



BHy2xx/BHI3xx

Ultra-low power high performance Smart Sensor Hub with integrated sensors

BHy2xx/BHI3xx Evaluation Setup Guide

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1 General description

This guide provides the tools and information needed to evaluate features of BHI260AB/BHA260AB (hereafter referred to as BHy2xx) and BHI360/BHI380/BHI385 (hereafter referred to as BHI3xx), on both Windows and Linux based systems.

Hardware and software requirements are described, and simple examples can be used to get started with the BHy2xx/BHI3xx sensor. The examples can then be used as a reference to build custom examples for various tasks. Additionally, the setup can be used to evaluate custom firmware images developed using the Software Development Kit (see Reference 4).

Finally, the command line interface tool bhy2cli is introduced. This provides a simple and quick way of communicating to the BHy2xx/BHI3xx device via a command line.

The examples provided are based on **COINES** ("COmmunication with INertial and Environmental Sensors"), an evaluation software tool from Bosch Sensortec, which provides a low-level interface to Bosch Sensortec's Application board 3.0/3.1 connected to a BHI sensor shuttle board.

2 Software requirements

2.1 COINES

COINES is a software tool that enables users to evaluate sensors using the Bosch Sensortec Application Board.

1. [Download](#) the latest COINES software for your OS.
2. To install the COINES, follow the instructions below for the respective operating system.
 - a. **Windows**
Run the COINES installation package (.exe) to install the software.
 - b. **Linux**
Run the `./coines_v<version>.sh` with executable privilege in a shell to install the COINES software.
Note: This requires an internet connection. Root privileges may be required to install dependencies.
3. After COINES is installed, install the USB driver for the application board. A prompt should follow the COINES installation to install this or can be installed later using the installer under `COINES_SDK\v2.10.4\driver`.

2.1.1 Linux and MacOS

Details about the operation of COINES can be under `<COINES install path>\v2.10.4\doc\BST-DHW-AN013.pdf`.

2.2 Firmware on the Application Board

The Application board ships with default firmware which may need an update depending on the time of update. In any case, it is recommended to update the board's firmware, instructions for which are available in the [README](#).

2.2.1 Update COINES bridge firmware

BHy examples in COINES V2.10.4 and later version are only supported COINES bridge firmware Users need running "update_coines_bridge_flash_fw.bat" file. The location of the file is in different paths depending on the Application Board used, "C:\COINES_SDK\v2.10.4\firmware\app3.0\coines_bridge" or "C:\COINES_SDK\v2.10.4\firmware\app3.1\coines_bridge"

Note:

If switch to default firmware, users need running "update_dd_fw.bat" file present in "C:\COINE_SDK\v2.10.4\firmware\app3.0".

2.3 BHy2xx/BHI3xx Sensor API

The Sensor API should be updated separately. The latest Sensor API repository on Github contains the host drivers to be used in the user's product, along with relevant application examples. Some of these examples, such as the bhy2cli tool, are also utilities to be used during the development and evaluation of the product. The Sensor API is available to

be [cloned](#) or [downloaded](#). For evaluation, the sensorAPI examples can be compiled using the COINES environment, to do so, copy or clone the SensorAPI github files to <COINES install path>\v2.10.4\examples\<sensorAPI>.

2.4 BHy2xx/BHI3xx CLI tool

The Application Board can be interfaced using a CLI tool using the bhy2cli_ble example in the SensorAPI. A pre-compiled version of this is included in the SDK, or it can be compiled from the Sensor API by installing the compiler and toolchain described below.

