OSX – Open-SDI12-Blue Bluetooth®

Version SHT4x – Precision Temperature/rel. Humidity, Type 341


The SHT4x Sensor and APP

1   Quick setup

The OSX SHT4x is a Precision Temperature/rel. Humidity Sensor with Low-Voltage SDI-12 and Bluetooth. The Sensor SHT4x is available in several Versions. E.g.:

- **Version SHT45:**

  Based on the Sensirion's SHT-45AD1F[1] (with internal 2.nd PTFE membrane) and excellent precision:

  +/- 1.0% rel. Humidity (20 - 70%rH) and +/- 0.1°C Temperature (5 – 60°C):

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1   SHT-45AD1F Datasheet: https://sensirion.com/products/catalog/SHT45-AD1F
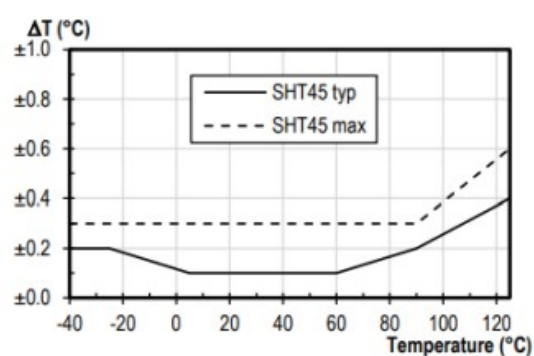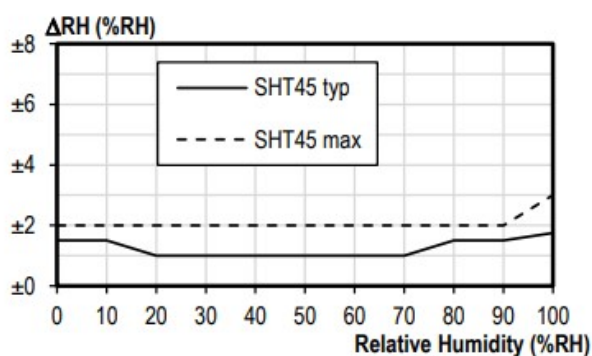
An outer PTFE protection filter cap protects the sensor element from particles. The SHT4x uses the popular Ultra-Low-Power SDI-12 Bus (V1.3) as communication protocol. The signal levels have been extended to Low-Voltage SDI-12 operation down to 3.6V supply voltage.

The parameters of the SDI-12-Interface (based on Open-SDI12-Blue platform) can be changed via Bluetooth. Also it is possible to use a custom 2-point calibration.

SDI-12-Cable (core cable ends):

> BLACK: GND
> BROWN: 3.6V-16V Supply (Low-Voltage SDI-12) / 2.8V-3.6V (Bluetooth only)
> WHITE: SDI-12 Signal

Warning: The sensor is internally protected against normal transients and spikes, but reverse or false Connection may damage the sensor!

The command set is based on standard SDI-12 (V1.3) command set. Most important commands:

aAn!   :   Change Address from 'a' to 'n'. (a might be always be a '?' as wild card).

aI!   :   Identify Node (should identify as 'a13TT_SHT_A_0341_OSXxxxxxxxx')

aM!   :   Start measure (also 'aMC!'). This will start the measure. After finishing all measured values are available in an internal cache. Up to 2 data may be read with the „D"- command: a.) rel. Humidity (in %) and b.) Temperature (in °C)

aM1!   :   Start measure (also 'aMC1!'). This will start the measure including Supply Voltage. After finishing all measured values are available in an internal cache. Up to 3 data may be read with the „D"- command:
                a.) relative Humidity (in %), b.) Temperature (in °C) and c.) Voltage

aD0!   :   This will read the 1 to max. 3 measures from the preceding „M"- command.

