Introduction

The X-NUCLEO-OUT02A1 industrial digital output expansion board for STM32 Nucleo is based on the ISO8200AQ galvanic isolated octal high-side smart power solid state-relay.

It provides an affordable and easy-to-use solution for the development of 8-channel digital output modules, letting you easily evaluate the ISO8200AQ communication and industrial load driving features.

The X-NUCLEO-OUT02A1 can be connected to a NUCLEO-F401RE, NUCLEO-F103RB or NUCLEO-F302R8 development board via Arduino™ UNO R3 connectors.

You can also evaluate the 16-channel digital output modules by connecting two X-NUCLEO-OUT02A1 expansion boards and activating the daisy chaining feature.

The X-NUCLEO-OUT02A1 interfaces with the STM32 controller via SPI and GPIO pins and is compatible with the Arduino™ UNO R3 (default configuration) and ST morpho (optional, not mounted) connectors.

Industrial PLC functionality with 8 inputs and 16 outputs can be added with the X-NUCLEO-PLC01A1 expansion board.

Figure 1. X-NUCLEO-OUT02A1 expansion board
1 Getting started

1.1 Overview

The X-NUCLEO-OUT02A1 expansion board features:

- Based on the ISO8200AQ whose main characteristics are:
  - Embedded 4kV galvanic isolation
  - Radio frequency communication between the logic and process sides for maximum noise immunity
  - Very low power dissipation ($R_{ON(MAX)} = 220 \text{ m}\Omega$)
  - Fast decay for inductive loads
  - 20 MHz SPI I/F on logic side
  - $V_{CC}$ power good diagnostics
  - Overload and overheating protections with thermal shutdown and diagnostics
  - QFN-32L (9x11x1 mm) package
- 10.5 to 33 V operating voltage range
- Green LED (x8) for output on/off status
- Red LED for process supply power good fault
- Red LED for overload and overheating
- Supply reverse polarity protection
- EMC compliance according to IEC61000-4-2, IEC61000-4-3, IEC61000-4-5
- Compatible with STM32 Nucleo boards
- Equipped with Arduino™ UNO R3 connectors
- CE certified
- RoHS and China RoHS compliant
- WEEE compliant

The SPI interface and the embedded power good detection allow a deeper diagnostics, daisy chaining and less MCU GPIO resources on the PLC logic stage.

Note: The X-NUCLEO-OUT02A1 offers a digital output solution: each output stage is managed at microcontroller level. As the board has no input stage, no sensors can be connected to it.

1.2 Hardware requirements

To use STM32 Nucleo development boards with the X-NUCLEO-OUT02A1 expansion board, match the boards via the Arduino™ UNO R3 connector pins on the STM32 Nucleo development board.
The X-NUCLEO-OUT02A1 has been designed to be used with
• NUCLEO-F103RB
• NUCLEO-F302R8
• NUCLEO-F401RE

1.3 System requirements
To use the STM32 Nucleo boards with the X-NUCLEO-OUT02A1 expansion board you need:
• a Windows PC/laptop (Windows 7 or above) to install the firmware package (X-CUBE-OUT02)
• a type A to Mini-B USB cable to connect the STM32 Nucleo board to the PC
• an STM32 Nucleo development board (NUCLEO-F103RB, NUCLEO-F302R8 or NUCLEO-F401RE)
• an X-NUCLEO-OUT02A1 expansion board

1.4 Board setup
Step 1. Connect the micro-USB cable to the PC.
Step 2. Download the firmware version onto the microcontroller.
Step 3. Set the following jumper configurations on the STM32 Nucleo board:
   – Close SB62 and SB63 jumpers
   – Open SB13 and SB14 jumpers
Step 5. Provide the digital supply voltage.
   – when connected to the PC: keep the micro-USB cable connected and close jumper JP5 on the STM32 Nucleo board between pins 1 and 2.
   – in standalone mode: provide a 7 to 12 V external supply via J2 on the X-NUCLEO-OUT02A1 and close jumper JP5 on the STM32 Nucleo board between pins 2 and 3.
Step 6. Connect the load on the output connector.
Step 7. Run the STM32 and push the blue button on the STM32 Nucleo board to select the example provided in the firmware package.
2 Hardware description and configuration

2.1 Digital section
The digital section is associated with the STM32 interface and digital supply voltage to and from the X-NUCLEO-OUT02A1 expansion board.

Figure 3. X-NUCLEO-OUT02A1 expansion board: digital interface components

The four Arduino™ UNO R3 connectors:
• allow the ISO8200AQ communication with the STM32 Nucleo board microcontroller and access to the STM32 peripheral and GPIO resources;
• provide digital supply voltage to/from the STM32 Nucleo development board and the X-NUCLEO-OUT02A1 expansion board.

To provide an external digital supply:
• close jumper JP5 between pins 2 and 3 on the STM32 Nucleo development board;
• connect a 7 to 12 V supply at screw connector J2 on the X-NUCLEO-OUT02A1 expansion board.

2.2 Power section
The power section involves the power supply voltage, load connection and electromagnetic compatibility (EMC) protections.
For EMC:
- a Transil™ diode SMC30J30CA is placed on $V_{CC}$ track to protect the ISO8200AQ against surge discharge;
- for common mode surge testing, two single-layer capacitors (C1 and C3, not mounted) must be soldered;
- 22 nF capacitors are included on the output lines for burst disturbance filtering.

To supply the load, connect the supply voltage to the J1 2-way screw connector. The load is connected to the 8-way output.
### Table 1. X-NUCLEO-OUT02A1 bill of materials

<table>
<thead>
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<th>Item</th>
<th>Q.ty</th>
<th>Ref.</th>
<th>Part/Value</th>
<th>Description</th>
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<td>Galvanic isolated octal high-side smart power solid state-relay</td>
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<td>ISO8200AQ</td>
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<td>2</td>
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<td>C19, C20, C21, C22, C23, C24, C25, C26</td>
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<td>TDK</td>
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<td>OSRAM</td>
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<td>4</td>
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<td>Bourns</td>
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<td>Phoenix Contact</td>
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<td>6</td>
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<td>25</td>
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<td>3 ways, 1 row (STM32, ISO8200AQ LV supply) TH 3.5 mm</td>
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<td>RS</td>
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Figure 5. X-NUCLEO-OUT02A1 circuit schematic (1 of 2)

Figure 6. X-NUCLEO-OUT02A1 circuit schematic (2 of 2)
References

Freely available on www.st.com:
• ISO8200AQ datasheet
• X-CUBE-OUT02A1 user manual
• X-NUCLEO-PLC01A1 user manual
• ST-PLC data brief
## Revision history

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