



DIY Pressure and Temperature sensor for Home Assistant

Introduction

Welcome! In this guide, you'll learn how to build a smart indoor presence detection system using a **BMP390 barometric pressure sensor**, an **ESP32 board**, and **ESPHome** with **Home Assistant**. This setup helps you detect when a door or window is opened by monitoring minute pressure changes in a room. Perfect for automation enthusiasts or anyone curious about using sensors in creative ways!

Project Goal

Use a high-precision BMP390 pressure sensor with ESPHome and Home Assistant to detect subtle indoor events, such as a **door or window opening**, by monitoring small pressure changes.



What You Will Need

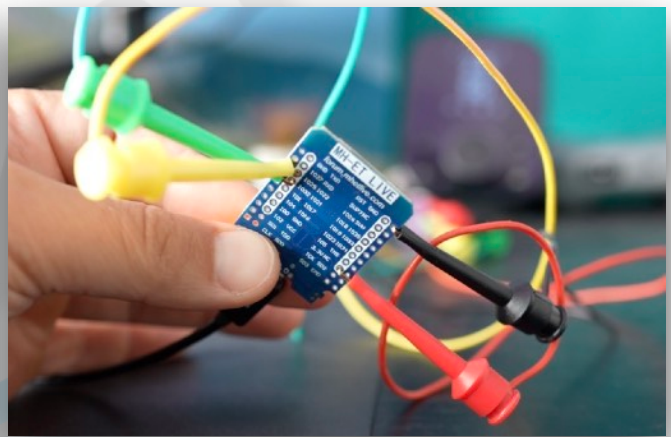
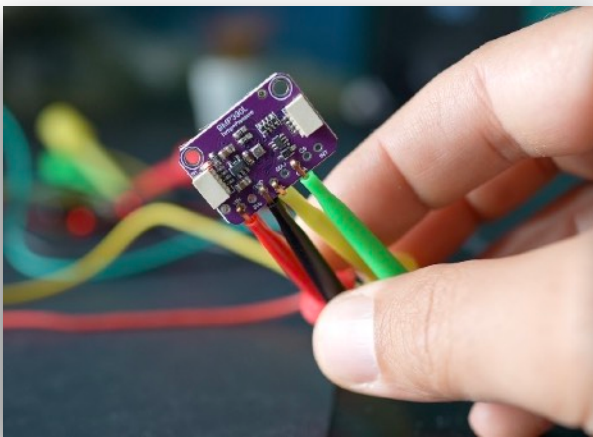
Item	Description	Buying Link
ESP32 Dev Board	Microcontroller with Wi-Fi and I2C support	Link Link
BMP390 Sensor Module	High-precision barometric pressure sensor	Link Link Link
Jumper (Dupont) Wires	For connecting the sensor to ESP32	Link Link
Test Clips (optional)	You can use these to quickly attach/detach boards & sensors instead of jumper wires	Link Link
USB Cable	To power and flash the ESP32	Link Link
Home Assistant Installed	With ESPHome add-on installed and enabled	Link



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🔌 Wiring BMP390 to ESP32 (I2C)

BMP390 Pin	ESP32 Pin
VIN	3.3V or 5V
GND	GND
SDA	GPIO21
SCL	GPIO22



You can use:

- **Test clips** or **Breadboard** for quick setup and test
- **Soldering** for a permanent install

NEW Creating a New ESPHome Device

1. Open the ESPHome dashboard in your Home Assistant.
2. Click "+ New Device".
3. Name your device `tnp-sensor` (or something you like more) and choose **ESP32** as the board type.
4. Follow the on-screen and skip the initial installation.



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5. Edit the configuration by adding the following code to the bottom of the existing ESPHome code (add new line at the very bottom and paste the code below there):

📌 Use the [ESPHome Code from this link](#)

6. Save the configuration and connect the D1 Mini to your Home Assistant device using a micro USB cable.
7. Click on “Install” and select “Plug into the computer running ESPHome Dashboard”. This will upload the code to your D1 Mini.