Error codes (all values lower than -1000.000):

-1009.0:   Sensor internal error ('No Reply') probably sensor or internal connection broken)
-10xx.0:   Data corrupt (may water in the sensor or cable).
others: Displayed as text in BlxDashboard or BlueShell

2   The Open-SDI12-Blue platform

OSX Sensors are based on an open platform:

Link: https://github.com/joembedded/Open-SDI12-Blue

In this case the PCB was modified to smaller size:
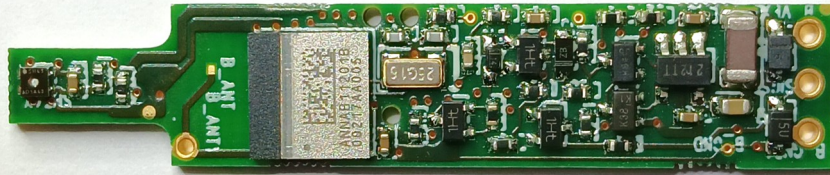
PCB Size: 9.5 mm x 45 mm

3   Software

3.1.1 Software to access the sensor

OSX Sensors can accessed by SDI-12 (V1.3) or Bluetooth BLE or SDI-12 via Bluetooth.

- BlueShell for PC (Windows 10 / 11)

- BlxDashboard (PC (Browsers: Chrome, Edge, Opera, …) or Android). No installation of an APP required, however BlxDashboard can be installed as "Progressive Web APP" (PWA) for offline use!
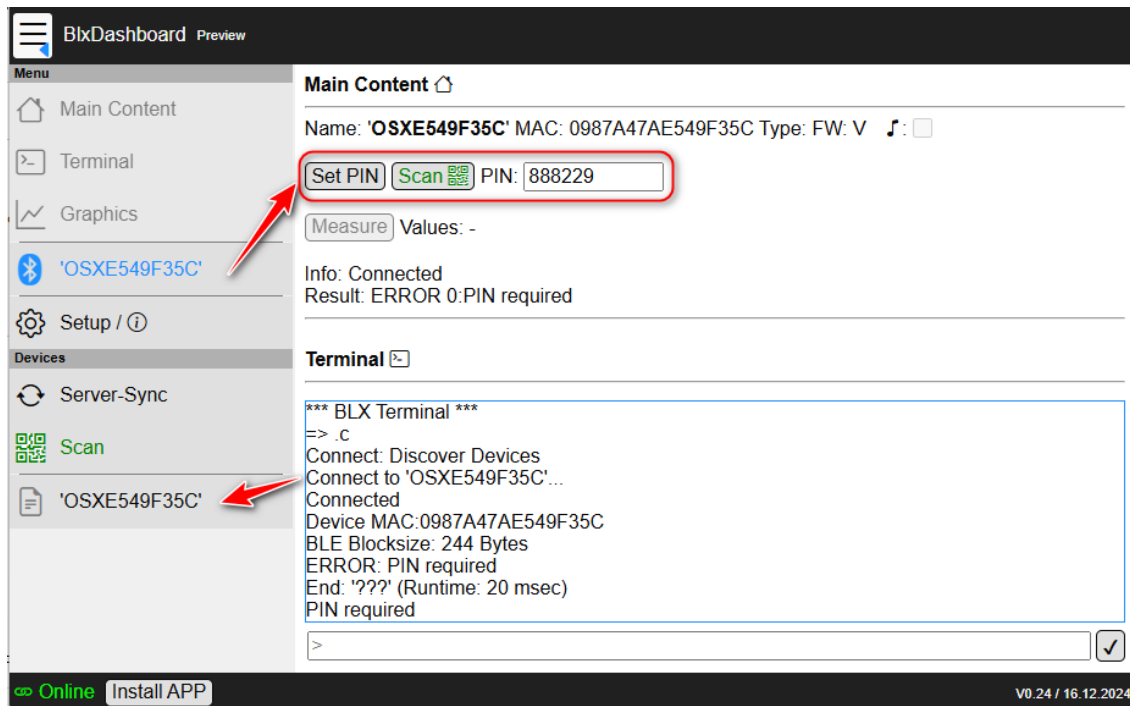 (The complete BlxDashboard is written in JavaScript and available as Source Code)

