7Semi

Single Channel I2C (Qwiic) Relay Module

Version 1.0

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1.Introduction

The **7Semi Single Channel I2C (Qwiic) Relay Module** is a compact and reliable industrial control solution designed for automation and remote switching applications. It features **1 high-performance relay outputs**, enabling efficient control of electrical loads through a robust I2C communication interface.

It allowing seamless operation alongside remote I2C commands. For multi-device applications, the board includes **hardware address selection via back-side solder jumpers**, enabling flexible integration on a shared I2C bus.

Designed for continuous operation, the module ensures **stable performance with CRC-protected communication**. Its rugged design and noise-immune communication make it suitable for **industrial environments**, including control panels, embedded systems, and smart automation applications.

1.1 Features

- 1 Industrial-grade Relay Outputs
- I2C Slave Interface (7-bit addressing)
- Hardware Address Selection via Back-side Solder Jumpers
- Compact, Rugged & Industrial Design

2.Technical specification

The **7Semi Single Channel I2C (Qwiic) Relay Module** is designed to deliver reliable and efficient relay control for industrial and automation applications. The module provides **independent relay outputs**, allowing flexible control of electrical loads through a robust I2C communication interface.

The module supports a standard **I2C slave interface with hardware-configurable addressing via back-side solder jumpers**, enabling seamless integration of multiple devices on a shared I2C bus. Each relay channel can be individually controlled or grouped using a simple command protocol with **CRC-based data validation**, ensuring secure and error-free communication.

It Designed for continuous industrial use, with its **robust I2C-driven relay control and noise-immune design**, the module ensures stable and consistent performance in harsh environments, making it ideal for control panels, embedded systems, and industrial automation applications.

Applications

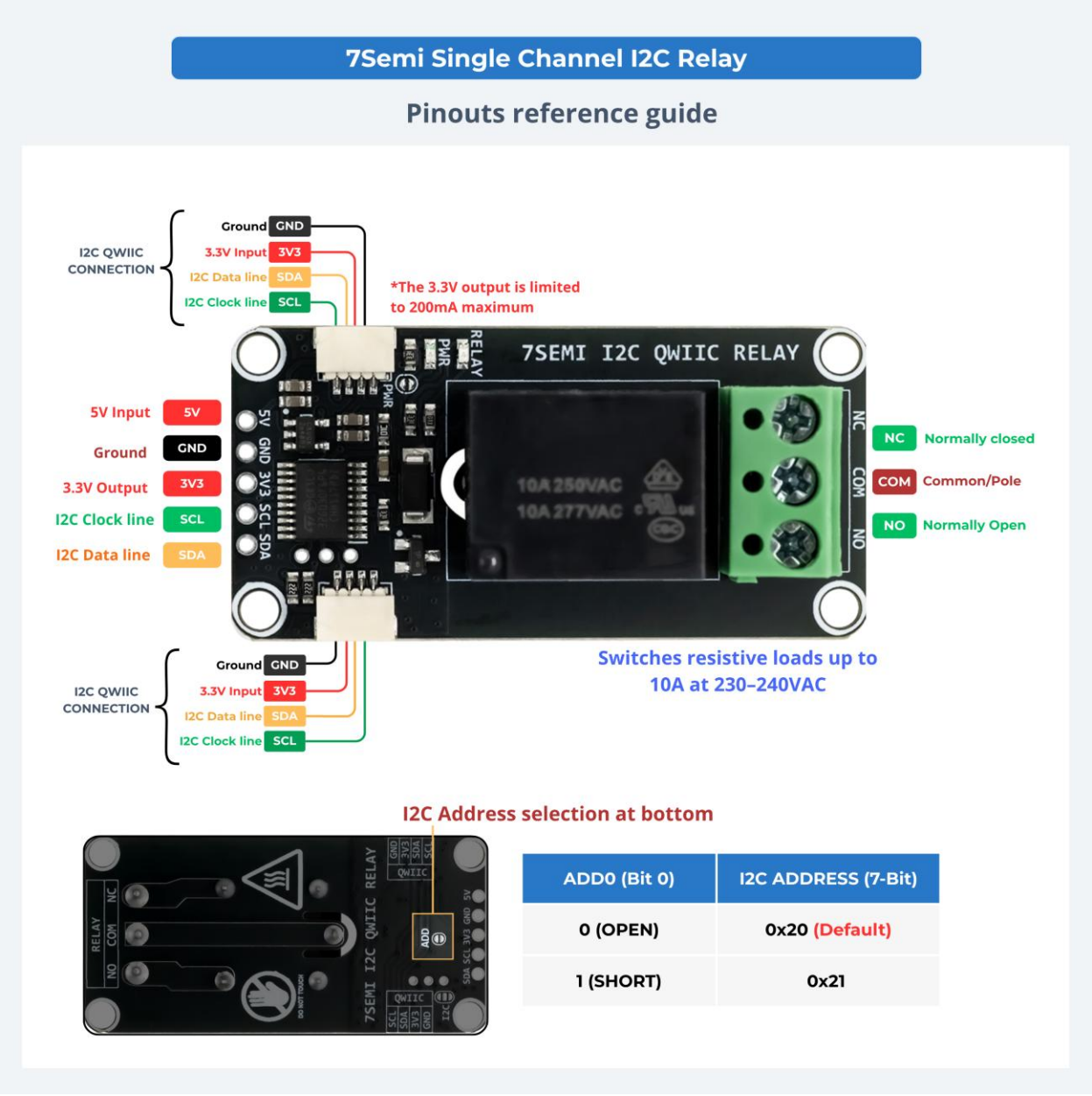
- HVAC Control Systems
- Building Automation Systems
- Industrial Automation & Control Panels
- PLC Expansion Modules
- Remote Relay Switching Systems
- Smart Energy Management Systems
- Process Monitoring & Control
- IoT & Embedded Control Systems

