

# Data Sheet

## TSens V1.1

General purpose – low power – temperature, humidity and pressure sensor platform



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## 1. Introduction and Overview

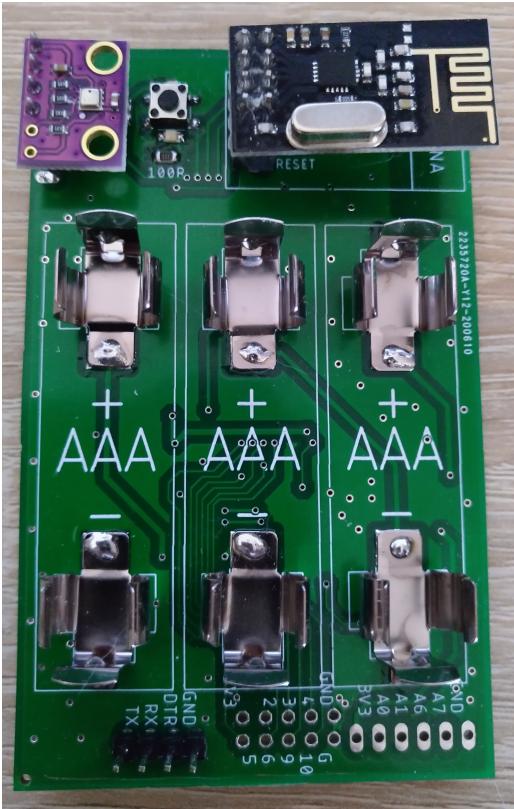
The TSens V1.1 is a general-purpose sensor platform for use as battery-operated temperature, humidity and pressure, in short “THP”, sensor. It has the ability to accept multiple additional sensors through I2C, UART or GPIO pins.

Being battery-operated, it features an ultra-low-power design, only consuming 6 $\mu$ A in sleep state, allowing for up to 10 years<sup>1</sup> of battery operation.

For data communication it features a NRF24L01 low-power communication module containing auto-acknowledge, collision-detection as well as automatic re-transmission.

In the standard application, a BME280<sup>2</sup> sensor is used for THP sensing. However, this sensor can be directly replaced by a BME680<sup>3</sup> sensor, adding air quality measurement. Furthermore, the open-source expansion bus can be used to connect analog or digital sensors, such as a rain-presence-sensor and rain-gauge, UV sensor or even lightning detector. Keep in mind additional sensor might consume more power leading to lower battery life.

In order to upload new firmware, a debug and programming port in the form of a UART connection is available. **NOTE:** Voltage levels of any interface shall never exceed 3.3V!



Front view of TSens V1.1



Back view of TSens V1.1

<sup>1</sup> with 3xAAA-Batteries, measurement interval 1 minute, on-time 15ms, self-discharge not included

<sup>2</sup> see <https://www.bosch-sensortec.com/products/environmental-sensors/humidity-sensors-bme280/>

<sup>3</sup> see <https://www.bosch-sensortec.com/products/environmental-sensors/gas-sensors-bme680/>

## **Front of TSens V1.1:**

Battery Holders	3xAAA-Batteries, polarity as depicted, reverse-polarity protected
BME280 Module	User-swappable
NRF24L01 Module	User-swappable
User Button	Short press for reset, long press to change settings
User LEDs	Feedback of status
Programming / Debug Header <sup>1</sup>	See pinout and description below
Expansion Bus	See pinout and description below