Link: Download Link BlueShell or BlxDashboard

3.1.2 Software for SDI-12

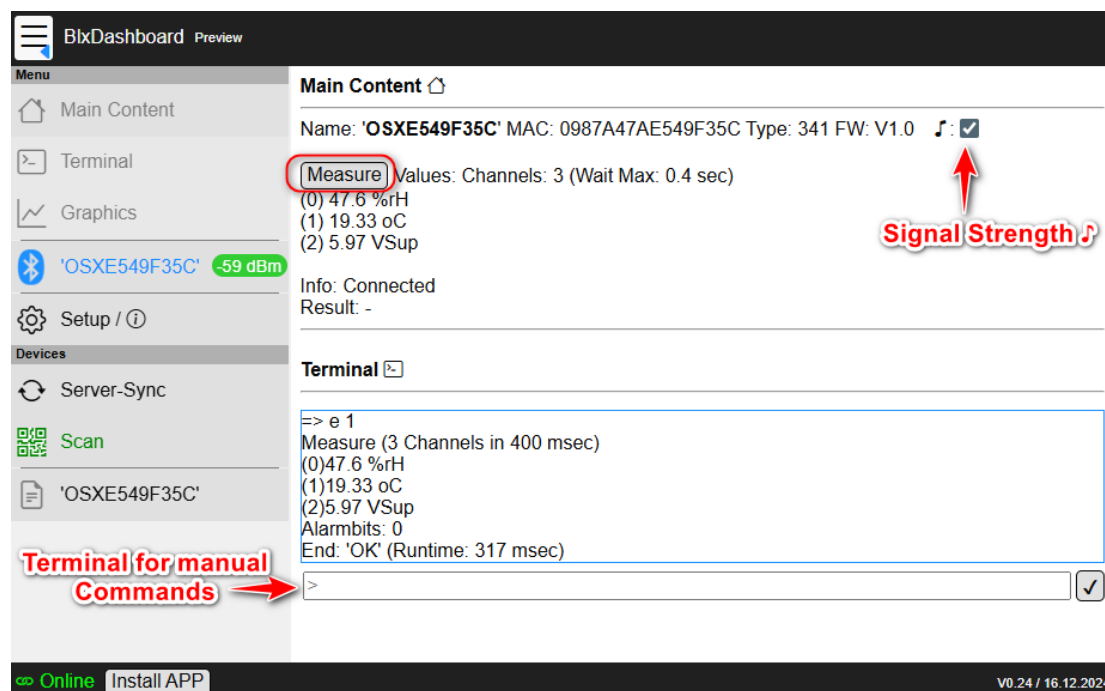- A simple SDI12Term for PC (Windows) (connect SDI-12 sensors via RS232)

Link: https://github.com/joembedded/SDI12Term

4   Sample session BlxDashBoard

PIN required: Scan (via Camera) or enter manually

The sensors are locked with a 6 digit PIN (Authentification method: Challenge-Response)

A Test Measure

5   Commands

A selection of commands for setup (enter via BlxDashboard or BlueShell Terminal)

5.1.1 Commands for this type (SHT4x Type 341):

Measure:

- M or MC or M1 or MC1 starts the measure, measure takes < 1 sec

- D replies the values

5.1.2 Standard commands for Open-SDI12-Blue (SDI-12 via BLE):

All „SDI-12 via BLE" commands are preceded by ‚z':

> z?I!	SDI12 via BLE: Identify

Reply: '013TT_SHT_A_0341_OSXE549F35C<CR><LF>'
End: 'OK' (Runtime: 229 msec)

> z?M!	SDI12: Measure

Reply: '00012<CR><LF>'
Reply: '0<CR><LF>'
End: 'OK' (Runtime: 358 msec)

> z?D0!	SDI12: Values

Reply: '0+45.3+26.36<CR><LF>'
End: 'OK' (Runtime: 302 msec)

> z?MC!	SDI12: Measure+CRC

Reply: '00012<CR><LF>'
Reply: '0<CR><LF>'
End: 'OK' (Runtime: 387 msec)

> z?D0!	SDI12: ‚CAa' is CRC

Reply: '0+45.3+26.37CAa<CR><LF>'
End: 'OK' (Runtime: 290 msec)

> z?XDevice!	SDI12: XDevice

Reply: '0M:0987A47AE549F35C,T:341,V1.0, P:888229!<CR><LF>' SDI12: Red: Dev.PIN
End: 'OK' (Runtime: 299 msec)

> z?XFactoryReset!	SDI12: Factors Reset:
Disconnected	SDI12: New setup

5.1.3 Firmware update

> .firmware	Secure firmware update

Select new firmware (*.sec)…

5.1.4 Special commands for Open-SDI12-Blue (SDI-12 via BLE):

Sensor setup / scan commands:

Important: our sensors are are delivered "ready-2-run" and no special setup is required (except e.g. after Factory Reset or if sensor configuration was changed). The following commands are only listed for technical completeness.

