485 has priority over USB when both interfaces are active.

5. Processing Unit

- CPU: ESP32-S3-WROOM-1 (N16R8).
- Operating system: Real-time OS.
- Real-time multitasking with deterministic scheduling.

6. Applications & System Capabilities

- Industrial automation.
- IoT and Industrial Internet of Things (IIoT) applications.
- Process control systems.
- Remote I/O expansion.
- SCADA & PCS integration.
- Energy and infrastructure monitoring.
- Agricultural automation and smart farming systems (irrigation control, pumping stations, environmental monitoring).
- Smart home and building automation (lighting, HVAC, access control, energy management).
- Customizable control logic and communication mapping.
- Renewable energy systems (solar plants, hybrid systems, energy storage monitoring).
- Data acquisition and telemetry systems.

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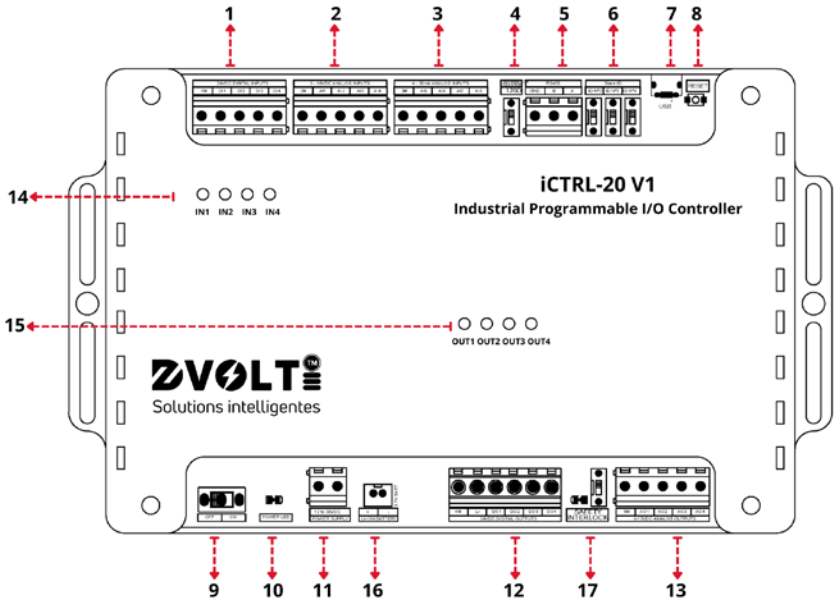
7. Functional Blocks (internal functions)

F1	Analog Output value (0 - 10 V) configuration.
F2	Analog input alarm thresholds linked to Digital outputs.
F3	Power Alarm linked to Digital Outputs.
F4	Digital Input to Digital Output linking (DI → DO mapping).
F5	Selectable timer types for Digital Outputs, triggered by Digital Inputs, Power Alarm and Analog input alarm thresholds: • **TON (Timer ON Delay):** Digital Output (DO) activates after a preset delay(sec), provided that the Digital Input (DI) remains active throughout the entire countdown. • **TOF (Timer OFF Delay):** The Digital Output (DO) activates immediately when the input (DI) is triggered, then remains active for a preset delay(sec) after the input (DI) has been switched off. • **TP (Pulse Timer):** Digital Output (DO) activates for a fixed duration(sec) regardless of whether the input (DI) is triggered briefly or held long-term. • **TONOFF (Cyclic Timer):** Digital Output (DO) alternates between ON Delay(sec) and OFF Delay(sec) cycles repeatedly if the Digital Input (DI) is active.
F6	Analog input (0–10 V) conversion to real values for display.
F7	Analog input (4-20 mA) conversion to real values for display.
F8	Configurable digital input logic (normal or inverted).
F9	Auto Save automatically stores any changes made to the system parameters in non-volatile memory.
F10	Interlock Safety forces all digital and analog outputs to be disabled, ensuring a safe state for operators during maintenance operations.
F11	Link analog inputs (AI1–AI4) directly to analog outputs (AO1–AO4)
F12	Count rising edges on DI1–DI4 for flow metering, production counting, and energy metering. Enabled/disabled per DI via Modbus coils.

8. Installation & Compliance

- Designed for control cabinet installation.
- Intended for integration into an industrial enclosure.
- DIN rail mounting.
- Power supply must be protected by an external fuse or circuit breaker.
- Not intended for direct exposure to moisture, dust, or corrosive environments.

