

# UM11835

## Introduction to the FRDMSTBI-NMH1000 shield board

Rev. 1 — 10 October 2022

User manual

### Document information

Information	Content
Keywords	Magnetic switch, hall effect magnetic field sensor, FRDMSTBI-NMH1000, shield board, evaluation, board, evaluation hardware, ecosystem, NMH1000
Abstract	This document introduces the FRMDSTBI-NMH1000 shield board and explains where to find resources, how to install, configure, and use the tools associated with the board.



Revision history

Rev	Date	Description
v.1	20221010	initial version

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## 1 Introduction

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The FRDMSTBI-NMH1000 is an evaluation board comprised of all necessary headers, jumpers, and signal test points to quickly evaluate the NMH1000 magnetic sensor.

This document is intended to help a user quickly set up, configure and operate the FRDMSTBI-NMH1000 evaluation board.

## 2 Finding kit resources and information on the NXP web site

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NXP Semiconductors provides online resources for this evaluation board and its supported device(s) on <http://www.nxp.com>.

The information page for the magnetic sensor, NMH1000, and the FRDMSTBI-NMH1000 evaluation shield board can be found at:

<http://www.preview.nxp.com/products/sensors/magnetic-angular-position-sensors/nmh1000-ultra-low-power-and-low-voltage-magnetic-switch:NMH1000>

The information page provides overview information, documentation, software and tools, ordering information and a Getting Started tab. The Getting Started tab provides quick-reference information applicable to using the FRDMSTBI-NMH1000, including the downloadable assets referenced in this document.

### 2.1 Collaborate in the NXP community

The NXP Community is for sharing ideas and tips, asking and answering technical questions, and receiving input on just about any embedded design topic.

The NXP Community is at <http://community.nxp.com>.

## 3 Getting ready

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Working with the FRDMSTBI\_NMH1000 evaluation shield board also requires a FRDM-KE15Z MCU board, a PC and project demo software available at NXP.com.

### 3.1 Kit contents

The FRDMSTBI-NMH1000 contents include:

- FRDMSTBI-NMH1000 shield board with Arduino headers

### 3.2 Additional hardware

The FRDMSTBI-NMH1000 can be paired with NXP MCU boards of your choice, however there is a demo project provided for the FRDM-KE15Z MCU board for evaluation. Detailed information is provided in [Section 4 "Getting to know the hardware"](#).

### 3.3 Static handling requirements

**CAUTION**

This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling. You must use a ground strap or touch the PC case or other grounded source before unpacking or handling the hardware.

### 3.4 Minimum system requirements

The FRDMSTBI-NMH1000 evaluation board requires a Windows 10 PC workstation and a Freedom FRDM-KE15Z MCU board.

### 3.5 Software

Installing software is necessary to work with this evaluation board. All listed software is available on the evaluation board's information page at <https://www.nxp.com/products/sensors/magnetic-sensors/nmh1000-ultra-low-power-and-low-voltage-magnetic-switch:NMH1000>.

## 4 Getting to know the hardware

### 4.1 Kit overview

The FRDMSTBI-NMH1000 shield board incorporates a NMH1000 fully integrated magnetic sensor that provides a small footprint, low current and low operating voltage, I<sup>2</sup>C mode or standalone mode capabilities.

The FRDMSTBI-NMH1000 shield board can be easily connected to a NXP Freedom MCU board via the Arduino headers for evaluation (See [Section 5 "Configuring the hardware"](#)). The following board is recommended:

- FRDM-KE15Z

The user can connect the two boards for evaluation of the NMH1000 magnetic sensor with either a terminal program using the NXP provided Component Library [Section 5 "Configuring the hardware"](#) or standalone use. In either use case, the hardware helps users in their software development.

These evaluation boards provide an intuitive way to change between the sensors standalone modes and using the I<sup>2</sup>C interface for communication through jumper selections as well as providing test points that are typically used for evaluation. The NMH1000 datasheet provides additional information and configuration details.