- Each channel has 2 coefficients for (optional) user calibration.
  By default these coefficients are 1.0 (Multi) and 0.0 (Offset), this means the values of the sensor are not changed. Since the SHT4x sensors are internally factory calibrated, user calibration coefficients are normally also not required. Mentioned only for completeness.

- The 4 Coefficients:
  Formula is (BLX standard): Formula: VALUE = (MEASURED * Multi) – Offset.
  K0: Humidity Multi (Default: 1.0)
  K1: Humidity Offset (Default: 0.0)
  K2: Temperature Multi (Default: 1.0)
  K3: Temperature Offset (Default: 0.0)

- The "Write" command writes changed parameters to Flash.

In this example K3 (Offset for Temperature) is 'adjusted' to display 1.23°C less:

> e	Measure
Measure (2 Channels in 300 msec)	
(0)43.9 %rH	
(1)26.47 oC	
End: 'OK' (Runtime: 564 msec)	
> z?XK3!	Coefficient for Temperature
Reply: '0K3=0.000000<CR><LF>'	
End: 'OK' (Runtime: 271 msec)	
> z?XK3=1.23!	Decrease Temp. by 1.23°C
Reply: '0K3=1.230000<CR><LF>'	
End: 'OK' (Runtime: 191 msec)	
> e	And check result
Measure (2 Channels in 300 msec)	
(0)43.8 %rH	
(1)25.24 oC	
> z?XWrite!	Save Settings to Flash
Reply: '0<CR><LF>'	
End: 'OK' (Runtime: 162 msec)	

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6   Sensor

- Sensor element: see Chapter 1

- Outline/Material: 12 mm x 70 mm ABS with 45 mm cable kink protection

7   Power Supply

The OSX Sensor works from 2.8V to 16V (see Open-SDI12-Blue documentation).
For Low-Voltage SDI-12 a minimum supply voltage of 3.6V-16V is recommended, below this only Bluetooth should be used.

