Technical Description SENSEVAL-SHT4XV1
Evaluation Board for SHT4x Temperature and Humidity Sensor

- Evaluation board with SHT4x RHT sensor
- Compatible with the STMicroelectronics DIL 24 socket
- Supported by the STEVAL-MKI109V3 Motherboard
- Compatible with STM32Nucleo boards and STM32Cube Software
- 1.08 V to 3.6 V supply voltage and ultra-low power consumption

Product Summary

The evaluation kit for the SHT4x RHT enables easy sensor evaluation and facilitated prototyping.

The SHT40 Evaluation Board is compatible with the STMicroelectronics DIL 24 socket and is supported by the STEVAL-MKI109V3 motherboard. The Evaluation Board is also compatible with the STM32Nucleo boards from STMicroelectronics.

This technical description is limited to the SENSEVAL-SHT4XV1 evaluation board. For more information on the SHT4x specifications and the interfacing consult the [SHT4x datasheet](#).

SHT4x is a digital sensor platform for measuring relative humidity and temperature at different accuracy classes. Its I2C interface provides several preconfigured I2C addresses and maintains an ultra-low power budget. The power-trimmed internal heater can be used at three heating levels thus enabling sensor operation in demanding environments. The four-pin dual-flat-no-leads package is suitable for surface mount technology (SMT) processing and comprises an optional on-package patented PTFE membrane or a removable protection cap.

Table of Contents

1 Hardware Interface Specification

Figure 1: Schematic Diagram of the SENSEVAL-SHT4XV1

1.1 Sensor detailed Pinout

Pin	Name	Comment
1	SDA	I2C serial data input / output
2	SCL	I2C serial clock input
3	VDD	Power supply (positive supply)
4	GND	Ground (negative supply)

Table 1: Sensor pin assignment.

1.2 DIL24 Pinout

Figure 2: DIL24 Socket Circuit Diagram

Pin	Name	Comment
1	VDD	Power supply (positive supply)
13	GND	Ground (negative supply)
20	SCL	I2C serial clock input
21	SDA	I2C serial data input / output

Table 2: DIL 24 pin assignment. Unused pins are omitted from the table

2   Evaluation using the Professional MEMS Motherboard MKI109V3

The SENSEVAL-SHT4xV1 is compatible with the ST MEMS Motherboard MKI109V3 through the DIL24 connector.
SENSEVAL needs to be connected so that the Sensirion and ST logos on the board are in the same direction as the ST logo on the board.

The STEVAL-MKI109V3 firmware needs to be compatible with Unico GUI version 9.14 and above.
To update the firmware on STEVAL-MKI109V3:
1. Download and install the latest Unico GUI from the ST Website
2. Locate the downladed file, navigate to the FIRMWARE folder and then to ProfiMEMSTool board and locate the .bin file. You will need this for the firmware update
3. Download and install the STM32CubeProgrammer software
4. Make the MKI109V3 boot in DFU mode by following the instructions in chapter 2.2 of the MKI109V3 user manual
5. Upgrade the firmware using the .bin file from step 2 and the instructions in chapter 2.2.2 2 of the MKI109V3 user manual

As soon as the MKI109V3 is updated with the latest firmware you can launch the Unico GUI. Select the SENSEVAL-SHT4XV1 (SHT40) from the environmental sensors tab and click on Select Device.
The GUI should look like the figure below:

Figure 2. Unico GUI

To start measuring navigate to the Options tab and click on Easy Configuration (1) and then on Start (2) at the top of Unico GUI.
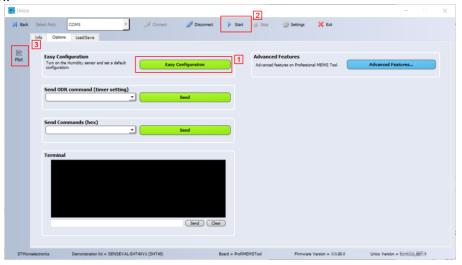