9. Front Panel & Connections



Connections:

1. (04) Digital Inputs 24V_{DC}
2. (04) Analog Inputs range: 0 – 10 V_{DC}
3. (04) Analog Inputs range: 4 – 20 mA
4. DIP termination resistor 120Ω for RS-485
5. RS-485 (A, B, GND)
6. DIPs switch for RS-485
7. USB port — firmware update and Modbus RTU configuration (CP2102, 9600 8N1).
8. RESET CPU Button
9. ON/ OFF Switch
10. Power LED
11. Power supply 12-30 V_{DC}
12. (04) Digital Outputs 24V_{DC}
13. (04) Analog Outputs range: 0 – 10 V_{DC}
14. LEDs indicator digital inputs
15. LEDs indicator digital outputs
16. 3.7V 18650 Li-ion battery connection
17. DIP switch for safety interlock

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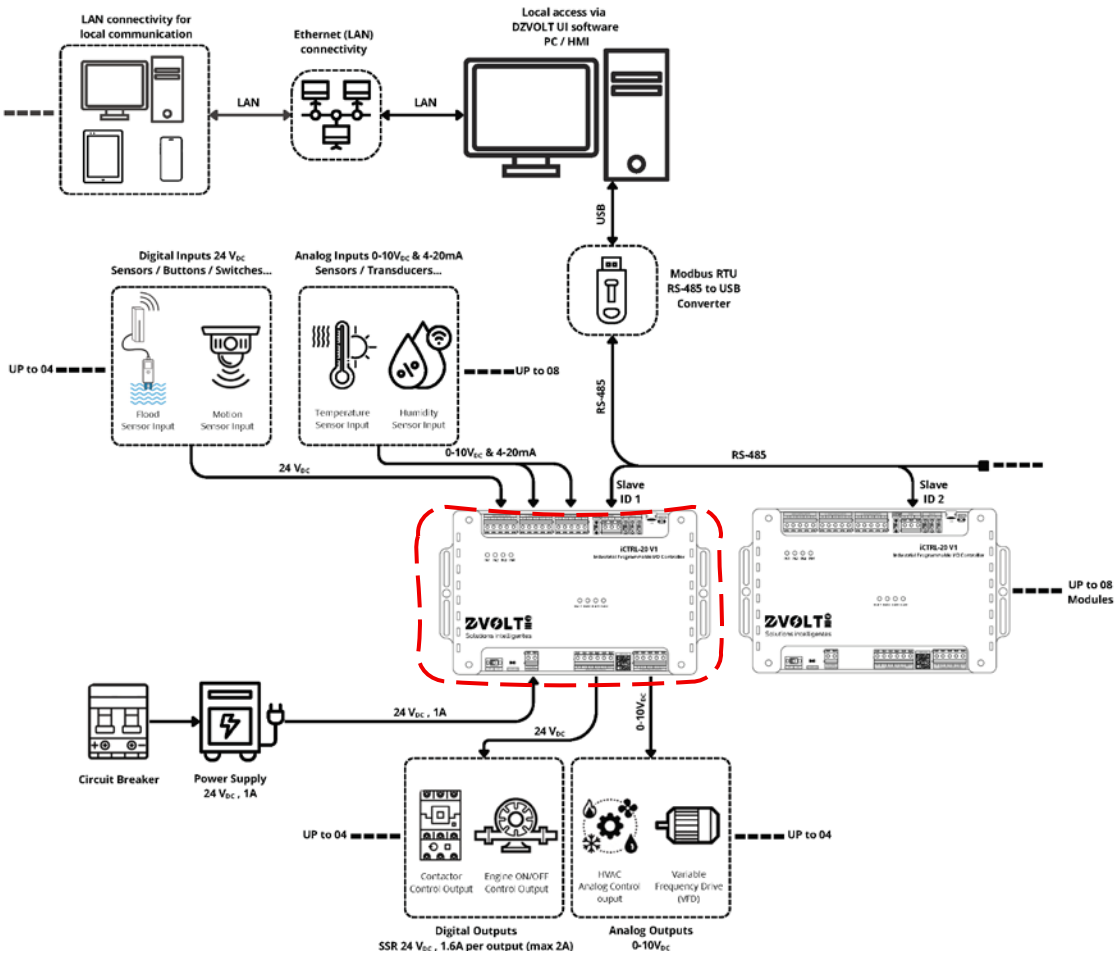
10. System Overview and Connectivity



N.B.: DZVOLT iCTRL-20 in red box.