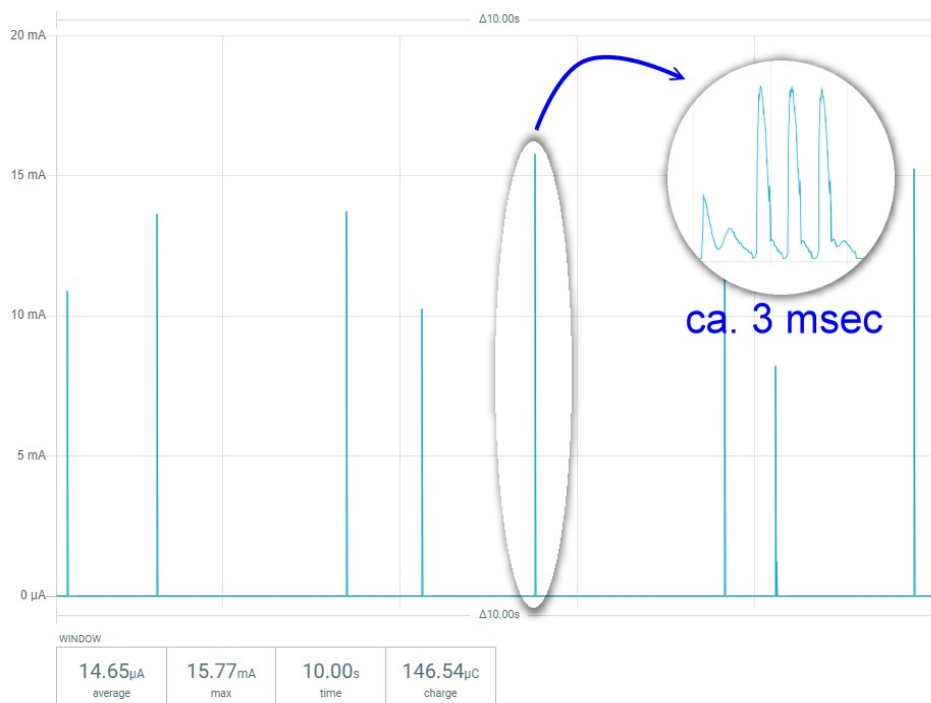- Measure: <5mA for ca. 500 msec

- Operating Temperature: -40°C - +85°C

7.1   Power Profile

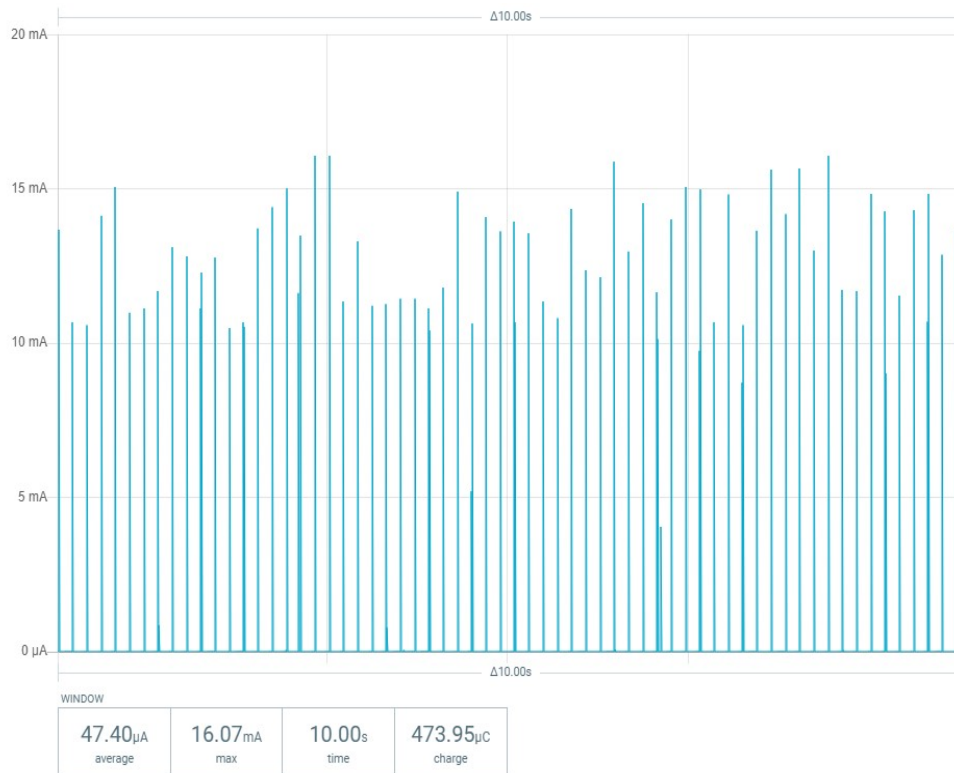### 7.1.1 Power Up Sequence

The Sensor is ready after ca. 250 msec.

7.1.2 Advertising (in deep sleep)

Average power consumption in deep sleep is <15 µA @ 4V

Advertising power consumption (one peak zoomed)

7.2 Connected Mode

Connected power consumption

In Connected Mode (active BLE connection) the average power consumption is <50 µA @ 4V

8   Compliance (Version: SHT4x)

8.1 Compliance: CE, RoHS

- EN 55022 Emission, class B < 30 dBµV/m (0.03...1 GHz)

- EN 61000-4-2 Electrostatic discharge 4 kV contact / 8 kV air

- EN 61000-4-3 Irradiated RF 10V/m (0.1...1 GHz)

- EN 61000-4-4 Transients (burst) 4 kV

- EN 301 489-1 V2.1.1 and EN 301 489-17 V3.1.1 EMC

- EN 300 328 V2.1.1 EN 300 330 V2.1.1 Radio Emission

- Bluetooth SIG listed: ID 138612

The sensor OSX – Version SHT4x, Type 341 complies with the essential requirements of Radio Equipment Directive (RED) 2014/53/EU and with the Directive 2011/65/EU (EU RoHS 2) and its amendment Directive (EU) 2015/863 (EU RoHS 3).

Manufacturers:

GeoPrecision GmbH   Terratransfer GmbH
Am Dickhäuterplatz 8   Ottostr. 19a
D-76275 Ettlingen   D-44867 Bochum

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Jürgen Wickenhäuser (R&D)

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