2.5 BHy2xx/BHI3xx Compiler and Toolchain

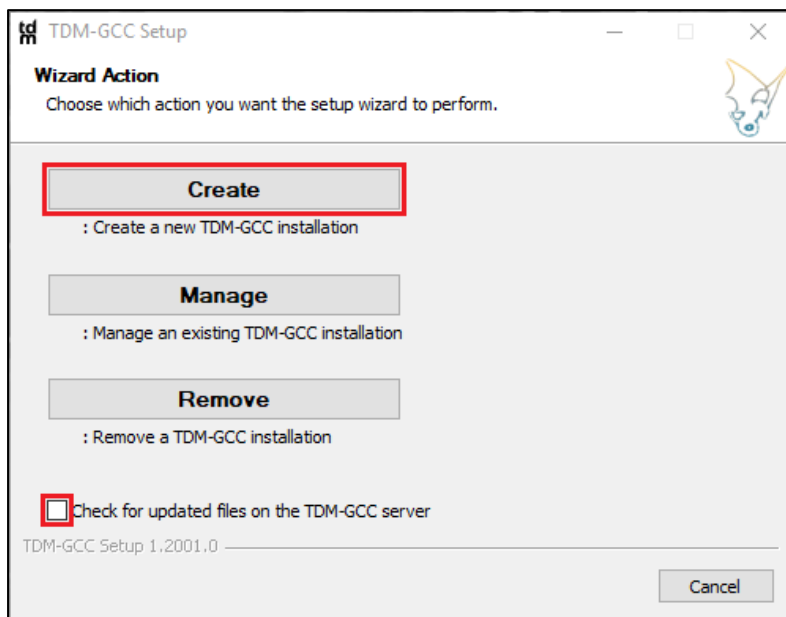
The following is a summary of the setup instructions in the previously installed COINES <COINES install path>\v2.10.4\doc\BST-DHW-AN013.pdf documentation. The system compiler is for executing examples from the PC interface in COINES. The toolchain allows cross-compilation to execute examples on the Application Board's MCU. The toolchain installation can be skipped if you only intend to run using the PC interface, for example if you just want to use the CLI tool.

2.5.1 Windows

It is recommended to use these Software tools in Windows 7 or newer.

To set up the required software environment, execute the following steps:

1. Install the GCC compiler for Windows as part of the TDM32 bundle (for 32-bit Windows installations) or TDM64 bundle (for 64-bit Windows installations), which can be found [here](#):
 - a. Uncheck the checkbox and click **Create**.



- b. Read and accept the license agreement, then finish the installation with default options.
2. If you wish to run the Application Board in MCU mode (e.g. If you need to disconnect the device from a PC) [download](#) and install the GNU ARM Embedded Toolchain. Make sure you have checked 'Add path to environmental variable'.

2.5.2 Linux and MacOS

On a Debian or Redhat based Linux system, the COINES installer prompts for the installation of missing the dependencies e.g. gcc, make and libusb-dev packages. If due to some reason installation fails, the user can manually install the dependencies:

- Debian based distros - gcc, make, libusb-1.0-0-dev, dfu-util
- Redhat based distros - gcc, make, libusb-devel, dfu-util
- MacOS - libusb, dfu-util

If you intend to run the COINES examples on Application Board's integrated MCU, download the latest version of GNU Embedded Toolchain for ARM for Linux and extract the package. Add the compiler to the PATH variable by editing \$HOME/.bashrc or similar config file such as /etc/profile or /etc/environment.

3 Hardware requirements

This section describes the hardware required for using COINES as an evaluation tool. The evaluation of BHy2xx and BHI3xx requires two components which are usually delivered pre-mounted:

- Bosch Sensortec Application Board 3.0/3.1
- BHy2xx/BHI3xx shuttle board

Additionally, a micro-USB-to-USB cable is required to connect the Application Board to a PC. See Figure 1 and Figure 2, which takes the BHI260 shuttle board as an example.

The Bosch Sensortec Application Board 3.0/3.1 is an evaluation device that supports most Bosch Sensortec sensors and allows users to change the sensor shuttle board freely.

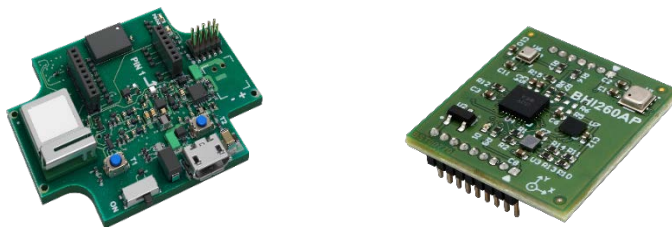


Figure 1: Required components.