Figure 3: Unico GUI, Options tab

You can see the measurements by clicking the plot button on the right of the application (3):
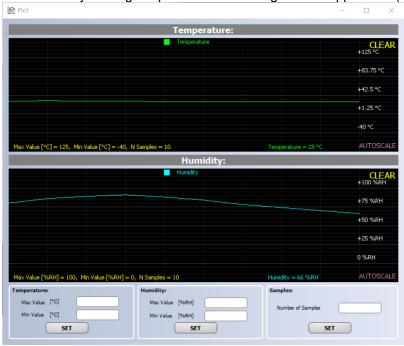

Figure 4: Unico GUI Plot

Unico GUI, allows the measurements to be saved in a file, to save the data:
1. Navigate to the Load/Save tab at Unico GUI,
2. Browse the folder and name the log file according to your liking,
3. Select the data you would like saved,
4. Start logging
5. Start the measurement of the sensor

Figure 5: Data logging
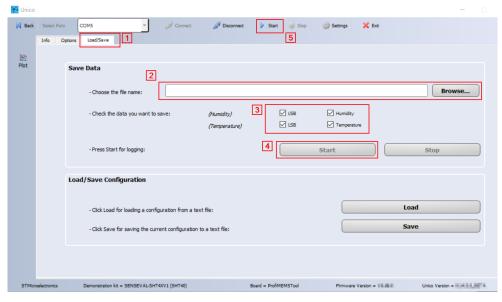
The user can adjust the frequency of the measurements via the Send ODR command button (Figure 6, step 1)
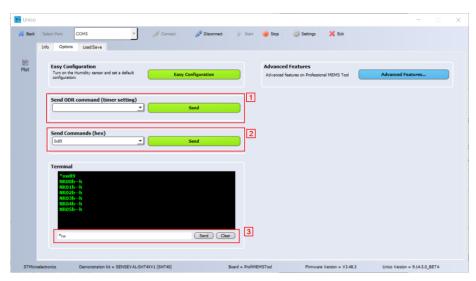

Figure 6: Interfacing with the sensor

Unico GUI, gives the ability to the user to send direct i2c commands to the sensor (Figure 6, Step 2) and read the response through the terminal provided (Figure 6, Step 3).

The i2c response can be read via the i2c read command *nr.

3   Evaluation using a Nucleo Board and a Nucleo Expansion Board

3.1   Hardware Setup

STMicroelectronics with the latest release of X-CUBE-MEMS-1 functional package (Version 9.5.0) added support for the Sensirion SHT40 sensor.

Users can quickly evaluate the performance of the sensor via the use of Unicleo-GUI provided by STMicroelectronics (Version 1.23.0).

The support is currently limited to the NUCLEO-F401RE board and the X-NUCLEO-IKS01A3 expansion board.

To get started with the evaluation make sure you have the correct hardware as mentioned above and connect the expansion board on the X-NUCLEO-F401RE. Afterwards, connect the SENSEVAL-SHT4xV1 on the expansion board using the DIL24 socket.
Make sure that the Sensirion and ST logo on the SENSEVAL-SHT4xV1 is facing the same direction as the ST logo on the X-NUCLEO-IKS01A3 expansion board.
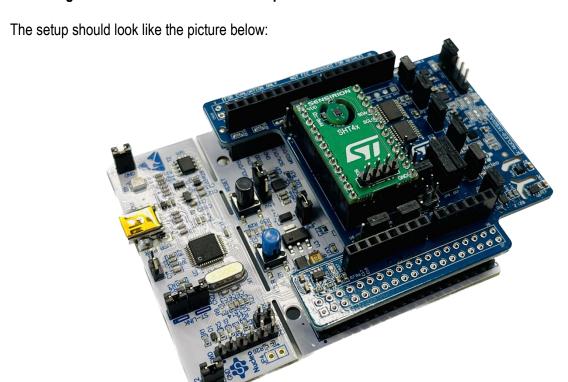
The setup should look like the picture below:

Figure 7: the SENSEVAL-SHT4XV1 mounted on the X-NUCLEO-IKS01A3 expansion board with the Nucleo F401RE board

3.2   Firmware update

The firmware on the Nucleo F401RE board needs to be flashed so that it can work with UNICLEO GUI. STMicrolectronics provides an example to get things started with the X-CUBE-MEMS-1 functional package.