2.1 General specifications

- **Relay Channels:** 1 (Independent Control)
- **Communication Interface:** I2C (7-bit Slave)
- **Address Configuration:** Hardware Selectable via Back-side Solder Jumpers
- **Operating Voltage:** 5V DC
- **Relay Contact Rating:** 10A @ 250VAC / 30VDC
- **Data Integrity:** CRC-based Communication
- **Operating Temperature:** -20°C to +70°C
- **Dimensions:** 26.0 × 53.0 × 19.30 mm
- **Operation Mode:** Continuous 24/7 Operation

3. Hardware setup

3.1 Pinouts



ADD0 (Bit 0)	I2C ADDRESS (7-Bit)
0 (OPEN)	0x20 (Default)
1 (SHORT)	0x21

Note: The PCB includes a 2.2 kΩ I²C pull-up resistor by default. If a different or higher resistor value is required, simply desolder the solder bridge located at the bottom-right corner to disconnect the onboard pull-up resistor, and then use an external resistor of the desired value.

4. I2C Communication Protocol

The **7Semi Single Channel I2C (Qwiic) Relay Module** utilizes a simple and efficient **I2C communication protocol** for device control and status monitoring. The module operates as an **I2C slave device**, responding to commands from a master such as microcontrollers, embedded systems, or control units.

Communication is based on a compact frame structure consisting of **register, data, and CRC fields**, ensuring reliable data exchange. A built-in **CRC (Cyclic Redundancy Check)** mechanism provides error detection for robust and noise-immune communication in industrial environments. the module supports both **relay control commands and status read operations**, enabling flexible integration into automation systems.

Supported Command Registers

Register	Description
0x00	Read Relay State
0x01	Set Relay State
0x02	Turn ON Relay
0x03	Turn OFF Relay

Command Description

- **Register 0x00:** Read relay state.
- **Register 0x01:** Set full relay state (0x01 = ON, 0x00 = OFF)
- **Register 0x02:** Sets (turns ON) Relay.
- **Register 0x03:** Clears (turns OFF) Relay.

