Quick Start Guide
Stepper motor driver expansion board based on L6474 for STM32 Nucleo
(X-NUCLEO-IHM01A1)

Version 1.1 (July 07, 2015)
Overview

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STM32 Open Development Environment
Lowering the barriers for “developers”

Easy access to technology

Fast, flexible, affordable and based on commercial components

Scalable software for faster time to market
STM32 Open Development Environment

The STM32 Open Development Environment consists of a set of modular developer boards and a software environment designed around the STM32 microcontroller family.

- **STM32 Nucleo development boards**
- **STM32Cube development software**
- **STM32 Nucleo expansion boards**
- **STM32Cube expansion software**

Compatibility with multiple development environments.
STM32 Open Development Environment
Building block approach

The building blocks
- Sense
  - Accelerometer, gyroscope
  - Inertial modules, magnetometer
  - Pressure, temperature, humidity, UV
  - 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
- Power
  - Energy management & battery
- Process
  - General-purpose microcontrollers
  - Secure microcontrollers
- Software

Your need

Our answer

STM32 Open Development Environment

www.st.com/stm32ode
STM32 Nucleo development board

• Based on ST’s 32-bit ARM® Cortex®-M STM32 microprocessors
  • Development board with 1 MCU and hardware to program/debug
• Two connectors for companion chip boards
• For all STM32 families

(*) Thanks to its electrical compatibility, it can be used as a shield for Arduino UNO R3 or similar.
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X-NUCLEO-IHM01A1 Hardware description

• The X-NUCLEO-IHM01A1 is a stepper motor driver expansion board based on the L6474. It provides an affordable and easy-to-use solution for driving a stepper motor in your STM32 Nucleo project. The advanced current control of the L6474 and a complete set of protection features offer high levels of both performance and robustness.
• The X-NUCLEO-IHM01A1 is compatible with the Arduino UNO R3 connector, and supports the addition of other boards which can be stacked to drive up to three stepper motors using a single STM32 Nucleo board.

Key features

• Voltage range from 8 V to 45 V
• Phase current up to 3 A_{RMS}
• Power OK and fault LEDs
• Advanced current control
• Fully protected power stage
• Up to 1/16 microstepping resolution
• RoHS compliant

Key product on board

L6474: Fully integrated microstepping motor driver

Latest info available at X-NUCLEO-IHM01A1

Order code: X-NUCLEO-IHM01A1

** Connector for the STM32 Nucleo board
X-CUBE-SPN1 software package

- The X-CUBE-SPN1 is an expansion software package for STM32Cube, associated with the X-NUCLEO-IHM01A1 expansion board. It is compatible with the NUCLEO-F401RE, the NUCLEO-F030R8 and the NUCLEO-L053R8 development boards when they are equipped with one or more (up to 3) X-NUCLEO-IHM01A1 boards.

- The source code of this package is based on STM32Cube to ease portability across different STM32 MCU families.

Key features

- Driver layer for complete management of the L6474 microstepping motor driver integrated in the X-NUCLEO-IHM01A1 expansion board
- Examples for controlling up to three stepper motors
- Easy portability across different MCU families, thanks to STM32Cube
- Free, user-friendly license terms

Overall system architecture
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Documents & related resources

All documents are available in the Design Resources tab of the Stepper motor driver expansion board webpage

X-NUCLEO-IHM01A1: Product webpage (Link)
- Gerber files, BOM, and schematics
- DB2360: Stepper motor driver expansion board based on L6474 for STM32 Nucleo – Databrief
- UM1857: Stepper motor driver expansion board based on L6474 for STM32 Nucleo – User manual

X-CUBE-SPN1: Product webpage (Link)
- DB2456: STM32Cube software expansion for the X-NUCLEO-IHM01A1 expansion board – Databrief
- UM1848: Getting started with the software package for L6474 stepper – User manual
- Software setup file

L6474: Product webpage (Link)
- DS8773: Product datasheet with details about default parameters - datasheet
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Getting started with hardware

The X-NUCLEO-IHM01A1 expansion board is a stepper motor driver covering a wide range of applications.

The maximum ratings are:

- Power stage supply voltage (VS) from 8 V to 45 V
- Motor phase current up to $3 \text{ A}_{\text{RMS}}$

To start your project with the board:

1. Check the jumper position in accordance with your configuration (see Section 2 of UM1857).
2. Connect the board to the STM32 Nucleo board with the connector:
   a. Arduino UNO R3 for the X-NUCLEO-IHM01A1
   b. ST Morpho for the X-NUCLEO-IHM01A

Up to three expansion boards can be stacked on the same STM32 Nucleo board, as described in Section 2.2 of UM1857.