To update the firmware you can use STM32cubeProgrammer and load the ready-made example by navigating to the folder of the X-CUBE-MEMS-1 functional package:
"en.x-cube-mems1\Projects\NUCLEO-F401RE\Examples\IKS01A3\DataLogExtended\Binary\ DataLogExtended.bin"
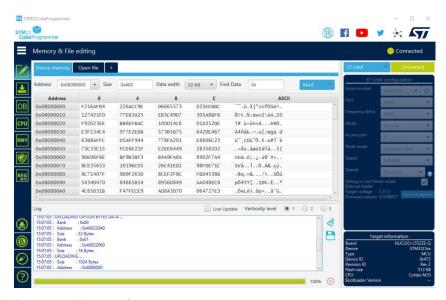
Figure 8: STM32CubeProgrammer User Interface

To load the .bin file please follow the steps below:
1. Open the STM32CubeProgrammer
2. Select the Nucleo board from the dropdown menu on the right of the screen and click Connect
3. Click on the "Open File" tab and navigate to the location of the .bin file shown above
4. As soon as you open the .bin file the light blue button will change from Read to Download
5. Click on Download and wait for the firmware to be downloaded into your Nucleo Board
6. Disconnect the board

3.3   Unicleo GUI

Now we are ready to launch Unicleo GUI. Please follow the steps below:
1. Download and install Unicleo GUI
2. Open the Unicleo GUI
3. Connect the Nucleo F401RE board with your computer via the supplied USB cable
4. Unicleo GUI will automatically detect the COM port where the Nucleo F401RE board is connected
5. Click Connect
6. Select the correct sensors from the drop-down menus. For Humidity and Temperature select SHT40.

For Detailed information on how to use the Unicleo GUI please refer to the Unicleo GUI Getting Started Guide:
https://www.st.com/resource/en/user_manual/um2128-getting-started-with-unicleogui-for-motion-mems-and-environmental-sensor-software-expansion-for-stm32cube-stmicroelectronics.pdf

4 Prototyping with Sensirion Nucleo I²C SHT4X Driver

4.1 Example I²C SHT4X Driver

An example of the I²C SHT4X Driver for the STM32 Nucleo Cube can be found on Sensirion's GitHub repository: Sensirion/nucleo-i2c-sht4x: SHT4x driver for STs Nucleo F103RB board with the X-NUCLEO-IKS02A1 shield (github.com)

4.2 Connecting the Evaluation board to the Nucleo F103RB

To connect the SENSEVAL-SHT4XV1 to the Nucleo F103RB board please use a jumper wire set (not included with the evaluation board). Table 3 shows the connection between the evaluation board Pins and the Nucleo F103RB board pins

Nucleo F103RB board	SENSEVAL-SHT4XV1	SHT4x
1	Pin +3v3	VDD
13	Pin GND	GND
20	Pin PB_8	SCL
21	Pin PB_9	SDA

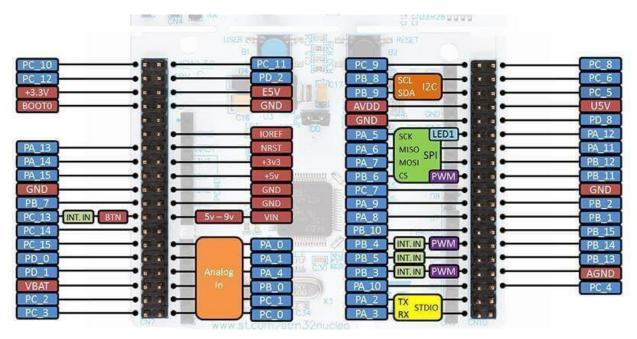**Table 3:** SENSEVAL- SHT4XV1 to Nucleo F103RB board Pin assignment

Figure 9: Nucleo F103RB Pinout diagram

Note: *The Nucleo board does not contain internal pull-ups. Either you have a breakout board for your sensor that has pull-ups, or you have to add pull-ups by our own. The provided setup assumes that ~5K pull-ups are installed. As the required pull-ups heavily depend on your actual hardware setup (e.g. length wires), it's a good thing to check the signals SCL and SDA with an oscilloscope.*

4.3 Using the SENSEVAL-SHT4XV1 with a DIL24 compatible STM32NUCLEO expansion board

The following STM32Nucleo expansion boards are compatible with the SENSEVAL-SHT4XV1:

- X-NUCLEO-IKS01A2
- X-NUCLEO-IKS01A3
- X-NUCLEO-IKS02A1

Figure 8, shows a picture of the SENSEVAL-SHT4XV1 mounted on the X-NUCLEO-IKS02A1 expansion board with the Nucleo F103RB board:

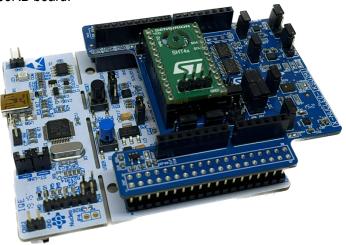**Figure 10:** the SENSEVAL-SHT4XV1 mounted on the X-NUCLEO-IKS02A1 expansion board with the Nucleo F103RB board

5   Revision History

Date	Version	Page(s)	Changes
November 2022	1	All	Initial version
March 2023	1.1	3-7	Added Section 2 and 3

Important Notices

Warning, Personal Injury

Do not use this product as safety or emergency stop devices or in any other application where failure of the product could result in personal injury. Do not use this product for applications other than its intended and authorized use. Before installing, handling, using or servicing this product, please consult the data sheet and application notes. Failure to comply with these instructions could result in death or serious injury.

If the Buyer shall purchase or use SENSIRION products for any unintended or unauthorized application, Buyer shall defend, indemnify and hold harmless SENSIRION and its officers, employees, subsidiaries, affiliates and distributors against all claims, costs, damages and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if SENSIRION shall be allegedly negligent with respect to the design or the manufacture of the product.

ESD Precautions

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take customary and statutory ESD precautions when handling this product.
See application note "ESD, Latchup and EMC" for more information.

Warranty

SENSIRION warrants solely to the original purchaser of this product for a period of 12 months (one year) from the date of delivery that this product shall be of the quality, material and workmanship defined in SENSIRION's published specifications of the product. Within such period, if proven to be defective, SENSIRION shall repair and/or replace this product, in SENSIRION's discretion, free of charge to the Buyer, provided that:

- notice in writing describing the defects shall be given to SENSIRION within fourteen (14) days after their appearance;
- such defects shall be found, to SENSIRION's reasonable satisfaction, to have arisen from SENSIRION's faulty design, material, or workmanship;

- the defective product shall be returned to SENSIRION's factory at the Buyer's expense; and
- the warranty period for any repaired or replaced product shall be limited to the unexpired portion of the original period.

This warranty does not apply to any equipment which has not been installed and used within the specifications recommended by SENSIRION for the intended and proper use of the equipment. EXCEPT FOR THE WARRANTIES EXPRESSLY SET FORTH HEREIN, SENSIRION MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT. ANY AND ALL WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY EXCLUDED AND DECLINED. SENSIRION is only liable for defects of this product arising under the conditions of operation provided for in the data sheet and proper use of the goods. SENSIRION explicitly disclaims all warranties, express or implied, for any period during which the goods are operated or stored not in accordance with the technical specifications.

SENSIRION does not assume any liability arising out of any application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. All operating parameters, including without limitation recommended parameters, must be validated for each customer's applications by customer's technical experts. Recommended parameters can and do vary in different applications.

SENSIRION reserves the right, without further notice, (i) to change the product specifications and/or the information in this document and (ii) to improve reliability, functions and design of this product.

Headquarters and Subsidiaries

SENSIRION AG Laubisruetistr. 50 CH-8712 Staefa ZH Switzerland	Sensirion Inc. USA phone: +1 312 690 5858 info-us@sensirion.com www.sensirion.com	Sensirion Korea Co. Ltd. phone: +82 31 337 7700~3 info-kr@sensirion.com www.sensirion.co.kr
phone: +41 44 306 40 00 fax: +41 44 306 40 30 info@sensirion.com www.sensirion.com	Sensirion Japan Co. Ltd. phone: +81 3 3444 4940 info-jp@sensirion.com www.sensirion.co.jp	Sensirion China Co. Ltd. phone: +86 755 8252 1501 info-cn@sensirion.com www.sensirion.com.cn/
Sensirion Taiwan Co. Ltd. phone: +41 44 306 40 00 info@sensirion.com	To find your local representative, please visit www.sensirion.com/contact	