Execute the following steps to set up the hardware components (if they are not already mounted):

1. Mount the BHy2xx/BHI3xx shuttle board to the application board. Ensure that the pins are aligned correctly to avoid damaging the connector or bending the pins. Note that one header is 7-pin, and the other is 9-pin.



Figure 2: Mounting the shuttle board.

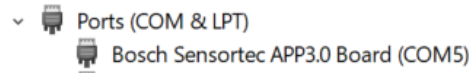
2. Once aligned, press down on the board to fit the Shuttle Board 3.0 onto the Application Board 3.0/3.1.
3. Connect the application board to your PC with a micro-USB-to-USB cable.
4. Turn on the Application Board by setting the power slider switch to the “on” position.

Under Windows, the correct connection of the application board as well as the installation of the necessary drivers can be confirmed by checking the device manager. The application board should now be visible under “BST Board” (see Figure 3).



Figure 3: Checking the connection in Device Manager.

If update coins bridge firmware, device will be visible as Bosch Sensortec APP3.0/3.1 Board (see Figure 4).

**Figure 4: Checking the connection in Device Manager**

4 Building and executing examples

This section will guide you through the process of building and executing the example “bhy2cli_ble”.

The following examples are included under <COINES Installation path>\examples\bhy2\examples.

1. Open a command prompt terminal or powershell terminal and navigate to the directory of the bhy2cli_ble example.

```
>cd C:\COINES_SDK\v2.10.4\examples\bhy2\examples\bhy2cli_ble
```

2. To build the application, execute mingw32-make.exe.
 - a. Windows

```
C:\COINES_SDK\v2.10.4\examples\bhy2\examples\bhy2cli_ble> mingw32-
make.exe
Platform: Windows
cc: "C:\TDM-GCC-64\bin\gcc.exe".
[ CC ] post_mortem.c
[ CC ] dinject.c
[ CC ] parse.c
[ CC ] logbin.c
[ CC ] cli.c
[ CC ] bhy2cli_callbacks.c
[ CC ] common_callbacks.c
[ CC ] verbose.c
[ CC ] ../common/common.c
[ CC ] ../../bhy2.c
[ CC ] ../../bhy2_hif.c
[ CC ] ../../bhy2_parse.c
[ CC ] ../../bhy2_klio.c
[ CC ] ../../bhy2_swim.c
[ CC ] ../../bhy2_bsec.c
[ CC ] ../../bhi3.c
[ CC ] ../../bhi3_multi_tap.c
[ CC ] ../../bhy2_head_tracker.c
[ CC ] bhy2cli.c
\v2.9\coins-api\build\PC\ble_com.c.d
\v2.9\coins-api\build\PC\cflags.save
[ MAKE ] coins-api
[ CC ] pc/coins_bridge.c
[ CC ] pc/serial_com/serial_com.c
[ CC ] pc/ble_com/simpleble_lib_loader.c
[ CC ] pc/ble_com/ble_com.c
[ AR ] libcoins-pc.a
[ LD ] bhy2cli
```

Linux and MacOS

```
$ make
```

```
Platform: Linux / macOS
cc: "/usr/bin/gcc".
[ MKDIR ] build/PC
[ CC ] parse.c
[ CC ] logbin.c
[ CC ] cli.c
[ CC ] bhy2cli_callbacks.c
[ CC ] common_callbacks.c
[ CC ] verbose.c
[ CC ] ../common/common.c
[ CC ] ../../source/bhy2.c
[ CC ] ../../source/bhy2_hif.c
[ CC ] ../../source/bhy2_parse.c
[ CC ] ../../source/bhy2_klio.c
[ CC ] ../../source/bhy2_pdr.c
[ CC ] ../../source/bhy2_swim.c
[ CC ] ../../source/bhy2_bsec.c
[ CC ] ../../source/bhy2_head_tracker.c
[ CC ] bhy2cli.c
[ MAKE ] coines-api
[ MKDIR ] build/PC
[ CC ] pc/coines.c
[ CC ] pc/comm_intf/comm_intf.c
[ CC ] pc/comm_intf/comm_ringbuffer.c
[ CC ] pc/comm_driver/usb.c
[ AR ] libcoines-pc.a
[ LD ] bhy2cli
```