### 4.2 NMH1000 magnetic sensor board features

The NMH1000 is a hall effect magnetic field sensor that is most sensitive to a vertical field passing through the top-to-bottom surfaces, orthogonal to the plane of the application printed circuit board. The sensor operates at low voltage, low current, low output data rate, and is a small physical size. Features include:

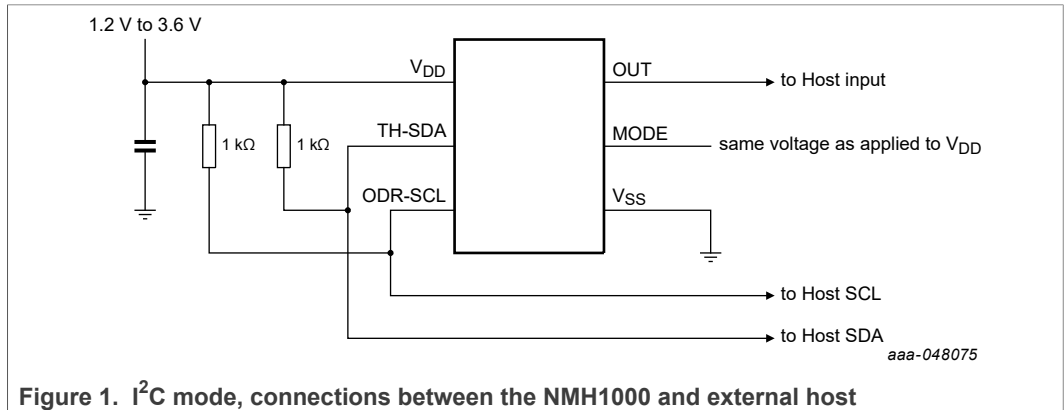
- Z- axis Hall effect switch for axial magnets
  - North and South polarity sensitivity

- Low operating voltage down to 1.2 V
- Ultra-low power consumption
  - 75 nA typ. @ 1 Hz sample rate
- Industrial operating temperature range
  - -40 °C to 85 °C
- Selectable Modes
  - Standalone Mode
    - Threshold selection 3-state hardware pin (70 Gauss, 140 Gauss or 210 Gauss)
    - Samples rate selection 3-state hardware pin (0.1 Hz, 1.0 Hz, 10 Hz)
  - I<sup>2</sup>C User Mode
    - Threshold selection data bits
    - Sample rate selection data bits (0.1 Hz to 100 Hz)
- Binary state hardware pin output; programmable polarity in I<sup>2</sup>C User Mode
- Small Form Factor Packaging
  - DFN 1.4 x 1.4 x 0.85 mm
  - 6 pins, 0.5 mm pitch

**4.3 Block diagram examples**

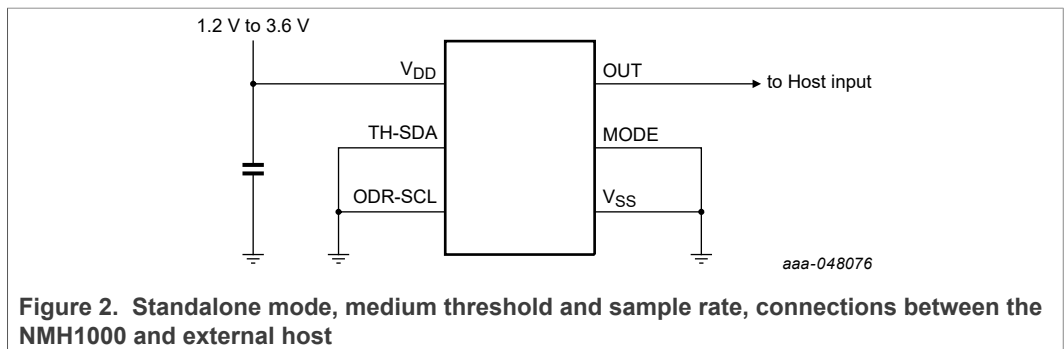
Example block diagrams of the NMH1000 with an external host is shown in [Figure 1](#) and [Figure 2](#).

[Figure 1](#) shows the I<sup>2</sup>C circuit setup where the NMH1000 mode is set to V<sub>DD</sub> and the output signal is sent to the host.



**Figure 1. I<sup>2</sup>C mode, connections between the NMH1000 and external host**

[Figure 2](#) shows the standalone mode circuit setup where the NMH1000 mode is set to GND and the output signal is sent to the host.



**Figure 2. Standalone mode, medium threshold and sample rate, connections between the NMH1000 and external host**

### 4.4 Kit featured components

Figure 3 identifies important components on the board and Table 1 provides additional details on these components.