Communication Notes

- The device operates as an **I2C slave with hardware-selectable address via back-side solder jumpers**.

• All commands include a **CRC byte for data validation**.

• Supports **continuous communication for real-time control**.

Register Address Mapping - Address quick reference

Register Address	Purpose	Description
0x00	Read Relay State	Returns current relay status (bitmask)
0x01	Write Full State	Set relay state (0x01 = ON, 0x00 = OFF)
0x02	Set Relay ON	Turn ON Relay
0x03	Set Relay OFF	Turn OFF Relay
0x20	Saved State	Last stored relay state (flash)
0x30	System Status	Device status / health information

Relay Bit Mapping

Bit Position	Relay
Bit 0	Relay 1

➢ **Notes**

• Relay control uses **single-bit bitmask** format
Example: 0x01 → Relay ON, 0x00 → Relay OFF

• All write commands include **CRC validation**

• Device operates as an **I2C slave** with address configurable via **back-side solder jumpers**

• Supports **individual relay control**

• Relay control is performed entirely through the I2C interface.

➢ Testing Steps & Standard I2C Frame

1) Basic Relay Control Test

➢ **Test Steps (Host Controller / Arduino / MCU)**

1. **Initialize I2C Master**
2. **Set Slave Address (Default: 0x20)**
3. **Send command to:**
   - **Command: ON** (Relay ON)
   - **Command: OFF** (Relay OFF)
   - **Command:** R1 ON / R1 OFF
   - **Command:** READ

- Expected :
  - Relay respond **immediately** to commands
  - Relay operates **reliably**
  - READ command returns correct **bitmask status**
  - I2C commands work **reliably**

➢ **Test Steps (Low-Level I2C Frame)**

Write Frame Format: [Slave Address] [Register] [Data] [CRC]
Example (Relay ON): 20 01 01 00

Field	Bytes	Value	Remarks
Slave address	1	0x20	Device address
Register	1	0x01	Write full state
Data	1	0x01	Relay ON
CRC code	1	0x00 (XOR)	Data integrity

➢ **Relay Control Examples**

Operation	Command (HEX)	CRC	Full Frame	Description
ON	20 01 01	00	20 01 01 00	Turn ON Relay
OFF	20 01 00	01	20 01 00 01	Turn OFF Relay
Relay ON	20 02 01	03	20 02 01 03	Set Relay 1
Relay OFF	20 03 01	02	20 03 01 02	Clear Relay 1