3. Run the bhy2cli executable.

a. Windows

```
>bhy2cli.exe -h
```

b. Linux and MacOS

```
$ ./bhy2cli -h
```

The output should match the following:

```

Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0   Build date: Dec 16 2024
Usage:
bhy2cli [<port>] [<port_name>] [<options>]
Options:
  -h OR help      = Print this usage message
  version        = Prints the version
  -v OR verb <verbose level>
                  = Set the verbose level. 0 Error, 1 Warning, 2 Infos
  -b OR ramb <firmware path>
                  = Reset, upload specified firmware to RAM and boot from RAM
                  [equivalent to using "reset ram <firmware> boot r" successively]
  -d OR flb <firmware path>
                  = Reset, upload specified firmware to Flash and boot from Flash
                  [equivalent to using "reset fl <firmware path> boot f" successively]
  -n OR reset     = Reset sensor hub
  -a OR addse <sensor id>:<sensor name>:<total output payload in bytes>:
    <output_format_0>:<output_format_1>
                  = Register the expected payload of a new custom virtual sensor
                  -Valid output_formats: u8: Unsigned 8 Bit, u16: Unsigned 16 Bit, u32:
                    Unsigned 32 Bit, s8: Signed 8 Bit, s16: Signed 16 Bit, s32: Signed
32 Bit,
                  f: Float, c: Char
                  -e.g.: addse 160:"Lean Orientation":2:c:c
                  -Note that the corresponding virtual sensor has to be enabled in the
same function
                  call (trailing actse option), since the registration of the sensor
is temporary.
  -g OR boot <medium>
                  = Boot from the specified <medium>: "f" for FLASH, "r" for RAM
...

```

5 Command-line interface tool bhy2cli

The command-line interface tool bhy2cli is an application based on the COINES API. It is used to communicate with BHy2xx/BHI3xx by using predefined commands that it translates to corresponding host interface commands. The requirements for using the tool are described in chapters 2 and 3.

Calls to the bhy2cli tool are structured as follows:

```
>bhy2cli <option1> <parameters1> <option2> <parameters2> ...
```

There can be any number of <options> used subsequently and the same options can be used multiple times.

5.1 Overview

The implemented options with necessary parameters and short descriptions can be found through running command

```
>bhy2cli.exe -h
```

using windows prompt. Or running command

```
$ ./bhy2cli -h
```

using Linux terminal.

5.2 Getting started

To start using bhy2cli, the following minimal example set of commands can be used to get started:

1. Establish the hardware connections described in chapter 3.
2. Build the tool as described in the chapter 4 based on software requirements in chapter 2.
3. Use the “-b” option to reset, load a firmware to RAM and boot the device from RAM. In the BHI360 example below, the “.fw” file is located in a different directory as the bhy2cli executable.

- a. Windows

```
> bhy2cli -b ..\..\..\firmware\bhi360\BHI360.fw
```

- b. Linux

```
$ ./bhy2cli -b ../../../../firmware/bhi360/BHI360.fw
```

4. Display general device information including the existing virtual sensors in the firmware.

- a. Windows

```
> bhy2cli -i
```

- b. Linux

```
$ ./bhy2cli -i
```

5. Activate the virtual sensor “Game Rotation Vector” at 25 Hz to see the data provided by the device.

- a. Windows

```
> bhy2cli -c 37:25
```

- b. Linux

```
$ ./bhy2cli -c 37:25
```

The following screen will appear.

