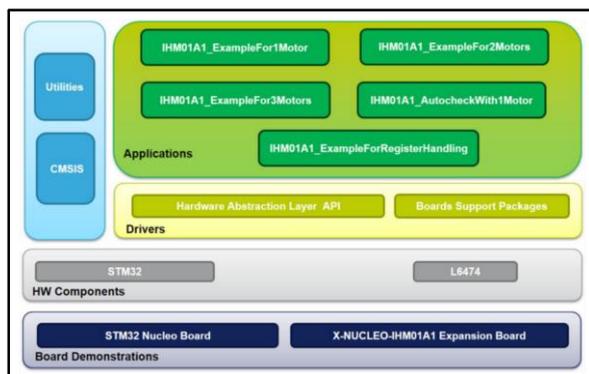


STM32Cube software expansion for the X-NUCLEO-IHM01A1 expansion board

Data brief



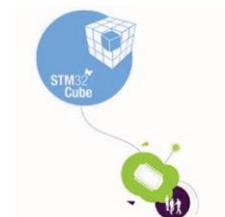
Description

X-CUBE-SPN1 is a software package based on STM32Cube for the X-NUCLEO-IHM01A1 expansion board. It is compatible with the NUCLEO-F401RE, the NUCLEO-F030R8, the NUCLEO-L053R8 and NUCLEO-F334R8 boards equipped with one or more (up to 3) X-NUCLEO-IHM01A1 boards.

The software is based on the STM32Cube technology to facilitate portability across different STM32 MCU families. Information regarding STM32Cube is available on www.st.com at <http://www.st.com/stm32cube>

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



What is STM32Cube?

STM32Cube™ represents the STMicroelectronics initiative to make developers' lives easier by reducing development effort, time and cost. STM32Cube covers the STM32 portfolio.

STM32Cube version 1.x includes:

- STM32CubeMX, a graphical software configuration tool that allows the generation of C initialization code using graphical wizards.
- A comprehensive embedded software platform specific to each series (such as the STM32CubeF4 for the STM32F4 series), which includes:
 - the STM32Cube HAL embedded abstraction-layer software, ensuring maximized portability across the STM32 portfolio
 - a consistent set of middleware components such as RTOS, USB, TCP/IP and graphics
 - all embedded software utilities with a full set of examples

How does this software complement STM32Cube?

The X-CUBE-SPN1 software package allows complete management of the L6474 fully integrated microstepping motor driver by providing complete APIs. It offers the following features:

- L6474 registers read, write
- Nucleo and expansion board configuration (GPIOs, PWMs, IRQs, etc.)
- Speed profile configuration
- Motion commands
- FLAG interrupts handling (alarms reporting)
- Microstepping handling
- Daisy chaining handling

When initializing the L6474 driver, the user specifies the number of L6474 devices which are connected to the STM32 Nucleo Board (i.e. the number of X-NUCLEO-IHM01A1 expansion boards). Once set, the number of devices must not be changed.

Depending on the number of devices, the driver:

- sets up the required GPIOs to handle the motor directions and the FLAG interrupt
- initializes the PWMs to act as step clock generators
- initializes the speed profile (acceleration, deceleration, min and max speed) from the parameters in `l6474_target_config.h`
- starts the SPI driver to communicate with the L6474 devices
- releases the reset of each of the L6474 devices
- disables the power bridge and clears the status flags of the L6474 devices
- loads the registers of each L6474 device with the predefined values in `l6474_target_config.h`

Once initialization is complete, the user can modify the L6474 registers and speed profile configurations as desired. Most of the functions of the driver take a device ID (from 0 to 2) as an input parameter so users can specify which device configuration to modify.

The user can also write a callback function and attach it to the Flag interrupt handler, depending on the actions to be performed when an alarm is reported (read the flags, clear and read the flags, etc.).

The user can then request the movement of one or more motors (via device IDs). This request can be:

- to move for a given number of steps in a specified direction

- to go to a specific position
- to run until it receives a new instruction

On reception of this request, the driver enables the PWM which is used as the step clock of the corresponding L6474.

For each pulse period, the motor performs one step and an ISR (interrupt service routine) is triggered on the microcontroller side. This ISR is used by the firmware to count the number of performed steps and to update the speed. Indeed, the motor starts moving by using the minimum speed parameter. At each step, the speed is increased using the acceleration parameter.

If the target position is far enough, the motor will perform a trapezoidal move:

- acceleration phase using the device acceleration parameter
- steady phase where the motor turns at maximum speed
- deceleration phase using the device deceleration parameter
- stop at the targeted position

Otherwise, if the target position does not allow it to reach maximum speed, the motor will perform a triangular move:

- acceleration phase using the device acceleration parameter
- deceleration phase using the device deceleration parameter
- stop at the targeted position

A move command can be interrupted at any time by either:

- a soft stop or `softHiz` which progressively decreases the speed using the deceleration parameter. Once the minimum speed is reached, the motor is stopped.
- a hard stop or `hardHiz` command which immediately stops the motor.

When the motor is stopped using the `softHiz` or `hardHiz` command, the power bridge is automatically disabled.

To inhibit the sending of a new command to a device before the completion of the previous one, the driver offers the `BSP_MotorControl_WaitWhileActive()` command which locks program execution until the motor stops moving. The driver also allows changing the step mode (from full step to 1/16 microstep mode) for each device. When the step mode is changed, the current position (`ABS_POSITION` register) is automatically reset, but the user must update the speed profile (maximum and minimum speed, acceleration deceleration).

Revision history

Table 1: Document revision history

Date	Version	Changes
07-Nov-2014	1	Initial release.
19-Feb-2016	2	Text changes throughout document Updated cover page image Added reference to NUCLEO-F334R8 compatibility

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