READ	20 00	---	Send: 20 00	Read relay state

- **Read Relay State**

  Step 1: Send register

  ```
  20 00
  ```

  Step 2: Read 1 byte response

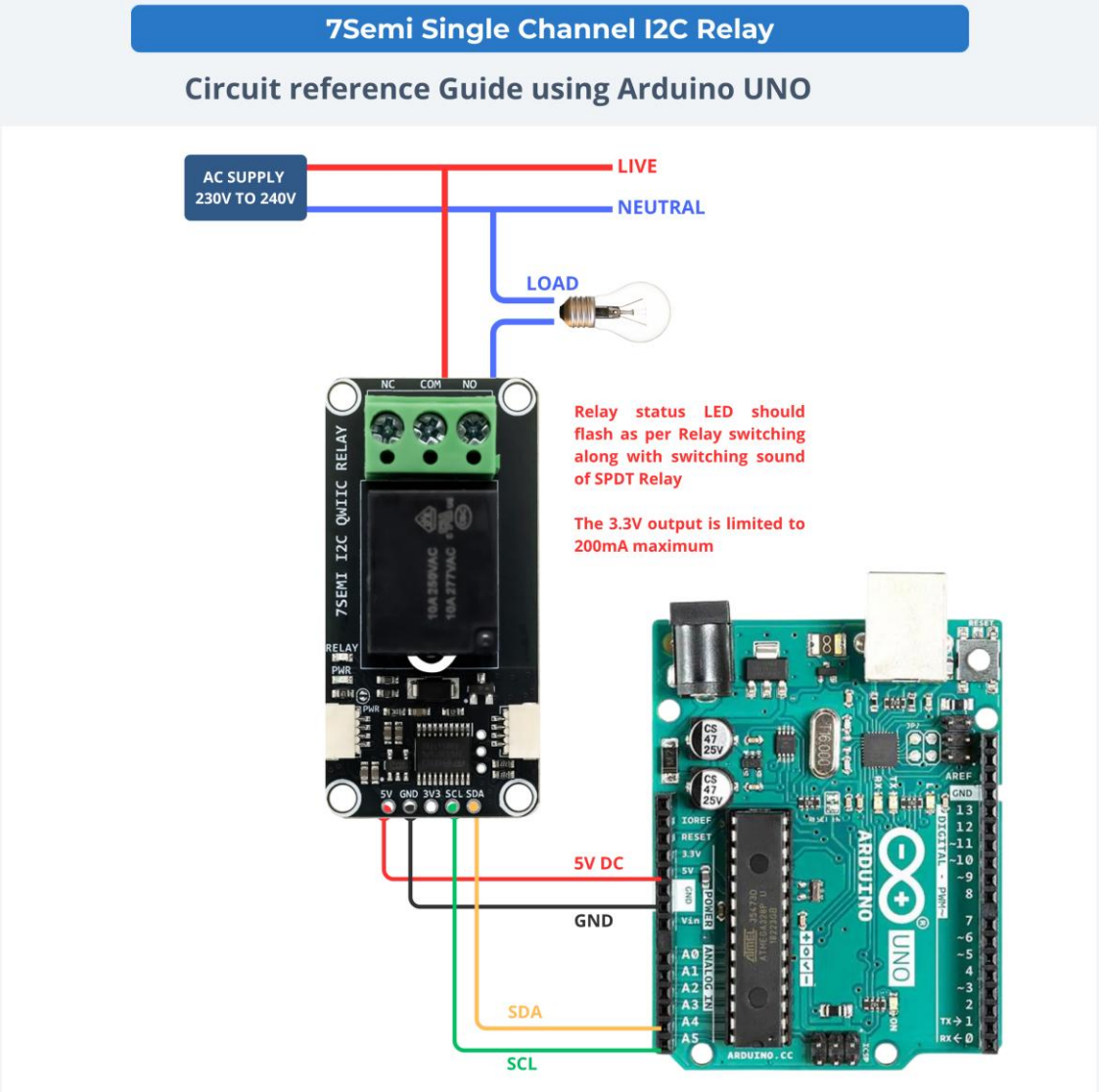
- **Response Format**

Bit	Relay	Description
Bit 0	Relay 1	ON = 1 / OFF = 0

- **Example**

Response	Binary	Active Relays
0x00	0000	Relay OFF
0x01	0001	Relay ON

4.1 Connection and sample code for Arduino



4.2 How to Install 7Semi Arduino Library

- **Install the Arduino IDE** on your computer.
- Once installed, **open the Arduino IDE**.
- Go to **Library Manager** and search for **"7Semi I2C Relay."**
- **Install** the library from the search results.
- After installation, navigate to **File → Examples → Basic → IndustrialRelayMaster**, example.
- **Upload** the example code to your Arduino board.
- Set the **baud rate to 9600** in the Serial Monitor.
- You should now **see the output** displayed on the Serial Monitor Use that command to drive relay like R1 ON => Relay 1 ON , R1 OFF => Relay 1 OFF .

Sample code link for manual download:- **"*7Semi_I2C_Relay*"**

Sample output image:-

```
==== INDUSTRIAL RELAY MASTER ====
ON / OFF
R1 ON / R1 OFF
R2 ON / R2 OFF
R3 ON / R3 OFF
R4 ON / R4 OFF
READ
```

5.Mechanical specification