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024Reset successful
Uploading 127228 bytes of firmware to RAM
Uploading firmware to RAM successful
Waiting for firmware verification to complete
Boot Status : 0x38: No flash installed. Host interface ready. Firmware verification
done.
[D][META EVENT WAKE UP]; T: 0.502281250; Firmware initialized. Firmware version 5991
[D][META EVENT]; T: 0.502281250; Firmware initialized. Firmware version 5991
Booting from RAM successful
```

```

Host Interface : SPI
Copyright (c) 2023 Bosch Sensortec GmbH
Version 0.4.9 Build date: Oct 2023
Product ID      : 89
Kernel version  : 5991
User version    : 5991
ROM version     : 5166
Power state     : sleeping
Host interface  : SPI
Feature status  : 0x4a
Boot Status : 0x38: No flash installed. Host interface ready. Firmware verification done.
Virtual sensor list.

```

Sensor ID	Sensor Name	ID	Ver	Min rate	Max rate
1	Accelerometer passthrough	205	1	1.5625	400.0000
3	Accelerometer uncalibrated	203	1	1.5625	400.0000
4	Accelerometer corrected	241	1	1.5625	400.0000
5	Accelerometer offset	209	1	1.0000	1.0000
6	Accelerometer corrected wake up	192	1	1.5625	400.0000
7	Accelerometer uncalibrated wake up	204	1	1.5625	400.0000
10	Gyroscope passthrough	207	1	1.5625	400.0000
12	Gyroscope uncalibrated	244	1	1.5625	400.0000
13	Gyroscope corrected	243	1	1.5625	400.0000
14	Gyroscope offset	208	1	1.0000	1.0000
15	Gyroscope wake up	194	1	1.5625	400.0000
16	Gyroscope uncalibrated wake up	195	1	1.5625	400.0000
28	Gravity vector	247	1	1.5625	400.0000
29	Gravity vector wake up	198	1	1.5625	400.0000
31	Linear acceleration	246	1	1.5625	400.0000
32	Linear acceleration wake up	197	1	1.5625	400.0000
37	Game rotation vector	252	1	1.5625	400.0000
38	Game rotation vector wake up	200	1	1.5625	400.0000
43	Orientation	254	1	1.5625	400.0000
44	Orientation wake up	202	1	1.5625	400.0000
136	Low Power Step counter	249	1	1.0000	1.0000
137	Low Power Step detector	248	1	1.0000	1.0000
142	Low Power Any motion	176	1	1.0000	1.0000
153	Multi Tap Detector	182	1	1.0000	1.0000
154	Activity recognition for Hearables	237	1	1.0000	1.0000
156	Low Power Wrist Gesture wake up	228	1	1.0000	1.0000
158	Low Power Wrist Wear wake up	178	1	1.0000	1.0000
159	Low Power No Motion wake up	181	1	1.0000	1.0000

```

[D][META EVENT]; T: 285.102781250; Flush complete for sensor id 37
[D][META EVENT]; T: 285.103343750; Power mode changed for sensor id 37
[D][META EVENT]; T: 285.103343750; Sample rate changed for sensor id 37
[D]SID: 37; T: 285.333890625; x: -0.011292, y: -0.021057, z: 0.000061, w: 0.999695;
acc: 0.000000
[D]SID: 37; T: 285.373421875; x: -0.011230, y: -0.021057, z: 0.000122, w: 0.999695;
acc: 0.000000
[D]SID: 37; T: 285.412953125; x: -0.011353, y: -0.021118, z: 0.000122, w: 0.999695;
acc: 0.000000

```

5.3 Examples and further descriptions

Display Help [-h]

Available commands and connection status of the device will be displayed. Usage:

```
>bhy2cli -h
```

```
Version 0.5.0 Build date: Dec 16 2024Usage:
bhy2cli [<options>]
Options:
-h OR help      = Print this usage message
version
                 = Prints the version
-v OR verb <verbose level>
                 = Set the verbose level. 0 Error, 1 Warning, 2 Infos
-b OR ramb <firmware path>
                 = Reset, upload specified firmware to RAM and boot from RAM
                   [equivalent to using "reset ram <firmware> boot r" successively]
```

```
.....
```

Show information [-i]

Display general device information, virtual sensors present in loaded firmware, boot status register content and error register content. Usage:

```
>bhy2cli -i
```

Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024Product ID : 89
Kernel version : 5991
User version : 9761
ROM version : 5166
Power state : sleeping
Host interface : SPI
Feature status : 0x4a
Boot Status : 0x38: No flash installed. Host interface ready. Firmware verification done.
Virtual sensor list.

Sensor ID	Sensor Name	ID	Ver	Min rate	Max rate
1	Accelerometer passthrough	205	1	1.5625	400.0000
3	Accelerometer uncalibrated	203	1	1.5625	400.0000
4	Accelerometer corrected	241	1	1.5625	400.0000
5	Accelerometer offset	209	1	1.0000	1.0000
6	Accelerometer corrected wake up	192	1	1.5625	400.0000
7	Accelerometer uncalibrated wake up	204	1	1.5625	400.0000
10	Gyroscope passthrough	207	1	1.5625	400.0000
12	Gyroscope uncalibrated	244	1	1.5625	400.0000
13	Gyroscope corrected	243	1	1.5625	400.0000
14	Gyroscope offset	208	1	1.0000	1.0000
15	Gyroscope wake up	194	1	1.5625	400.0000
16	Gyroscope uncalibrated wake up	195	1	1.5625	400.0000
19	Magnetometer passthrough	206	1	1.5625	400.0000
21	Magnetometer uncalibrated	245	1	1.5625	400.0000
22	Magnetometer corrected	242	1	1.5625	400.0000
23	Magnetometer offset	210	1	1.0000	1.0000
24	Magnetometer wake up	193	1	1.5625	400.0000
25	Magnetometer uncalibrated wake up	196	1	1.5625	400.0000
28	Gravity vector	247	1	1.5625	400.0000
29	Gravity vector wake up	198	1	1.5625	400.0000
31	Linear acceleration	246	1	1.5625	400.0000
32	Linear acceleration wake up	197	1	1.5625	400.0000
34	Rotation vector	251	1	1.5625	400.0000
35	Rotation vector wake up	199	1	1.5625	400.0000
37	Game rotation vector	252	1	1.5625	400.0000

Change verbose [-v]

Set the verbose level. 0 prints only the error messages, 1 print warning messages and errors, 2 prints all messages. The default is 2. Usage:

```
>bhy2cli -v 1
```

Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024Setting verbose to 1

Reset, load and boot [-b]

This will soft reset the device, load the firmware specified by the file location into RAM and boot the device from RAM. Usage:

```
>bhy2cli -b ..\..\..\firmware\bhi360\BHI360.fw
```

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024Reset successful
Uploading 136596 bytes of firmware to RAM
Uploading firmware to RAM successful
Waiting for firmware verification to complete
Boot Status : 0x38: No flash installed. Host interface ready. Firmware verification done.
[D][META EVENT WAKE UP]; T: 0.343796875; Firmware initialized. Firmware version 5991
[D][META EVENT]; T: 0.343796875; Firmware initialized. Firmware version 5991
Bootting from RAM successful
```

Reset Device [-n]

Perform a soft reset. Usage:

```
>bhy2cli -n
```

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024Reset successful
```

Load firmware to RAM [-u]

Load the firmware specified by the file location into RAM.

Note that a soft reset or hard reset has to be performed before being able to upload a firmware image. Usage:

```
>bhy2cli -u ..\..\..\firmware\bhi360\BHI360.fw
```

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024Uploading 136596 bytes of firmware to RAM
Uploading firmware to RAM successful
```

Load firmware to external FLASH [-f]

Load the firmware specified by the file location into external FLASH.

Note that a soft reset or hard reset has to be performed before being able to upload a firmware image. Load firmware to external FLASH is only for BHI260. Usage:

```
>bhy2cli -f ..\..\..\firmware\bhi260\Bosch_SHUTTLE_BHI260-flash.fw
```

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024 [E]Reset the BHI260/BHA260 before uploading
firmware to external flash
```

Erase Flash [-e]

Erase content of external flash. Erase Flash is only for BHI260. Usage:

```
>bhy2cli -e
```

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024 [E]Seems like a firmware is running. Reset the
BHI260/BHA260 before erasing external flash
```

Boot device [-g]

Boot device from RAM. Usage:

```
>bhy2cli -g r
```

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024Waiting for firmware verification to complete
Boot Status : 0x31: Flash detected. Host interface ready. Firmware verification done.
Bootting from RAM successful
```

Boot device from external FLASH. Usage:

```
>bhy2cli -g f
```

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024Waiting for firmware verification to complete
Boot Status : 0x31: Flash detected. Host interface ready. Firmware verification done.
Bootting from flash successful
```

Activate Sensor [-c]

Activate a virtual sensor by providing the Sensor ID, frequency [Hz] and a latency [ms] (optional, default is 0 ms). To stop streaming, press Ctrl + C. To activate multiple sensors at a time, the -c options can be chained. Note that the streaming of sensor data will start at the end of the bhy2cli function call – all other options will be

Example:

Activate virtual sensor “Game Rotation vector” (Sensor ID 37) at a sample rate of 25 Hz and a latency of 0 ms:

```
>bhy2cli -c 37:25:0
```

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024

[D][META EVENT]; T: 13225.538078125; Flush complete for sensor id 37
[D][META EVENT]; T: 13225.538640625; Power mode changed for sensor id 37
[D][META EVENT]; T: 13225.538640625; Sample rate changed for sensor id 37
[D]SID: 37; T: 13225.763671875; x: -0.012085, y: -0.020081, z: 0.000488, w: 0.999695; acc:
0.000000
[D]SID: 37; T: 13225.803187500; x: -0.012085, y: -0.019958, z: 0.000488, w:
```

Register custom virtual sensor payload [-a]

Register the output payload of a custom virtual sensor by providing the Sensor ID, an arbitrary name, the total output payload in bytes and each expected output format.

Note: The registration of a custom sensor only applies for the current function call. To stream sensor data, the `-c` option **has to** be used within the same call of the `bhy2cli` tool (see example below). Any registering of virtual sensor payloads using the `-a` option **has to** be done before the first `-c` option.

Possible output formats (with corresponding output payload) are:

- `c` : Character (1 byte)
- `u8` : Unsigned 8 bit (1 byte)
- `u16` : Unsigned 16 bit (2 bytes)
- `u32` : Unsigned 32 bit (4 bytes)
- `s8` : Signed 8 bit (1 byte)
- `s16` : Signed 16 bit (2 bytes)
- `s32` : Signed 32 bit (4 bytes)
- `f` : Single precision floating point (4 bytes)

Example:

Register the payload of the custom virtual sensor “Lean Orientation” (Sensor ID 160). This virtual sensor outputs two characters as the device orientation, e.g. “Z +”. Since one character takes one byte, the total output payload of the sensor is two bytes. Since the registration of a custom sensor is temporary and only applies to the current function call, the `-c`-option has to be trailing in order to be able to stream data from this sensor. In the following example, the “Lean Orientation” sensor payload is registered, and FIFO-data is streamed at 25 Hz (the provided name is only for display purposes and can be set to any string):

```
>bhy2cli -a 160:"Lean Orientation":2:c:c -c 160:25
```

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024Adding custom driver payload successful
[D][META EVENT]; T: 3.416359375; Flush complete for sensor id 160
[D]160; 3.658812500; Z +
[D]160; 3.698671875; Z +
[D]160; 3.738515625; Z +
```

Write register address [-w]

This command will write specified values (one byte each) to subsequent addresses. Since more than one byte can be written to register 0x00, specifying it will result in writing to subsequent bytes of the chosen register. Writing more than one byte to the register addresses 0x04 ongoing will result in writing to the specified register, as well as the following registers, since these registers only hold one byte each (address auto increment for addresses $\geq 0x04$). Detailed information about available registers can be found in Reference 1. Address and length can be specified as decimal or hexadecimal.

Note: The maximum write length is restricted to **46 bytes** for the current version of the tool.