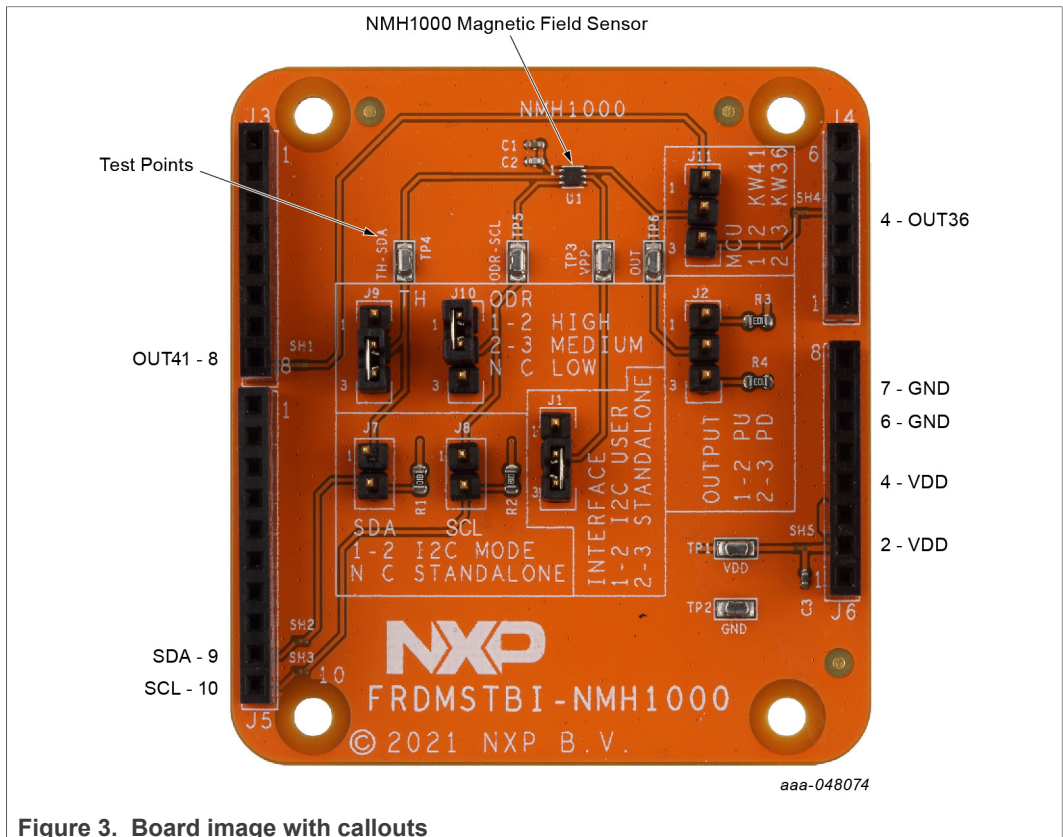


Figure 3. Board image with callouts

The FRDMSTBI-NMH1000 shield board comes with standard Arduino headers and can be paired with NXP Freedom MCU boards for user evaluations and software development. For quick evaluation and prototyping, NXP provides a demo project targeted to the FRDM-KE15Z board and the hardware design files for fast time to market.

Table 1. Evaluation board featured components location

Number	Description
U1	NMH1000 magnetic field sensor
J3	OUT41, pin 8
J4	OUT36, pin 4
J5	SDA, pin 9, SCL, pin 10
J6	VDD, pins 2, 4, GND, pins 6, 7

As labeled in the figure, the following signals are available on the Arduino headers and the selectable signal headers of the FRDMSTBI-NMH1000 shield board:

- The interface or sensor modes are selected by J1
  - I<sup>2</sup>C mode: J1, 1-2; J7 and J8 ON (placed)

- Standalone mode: J1, 2-3; J7 and J8 OFF (open)
- Standalone mode:
  - Threshold selection (low, med, high) is selected by jumper J9
  - Sampling rate or ODR (low, med, high) is selected by jumper J10
- The I<sup>2</sup>C interface is provided through J5. These are:
  - J5-9, SDA, Serial data
  - J5-10, SCL, Serial clock
- J11, pin 6 output section to either J4, 4 or J3, 8
- J2, pullup/pull down selection
- VDD is supplied through J6-2 / J6-4. This is typically supplied through a Freedom MCU board; i.e. FRDM-KE15Z.
- GND is supplied through J6-6 / J6-7. This is typically supplied through a Freedom MCU board; i.e. FRDM-KE15Z.

**4.4.1 Connectors**

Table 2. NMH1000 connectors

Connectors	Description
J3	Eight pin connector
J4	Six pin connector
J5	Ten pin connector
J6	Eight pin connector

**4.4.2 Test points**

Table 3. NMH1000 test points

Test Points	Description
TP1	V <sub>DD</sub>
TP2	GND
TP3	V <sub>PP</sub>
TP4	TH-SDA
TP5	ODR-SCL
TP6	Out

**4.4.3 Jumpers**

Table 4. NMH1000 jumpers

Jumper	Description
J1	Interface, I <sup>2</sup> C user or standalone
J2	Output
J7	SDA
J8	SCL
J9	TH
J10	ODR



Table 4. NMH1000 jumpers...continued

Jumper	Description
J11	MCU

#### 4.4.4 Switches

Table 5. NMH1000 switches

Switch	Description
SH1	Short
SH2	Short
SH3	Short
SH4	Short
SH5	Short

#### 4.5 FRDMSTBI-NMH1000 hardware design files

The FRDMSTBI-NMH1000 shield board design files can be found and downloaded from the NMH1000 product page under the Tools and Software tab. See [Section 6](#) for applicable documents and links.