1. Supply the board through pins 1 (VS) and 2 (ground) of the connector CN1.
2. The power OK (green) and fault (red) LEDs turn on.
3. Develop your application using the examples provided with the firmware library.

Selecting the chip select and clock lines of the SPI

The chip select and the clock lines of the SPI interface can be selected through dedicated resistors as indicated in Tables 3 and 5 of UM1857.

Multi-motor configuration

The expansion boards can be stacked on a single STM32 Nucleo board in order to drive up to three stepper motors (one for each motor). More in Section 2.2 of UM1857.
Configuration for driving 1, 2 or 3 motors
Setup & demo examples
System requirements to drive up to 3 motors (1/2)

To drive one motor, you need:

- One NUCLEO-F401RE or NUCLEO-F030R8 or NUCLEO-L053R8
- One, two or three X-NUCLEO-IHM01A expansion boards
- One, two or three stepper motors
- An external DC power supply with two, four or six electric cables
- A USB type A to mini-B cable
- A Windows PC with one of the supported development toolchains:
  - KEIL: MDK-ARM
  - IAR: EWARM
  - GCC-based IDEs (Atollic TrueStudio…)
  - STM32 Cube firmware for X-NUCLEO-IHM01A1 from: Link (firmware available in Related Tools and Software tab)
Setup & demo examples
System requirements to drive up to 3 motors (2/3)

• The STM32 Nucleo has to be configured with the following jumper positions:
  • JP1 off
  • JP5 (PWR) on UV5 side
  • JP6 (IDD) on

• The X-NUCLEO-IHM01A expansion board for first motor must have:
  • Mounted resistors (0R) on R1, R4, R7 and 10
  • Unmounted resistors on R2, R3, R5, R6, R8, R9, R11 and R12

Resistor setup for first motor

Hardware user manual
UM1857
Setup & demo examples

System requirements to drive up to 3 motors (3/3)

The X-NUCLEO-IHM01A expansion board for the second motor must have:
• Mounted resistors (0R) on R2, R5, R8 and R11
• Unmounted resistors on R1, R3, R4, R6, R7, R9, R10 and R12

The X-NUCLEO-IHM01A expansion board for third motor must have:
• Mounted resistors (0R) on R3, R6, R9 and R12
• Unmounted resistors on R1, R2, R4, R5, R7, R8, R10 and R11

Resistor setup for second motor

Resistor setup for third motor

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Setup & demo examples
System setup to drive up to 3 motors

- Plug the X-NUCLEO-IHM01A for the first motor on top of the STM32 Nucleo using the Arduino UNO connectors
- Plug the X-NUCLEO-IHM01A for the second motor on top of the one for first motor
- Plug the X-NUCLEO-IHM01A for the third motor on top of the second one
- Connect the STM32 Nucleo board to a PC using the USB cable via USB connector CN1 to power the board
- Power on the X-NUCLEO-IHM01A expansion boards by connecting their VIN and GND connectors to the DC power supply. The DC supply must be set to deliver the correct voltage required by the stepper motors.
- Connect each stepper motor to the A+/− and B+/− bridge connectors of their dedicated X-NUCLEO-IHM01A board

Hardware user manual
UM1857
Once the system setup is ready:

- Open your preferred tool chain (MDK-ARM from Keil, EWARM from IAR, or Atollic TrueStudio)
- Depending on your STM32 Nucleo board, open the software project from:
  - \stm32\cube\Projects\Multi\Examples\MotionControl\IHM01A1_ExampleFor3Motors\YourToolChainName\STM32F401RE-Nucleo for Nucleo STM32F401
  - \stm32\cube\Projects\Multi\Examples\MotionControl\IHM01A1_ExampleFor3Motors\YourToolChainName\STM32F030R8-Nucleo for Nucleo STM32F030
  - \stm32\cube\Projects\Multi\Examples\MotionControl\IHM01A1_ExampleFor3Motors\YourToolChainName\STM32L053R8-Nucleo for Nucleo STM32L053
- In order to adapt the default parameters which are used by the L6474s depending on your stepper motor characteristics, open the file: \stm32\cube\Drivers\BSP\Components\l6474\l6474_target_config.h. and modify the parameters which are postfixed by “_DEVICE_0” for the first motor, postfixed by “_DEVICE_1” for the second motor and by “_DEVICE_2” for the third motor.
- Rebuild all files and load your image into the target memory.
- Run the example. The motors automatically start (see main.c for the detailed demo sequence).