Example:

Write 0x0b to the first byte of Host Channel 0, 0x00 to the second byte of Host Channel 0, 0x04 to the third byte of Host Channel 0, 0x00 to the fourth byte of host channel 0, 0x01 to the fifth byte of Host Channel 0 and 0x00 to the last three bytes of Host Channel 0 (this executes the host command “Request Sensor Self-Test for the Sensor ID 1 (accelerometer)”). The command response can be found in the register Host channel 3 (register address 0x03). For more information regarding host commands please refer to Reference 1):

```
>bhy2cli -w 0x00=0x0b,0x00,0x04,0x00,0x01,0x00,0x00,0x00
```

Write 42(dec) to register address 0x08, 0x2a(hex) to register address 0x09 and 5(dec) to register address 0x0a:

```
>bhy2cli -w 0x08=42,0x2a,5
```

Read register address [-r]

This command will read a specified amount of data from subsequent addresses. Since the Host Channel registers 0x01 – 0x03 hold more than one byte, specifying one of these registers will result in reading subsequent bytes from the chosen register. Reading more than one byte from the register addresses 0x04 ongoing will result in reading from the specified register, as well as the following registers, since these registers hold one byte each (address auto increment for addresses >= 0x04). Detailed information about available registers can be found in Reference 1. Address and length can be specified as decimal or hexadecimal.

Note: The maximum read length is restricted to **53 bytes** for the current version of the tool.

Example:

Read 3 bytes from Host Channel 2:

```
>bhy2cli -r 0x02:3
```

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0   Build date: Dec 16 2024
Byte hex      dec | Data
-----
0x0000000     0 | 00 00 00
Read complete
```

Read the content of the general-purpose registers WGP1_0 (0x08), WGP1_1 (0x09) and WGP1_2 (0x0A):

```
>bhy2cli -r 0x08:3
```

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0   Build date: Dec 16 2024
Register address: Data
-----
0x08           : 2a
0x09           : 2a
0x0a           : 05
Read complete
```

Read parameter [-s]

Display the read parameter response of the specified parameter ID, without the parameter ID and the response length (first four bytes of the response). Detailed information about available parameters can be found in Reference 1. Parameter IDs can be provided as decimal or hexadecimal.

Example:

Read the parameter “Firmware Version” with the id 0x0104:

```
>bhy2cli -s 0x0104
```

```
Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0   Build date: Dec 16 2024
Byte hex      dec | Data
-----
0x0000000     0 | 00 00 a9 1a a1 ab 55 17
0x0000008     8 | a9 1a a1 ab 55 17 a9 1a
0x0000010    16 | a1 ab 55 17
Reading parameter 0x0104 successful
```

Write parameter [-t]

Write data to the specified parameter ID, without the parameter ID and the response length (first four bytes). Each additional value that is provided results in the following byte to be written. Detailed information about available parameters can be found in Reference 1. Parameter IDs can be provided as decimal or hexadecimal.

Example:

Write 5(dec) to the first byte and 6(dec) to the second byte of the parameter “FIFO Control” with the parameter ID 0x0103. For validating the parameter write result, the “-s” option targeting the same parameter ID can be used.

```
>bhy2cli -t 0x0103=5,6
```

Host Interface : SPI
Copyright (c) 2024 Bosch Sensortec GmbH
Version 0.5.0 Build date: Dec 16 2024

Byte	hex	dec	Data
0x000000	0	05 06	00 00 00 48 00 00
0x000008	8	00 00	00 00 00 4a 00 00
0x000010	16	80 01	00 00

Reading parameter 0x0103 successful

6 Legal disclaimer

6.1 Engineering samples

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6.3 Application examples and hints

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7 References

Reference 1: BHA260AB and BHI260AP Datasheet

Reference 2: BHI360 and BHI380 Datasheet

Reference 3: BHy2xx SDK Quick Start Guide

Reference 4: BHI360 SDK Quick Start Guide

8 Document history and modifications

Rev. No	Chapter	Description of modification/changes	Date
2.8	All	Main release.	2020-02-04
2.9	All	Adaptations to COINES v2.0	2020-03-03
2.10	All	Adaptations to COINES v2.3	2020-05-15
2.11	All	Replaced BHI260AB, BHA260AB and BHy2 with BHy2xx	2021-11-23
2.12	All	Add BHI3xx contents. Adaptations to COINES v2.7	2022-07-11
2.13	All	Adaptations to COINES v2.8.8	2023-10-30
2.14	All	COINES bridge update usage	2024-02-19
2.15	All	Adaptations to COINES v2.10.4	2025-04-14



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