Quick Start Guide

Industrial digital output expansion board based on ISO8200AQ for STM32 Nucleo (X-NUCLEO-OUT02A1)
Quick Start Guide Contents

- X-NUCLEO-OUT02A1: Industrial digital output expansion board
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- STM32 Open Development Environment: Overview
X-NUCLEO-OUT02A1 Hardware Description

- 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 or NUCLEOF334R8 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.

Features

- Based on the ISO8200AQ Galvanic Isolated Octal High Side Smart Power Solid State Relay with SPI interface
- 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

Key Products on board
ISO8200AQ:
Galvanic Isolated Octal High Side Smart Power Solid State Relay with SPI interface

Latest info available at www.st.com
X-NUCLEO-OUT02A1
X-CUBE-OUT2 Software Description

- The X-CUBE-OUT2 expansion software package for STM32Cube runs on the STM32 and includes a driver for the ISO8200AQ.
- The software 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 expansion is built on STM32Cube software technology to ease portability across different STM32 microcontrollers.
- The software comes with a sample implementation of the driver running on the X-NUCLEO-OUT02A1 expansion board connected to a NUCLEO-F401RE or NUCLEO-F334R8 development board.
- You can also perform evaluation of 16-channel digital output modules by connecting two X-NUCLEO-OUT02A1 and activating the daisy chaining feature.

Key features
- Complete software to build applications for the ISO8200AQ galvanic isolated octal high-side smart power solid state-relay
- GPIOs, SPI, PWMs and IRQs configuration
- Fault and power good interrupt handling
- Daisy chaining support
- Sample implementation available on the X-NUCLEO-OUT02A1 expansion board when connected to a NUCLEO-F401RE or NUCLEO-F334R8 development board
- Easy portability across different MCU families, thanks to STM32Cube
- Free, user-friendly license terms
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STM32 Open Development Environment: Overview
**Setup & Demo Examples**

**HW prerequisites (1/2)**

- 1x STM32 Nucleo Industrial digital output expansion board (X-NUCLEO-OUT02A1)
- 1x STM32 Nucleo development board (NUCLEO-F401RE or NUCLEO-F334R8)
- 1x USB type A to Mini-B cable
- 1x Laptop/PC running Microsoft Windows™ 7 or above
- 1x External power supply at 24 V
The STM32F401RE has to be supplied by USB cable or by external supply connected to X-NUCLEO-OUT02A1:

1. By USB cable of the STM32 Nucleo development board (DEFAULT)
   a) CLOSE JP5 to U5V position on the STM32 Nucleo development board

2. By external supply of the X-NUCLEO-OUT02A1
   b) Connect the external supply (from 7 to 12V) to CN2 of X-NUCLEO-OUT02A1
   c) CLOSE JP5 to E5V position on the STM32 Nucleo development board
• **STSW-LINK009**: ST-LINK/V2-1 USB driver

• **STSW-LINK007**: ST-LINK/V2-1 firmware upgrade

• **X-CUBE-OUT2**:  
  • Copy the .zip file content into a folder on your PC  
  • The package contains the source code example (Keil, IAR, SW4STM32) based on NUCLEO-F401RE or NUCLEO-F334R8

• **STSW-IFAPGUI or STSW-IOLINKGUI**  
  • This a GUI designed to drive interface with X-CUBE-OUT2 and to simplify the access to the feature of the X-NUCLEO-OUT02A1.
• Install and launch the GUI on your Laptop/PC
• Connect the USB cable to the NUCLEO-F401 or NUCLEO-F334R8 stacked with the X-NUCLEO-OUT02A1.
• USB scanning procedure starts and, after board has been detected, an STM32 blue icon appears on the GUI control window.
• Click on the STM32 blue icon (icon becomes green) to activate the panel of the X-NUCLEO-OUT02A1.
• Supply the X-NUCLEO-OUT02A1 by 24V.
• Start your evaluation.
X-CUBE-OUT2

Start coding in just a few minutes with X-CUBE-OUT2

1. Go to www.st.com/x-nucleo

2. Select X-NUCLEO-OUT02A1

3. Download & unpack X-CUBE-OUT2

4. Download and install ST-LINK/V2-1 USB driver

5. Open project example

6. Modify and build application

Generic Nucleo Docs
ISO8200AQ drivers
Application example

www.st.com/x-nucleo
All documents are available in the DESIGN tab of the related products webpage

