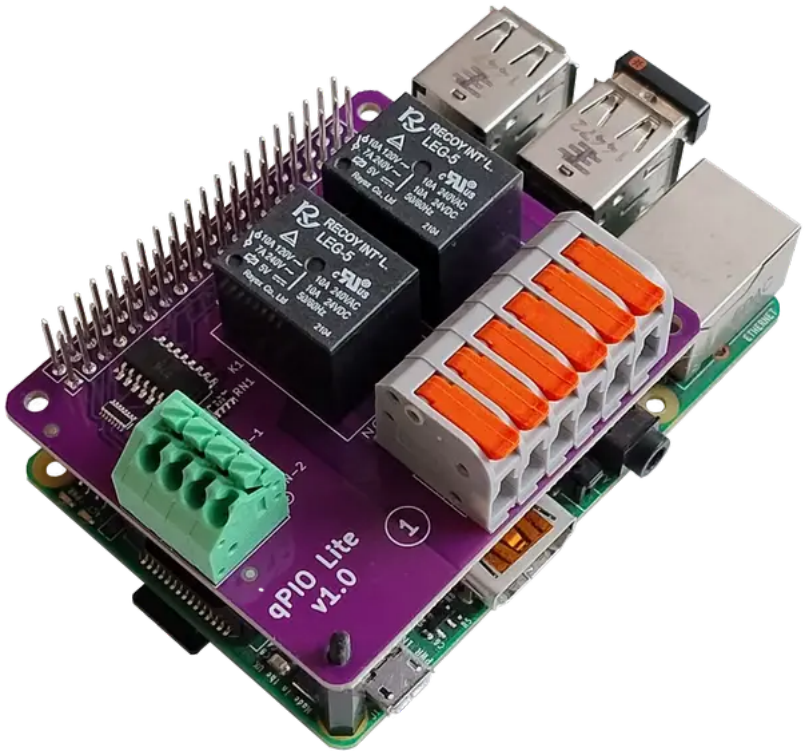
Technical Data Sheet: Synapse Nexus Lite v1.0

Industrial Compact I/O Module for Raspberry Pi (2 Input / 2 Output)

Official Product Page: https://aqex.eu/synapse-nexus-lite-raspberry-pi-io-hat.html



1. Product Concept & Strategic Advantages

The **Synapse Nexus Lite** is a cost-optimized industrial expansion board designed for applications that require a limited number of I/O points without compromising on electrical safety. While maintaining the standard Raspberry Pi HAT form factor, it offers a streamlined 2-in/2-out configuration, making it the most economical choice for simple automation and remote signaling tasks.

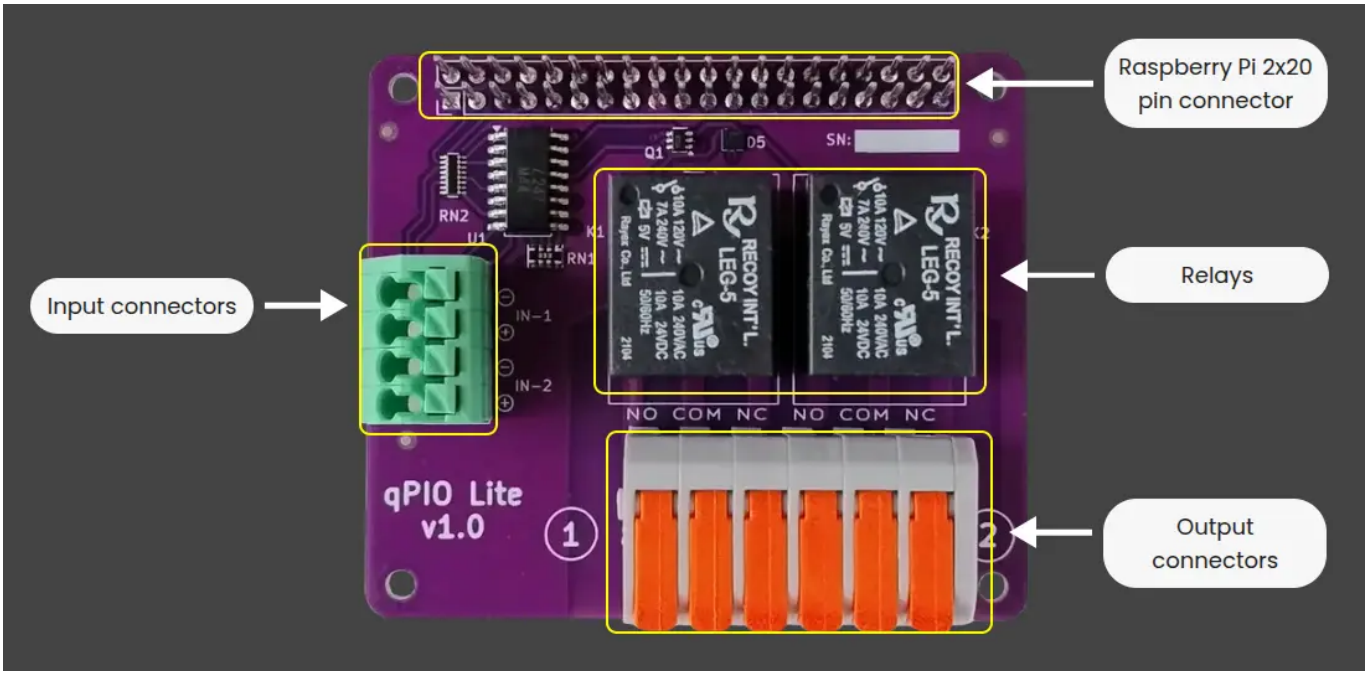
Strategic advantages:

- **Double Isolated Outputs:** Each relay output is protected by **dual isolation (Optocoupler + Mechanical Relay)**, ensuring the Raspberry Pi is completely decoupled from high-voltage loads.
- **SPDT Relay Configuration:** Features versatile **Single Pole Double Throw (SPDT)** relays, providing both Normally Open (NO) and Normally Closed (NC) contacts for maximum wiring flexibility.
- **Standard Voltage Inputs:** Features 2 opto-isolated digital inputs designed for **Voltage Level Sensing (3V-45V)**.
- **Cost-Efficient Industrial Build:** Focused on essential features and high-capacity (10A) switching to provide a more affordable industrial interface.
- **Industrial Connectivity:** Equipped with vibration-proof **Push-in (spring-type) terminal blocks** for rapid, tool-less field wiring.
- **Low GPIO Footprint:** Uses only 4 GPIO pins, leaving the rest of the 40-pin header free for other expansions.

2. Comprehensive Technical Specifications

Parameter	Value	Condition / Detailed Notes
Input Voltage (Vcc)	5.0V DC	Powered via Raspberry Pi 40-pin header
Number of Outputs	2	Double Isolated **SPDT** Relays
Max Switching Current	**10A**	Per relay (at 240V AC / 24V DC)
Number of Inputs	2	Opto-isolated digital inputs
Input Type	**Voltage Level**	**Standard 3V – 45V DC sensing**
Isolation (Output)	**Double Isolation**	**Optocoupler + Relay galvanic separation**
Terminal Type	**Push-in Spring**	Tool-less industrial terminal blocks

3. qUPS-P-SC User Interfaces and Indicators



4. Input & Output Configuration

4.1 Relay Outputs (2 Channels)

The module uses **SPDT** relays with full Changeover (CO) functionality. The logic side is protected by secondary opto-isolation.

Relay	GPIO	Header Pin	Contact Type
Relay 1	**GPIO 14**	Pin 8	SPDT (CO)
Relay 2	**GPIO 15**	Pin 10	SPDT (CO)

4.2 Digital Inputs (2 Channels)

Standard opto-isolated inputs for detecting industrial voltage levels.

Input	GPIO	Header Pin	Terminal Label
Input 1	**GPIO 17**	Pin 11	I1
Input 2	**GPIO 27**	Pin 13	I2

5. Hardware Interface

- **Industrial Terminals (Inputs, Outputs):** High-quality, vibration resistant spring terminals for field wiring.
- **Pass-through Header:** Allows stacking additional HATs (only the used 4 GPIOs are reserved).
- **3.3V Logic:** Internally compatible with the Raspberry Pi's 3.3V signaling level.

6. Software Integration

- **Logic Level:**
  - **Output:** Setting GPIO to HIGH energizes the relay.
  - **Input:** The GPIO reads HIGH when the input is active (Voltage present).
- **Compatibility:** Fully compatible with all Raspberry Pi models and standard programming environments (Python, C++, Node.js, Codesys).

7. Safety & Compliance

- **Galvanic Isolation:** The control side (Raspberry Pi) is completely separated from the load/sense side.
- **Overvoltage Protection:** Inputs are designed to withstand industrial transients up to the rated limits.

HW Version: 1.0 | **Released:** 2026
Manufacturer: AQEX Electronics | aqex.eu