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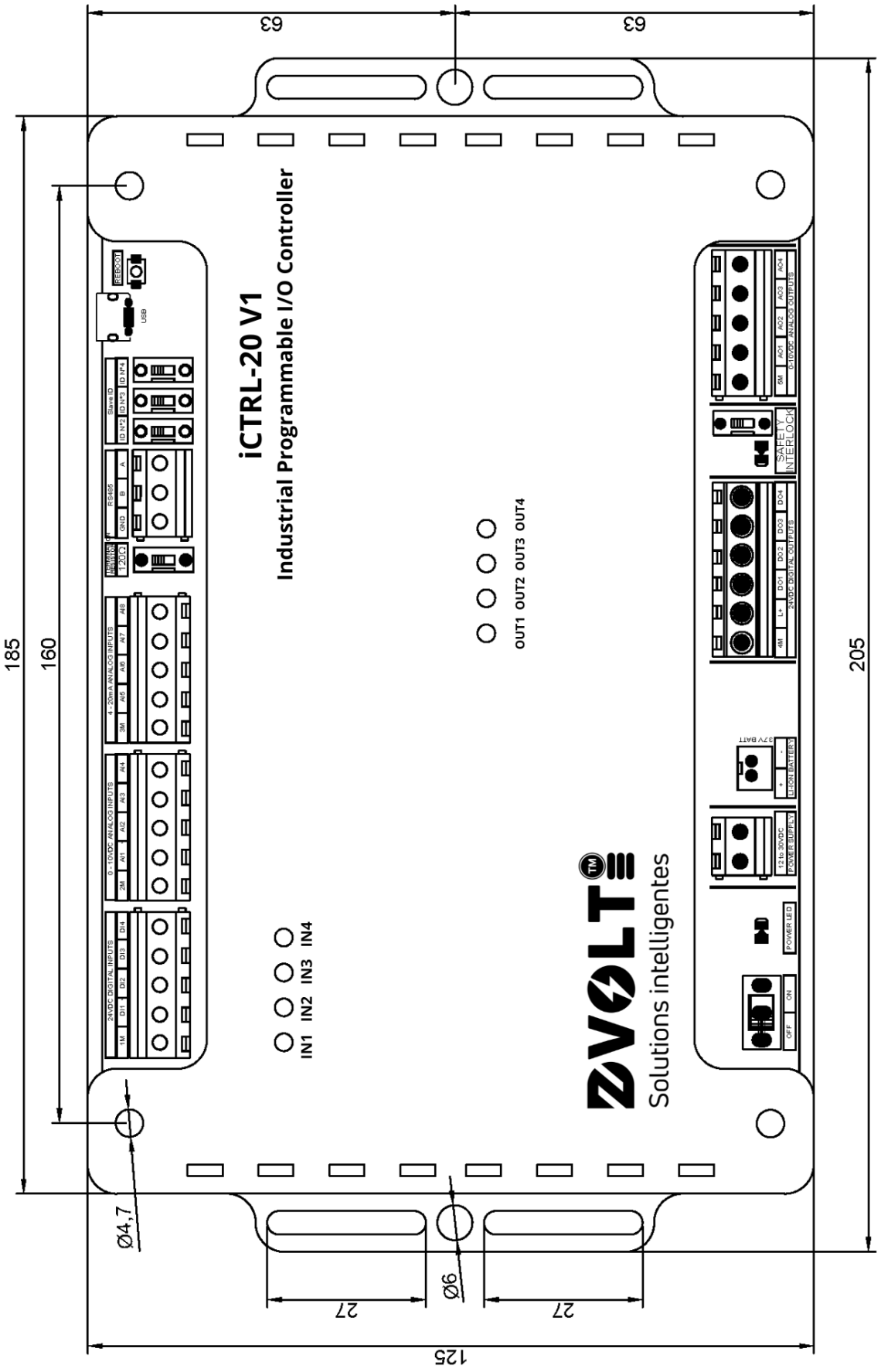
11. Dimensions (mm): ±1 mm



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