## **Back of TSens V1.1:**

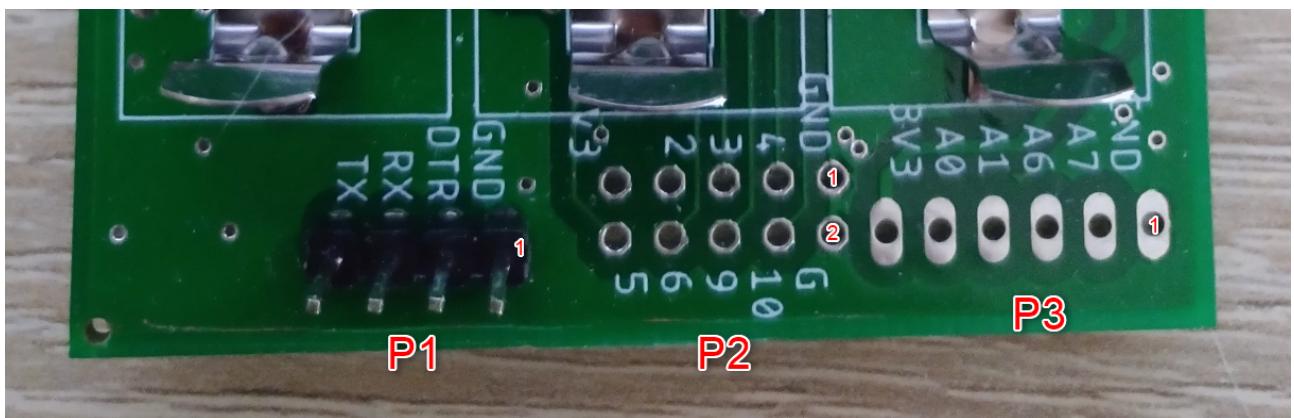
Processor	ATMEGA328P-AU – don't touch without ESD protection
Crystal Oscillator	16 MHz – protect from mechanical stress
General Circuit	Don't touch without ESD protection
Programming / Debug Header <sup>1</sup>	See pinout and description below

<sup>1</sup> may be populated on either side

## 2. Electrical Specification

Symbol	Parameter	Minimum	Value Nominal	Maximum	Unit
$V_{in}$	Input voltage	3.5	4.2	5.5	V
$I_{sup}$	Active supply current	-	20	200	mA
$I_{sleep}$	Sleep current	-	6.0	-	$\mu$ A
$V_{I/O}$	Voltage of all interfaces	-	3.3	3.3	V
$I_{out}$	Output current per pin		20	40	mA
$T_{operating}$	Operating Temperature	-40	25	+85	°C
$R_H$	Operating Humidity	0	-	100	%
P	Operating Pressure	300	-	1100	hPa

### Pinout:



Interface overview

### Programming / Debug Header P1

Used to debug or flash firmware via USB2UART (e.g. FTDI FT2323) adapter. Always make sure to select **3.3V** as interface voltage!

Pin No.	Signal	Description
1	GND	GND reference, connect to GND
2	DTR	DTR (used to initiate flashing), connect to DTR
3	Rx	Tx Pin of processor, connect to Rx
4	Tx	Rx Pin of processor, connect to Tx

## Expansion Port P2

Used to connect various sensors.  
Maximum voltage at all pins **3.3V!**

Pin No.	Signal	Description
1	GND	GND reference
2	GND	GND reference
3	D4	Digital I/O
4	D10	Digital I/O
5	D3	Digital I/O
6	D9	Digital I/O
7	D2	Digital I/O, interrupt capable, can be used by NRF by setting solder jumper
8	D6	Digital I/O, used by user button, can be used to reset
9	3.3V	3.3V supply
10	D5	Digital I/O, used by user LEDs

## Expansion Port P3

Used to connect various sensors.  
Maximum voltage at all pins **3.3V!**

Pin No.	Signal	Description
1	GND	GND reference
2	A7	Analog input
3	A6	Analog input
4	A1	Analog input or digital I/O
5	A0	Analog input or digital I/O
6	3.3V	3.3V supply

### 3. Flashing of Firmware

In order to flash new firmware, install the newest version of Arduino IDE and make sure to obtain and update all required software.

Connect the TSens V1.1 to the supplied USB2UART converter as described above.  
Insert fully charged 3x AAA batteries and connect the USB2UART converter to the PC.  
Wait until all drivers are installed, if necessary manually install them.

In the Arduino IDE, go to “Tools” → “Board” and select “Arduino Nano” as target. From here select the correct COM-Port.

To flash firmware click on the arrow symbol in the top left corner.



Wait until compilation and flashing is completed.

In case of error messages preventing successful flashing, contact the manufacturer providing all given error information.

## **4. Additional Information**

Always make sure to insert batteries in the correct way. There is reverse polarity protection built-in, however, longer periods of incorrect polarity may damage the TSens V1.1

Avoid direct contact with water or other harmful substances.

Never plug or unplug modules when powered on.

For all other questions, have a look at this tutorial: <https://www.youtube.com/watch?v=8ybW48rKBME>

Further documents:

Connection of Rain Gauge: App Note AP001

Connection of Rain Presence and UV Sensor: App Note AP002

Connection of Lightning Detector: App Note AP003