#### 4.6 Schematic, board layout and bill of materials

The schematic, board layout and bill of materials for the FRDMSTBI-NMH1000 evaluation board are located on the design resources tab at <https://www.nxp.com/products/sensors/magnetic-sensors/nmh1000-ultra-low-power-and-low-voltage-magnetic-switch:NMH1000>.

## 5 Configuring the hardware

[Figure 4](#) presents the typical hardware configuration incorporating the FRDMSTBI-NMH1000 evaluation board with standard Arduino headers combined with the FRDM-KE15Z Freedom MCU board.

NXP provides a Component Library software example for quick evaluation and prototyping. The demo project is targeted to the FRDM-KE15Z and is located under Design Resources, BSP, DRIVERS AND MIDDLEWARE at the following link: <https://www.nxp.com/products/sensors/magnetic-sensors/nmh1000-ultra-low-power-and-low-voltage-magnetic-switch:NMH1000>

Download the driver NMH1000 sensor driver with examples.

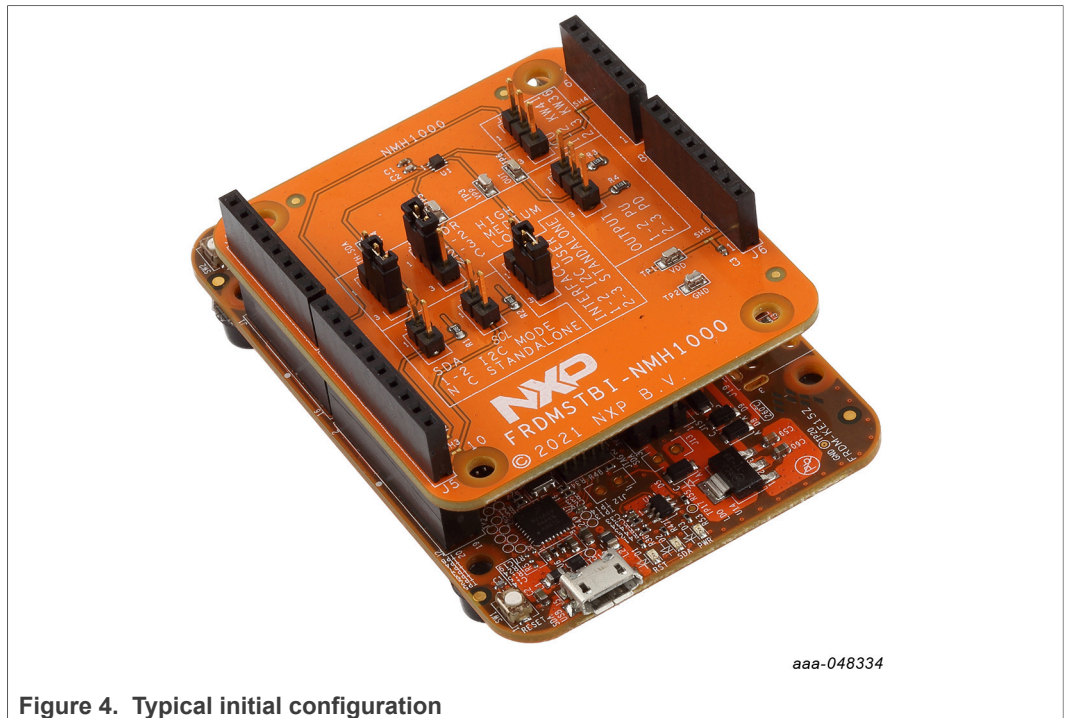


Figure 4. Typical initial configuration

## 6 References

- [1] NMH1000 — Magnetic field sensor product page. <https://www.nxp.com/products/sensors/magnetic-sensors/nmh1000-ultra-low-power-and-low-voltage-magnetic-switch:NMH1000>
- [2] FRDMSTBI-NMH1000 design files — Tools and software tab. <https://www.nxp.com/design/sensor-developer-resources/sensor-sw-component-library/sensor-drivers-for-nxp-sensors:SENSOR-DRIVERS>

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