Code Explanation:

- `web_server`: Optional, allows browsing the sensor readings on a local IP.
- `i2c`: Defines communication pins for BMP390.
- `sensor`: Reads temperature and pressure every 2 seconds.
- `iir_filter`: Smooths data for stable readings. The possible values are *OFF*, *2x*, *4x*, *16x*, *32x*, *64x*, *128x*. So play around with these values, by changing them saving the code and re-uploading it. Good start is 16x or 32x.
- `binary_sensor`: Detects pressure events like a door opening.
- `lambda`: Custom logic to check for tiny pressure changes and flag events.
 - In the lambda, you can test around and play here with the delta by changing the number from 0.0009 to 0.00009 or 0.009 for example in the `if (abs(delta) >= 0.0009)` row. This will make the sensor more or less sensitive and combine that with some changes in the `iir_filter` above you can easily have hundreds of combinations 🤔



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Adding the Sensor to Home Assistant

- Once the code is uploaded:
- The sensor will appear **automatically** in Home Assistant.
- Go to the **Integrations** page in Home Assistant.
- You should see a new device (your Temperature & Pressure sensor) ready to be configured. Click on “**Configure**” and then “**Submit**”.
- Once configured, you can find the sensor in your ESPHome section under configured devices.
- You can now use it in automations, scripts, and dashboards.



Automation in Home Assistant

alias: Window or Door Possibly Opened

description: ""

trigger:

- platform: state

- entity_id:

- binary_sensor.tnp_sensor_pressure_change_event

- to: "on"

action:

- service: persistent_notification.create

- data:

- message: Pressure changed slightly – check for a window or door open event.



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What This Automation Does (in Simple Words):

Name of Automation: "Window or Door Possibly Opened"

When it triggers:

- It watches a **pressure sensor** (`binary_sensor.tnp_sensor_pressure_change_event`).
- If the sensor **changes to "on"**, that means there's been a small change in air pressure.

What happens when triggered:

- It shows a **notification on your Home Assistant dashboard** saying: "Pressure changed slightly — check for a window or door open event."
- Of course, you can change or add more actions, like turn on/off some lights, sound alarm, send pictures, makes calls, etc.

 So, this is useful if you want to be alerted when there might be a **door or window left open**, based on pressure changes inside your house.

How to Test

- Place the sensor in a **sealed room**.
- Open and close a **window or door quickly**.
- You should see the **Pressure Change Event** briefly turn on.
- A notification should appear in Home Assistant.



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Some Pro Tips for Better Accuracy and Performance

- Use a higher `iir_filter` like 32x or more if your environment is noisy or lower like 4x if you are in a calm environment .
- Avoid placing sensor directly near doors, vents, A/C, kitchen hoods.
- Lower `abs(delta)` threshold if your readings are very flat or increase them if your readings are flapping.
- Use the `web_server` (optional) to debug values live in browser and once you are happy comment it so you can save resource of your ESP board.



Wrap it all in a case

Optionally, you can put the BMP390 sensor and the D1 Mini ESP32 in a case this can be any suitable box with ventilation or you can print one if you have access to or own a 3D Printer. If you don't have access you can always ask a friend to print it for you or you can search for a local 3D printing service in your neighborhood - these service are usually not expensive at all.

Below you can find a link to a suitable 3D model for this DIY project.

<https://www.thingiverse.com/thing:5739905>





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Final Thoughts

You've just built a clever presence detection system using just pressure! As bonus you have a smart temperature sensor as BMP390 have that as well. This setup is ideal for detecting door and window activity **without needing motion sensors or contact switches, but it needs some tests and fine tuning for different rooms.**

If you found this helpful or want to explore more ESPHome and Home Assistant projects, join our growing community!

👉 Join the conversation on Discord: [<https://discord.gg/HhUwn79zdc>]

Happy automating, and see you in the in the pressure logs! 🧠📈