X-NUCLEO-OUT02A1:
- **DB3767**: Industrial Digital Output expansion board based on ISO8200AQ for STM32 Nucleo – Data Brief
- Gerber files, BOM, Schematic

X-CUBE-OUT2:
- **DB3774**: Industrial Digital Output software expansion for STM32Cube – Data Brief
- **UMxxxx**: (TBD) – User Manual
- Software set-up file

STSW-IFAPGUI:
- **DB3775**: Graphical user interface for the industrial IPS and IO-Link transceiver evaluation boards based on STM32 Nucleo – Data Brief
- **UM2509**: Getting Started with the GUI for the X-NUCLEO-OUT02A1 expansion board – User Manual

Consult www.st.com for the complete list
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- STM32 Open Development Environment: Overview
The STM32 Open Development Environment (ODE) consists of a set of stackable boards and a modular open SW environment designed around the STM32 microcontroller family.

STM32Cube development software

STM32 Nucleo development boards

STM32 Nucleo expansion boards (X-NUCLEO)

STM32Cube expansion software (X-CUBE)

Function Packs (FP)

www.st.com/stm32ode
STM32 Nucleo Development Boards (NUCLEO)

- A comprehensive range of affordable development boards for all the STM32 microcontroller series, with unlimited unified expansion capabilities and integrated debugger/programmer functionality.

Power supply through USB or external source

STM32 microcontroller

Integrated debugging and programming ST-LINK probe

Complete product range from ultra-low power to high-performance

ST morpho extension header

Arduino™ UNO R3 extension headers
STM32 Nucleo Expansion Boards (X-NUCLEO)

- Boards with additional functionality that can be plugged directly on top of the STM32 Nucleo development board directly or stacked on another expansion board.

Example of STM32 expansion board (X-NUCLEO-IKS01A1)

www.st.com/x-nucleo
STM32 Open Development Environment
Software components

- **STM32Cube software (CUBE)** - A set of free tools and embedded software bricks to enable fast and easy development on the STM32, including a Hardware Abstraction Layer and middleware bricks.

- **STM32Cube expansion software (X-CUBE)** - Expansion software provided free for use with the STM32 Nucleo expansion board and fully compatible with the STM32Cube software framework. It provides abstracted access to expansion board functionality through high-level APIs and sample applications.

- **Compatibility with multiple Development Environments** - The STM32 Open Development Environment is compatible with a number of IDEs including IAR EWARM, Keil MDK, and GCC-based environments. Users can choose from three IDEs from leading vendors, which are free of charge and deployed in close cooperation with ST. These include Eclipse-based IDEs such as Ac6 System Workbench for STM32 and the MDK-ARM environment.

**Tools & IDEs**
- IAR EWARM, Keil MDK-ARM, GCC-based IDEs (e.g. Ac6 System Workbench for STM32)

**Applications**
- Sample applications (e.g. based on ST OpenSoftwareX)

**Middleware**
- STM32Cube middleware
- Upper level middleware (e.g. ST OpenSoftwareX)
- STM32Cube expansion middleware

**Hardware Abstraction**
- STM32Cube Hardware Abstraction Layer (HAL)

**Hardware**
- STM32 Nucleo expansion boards (X-NUCLEO)
- STM32 Nucleo developer boards

**OPEN LICENSE MODELS:** STM32Cube software and sample applications are covered by a mix of fully open source BSD license and ST licenses with very permissive terms.

www.st.com/stm32cube
www.st.com/x-cube
STM32 Open Development Environment
Building block approach

The building blocks

Sense
- Accelerometer, gyroscope
- Inertial modules, magnetometer
- Pressure, temperature, humidity
- Proximity, microphone

Connect
- Bluetooth LE, Sub-GHz radio
- NFC, Wi-Fi, GNSS

Translate
- Audio amplifier
- Touch controller
- Operation Amplifier

Move / Actuate
- Stepper motor driver
- DC & BLDC motor driver
- Industrial input / output

Power
- Energy management & battery

Process
- General-purpose microcontrollers
- Secure microcontrollers

Software

Your need

COLLECT

TRANSMIT

ACCESS

CREATE

POWER

PROCESS

Our answer

www.st.com/stm32ode