ESPEasy CO2-Tuya-detector

vrijdag 7 februari 2025   14:51

Parameter (condition)	Value
CO2 Range	0 .. 5,000 ppm
CO2 Accuracy	+/- (50 ppm +5%)
CO2 Repeatability	+/- 10 ppm
CO2 Response Time	60 sec
Temperature	-10 .. 50 °C
Temperature accuracy	+/- 0.3 °C
Temperature Response Time	120 s
RH Range	0 .. 100 %
RH Accuracy	+/- 2%
Total Power	? Watt

This device has a good NDIR CO2 Sensor: the Winson MHZ19D.
It has Tuya / SmartLife WIFI connection.
It costs between 35 and 40 Euro's.
The main disadvantage is that it's self-calibrating (24 hours cycle, but you can calibrate it manually too).

By adding an ESP32-C3 and removing one resistor, you can get rid of the auto-calibrate functionality and get also some new features (see here on the right)

ESPEasy based software
P2P Network
Web interface
5 .. 10 days Recording
MQTT broadcast
Software Calibration

The default web interface, automatically generated by EasyFetch.

If you uncomment line 67 in the Rule tab, you can also perform a CO2-Calibration by pressing the MHZ19D button in the web-interface.

```
66 On MHZ19DEvent Do
67    //MHZCalibrateZero
68 Endon
```

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66  On MHZ19DEvent Do
67     //MHZCalibrateZero
68  Endon
```
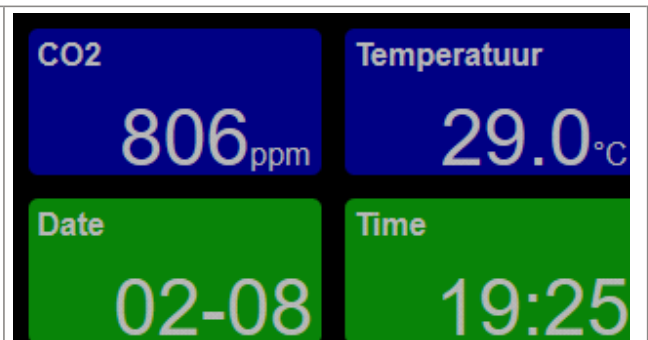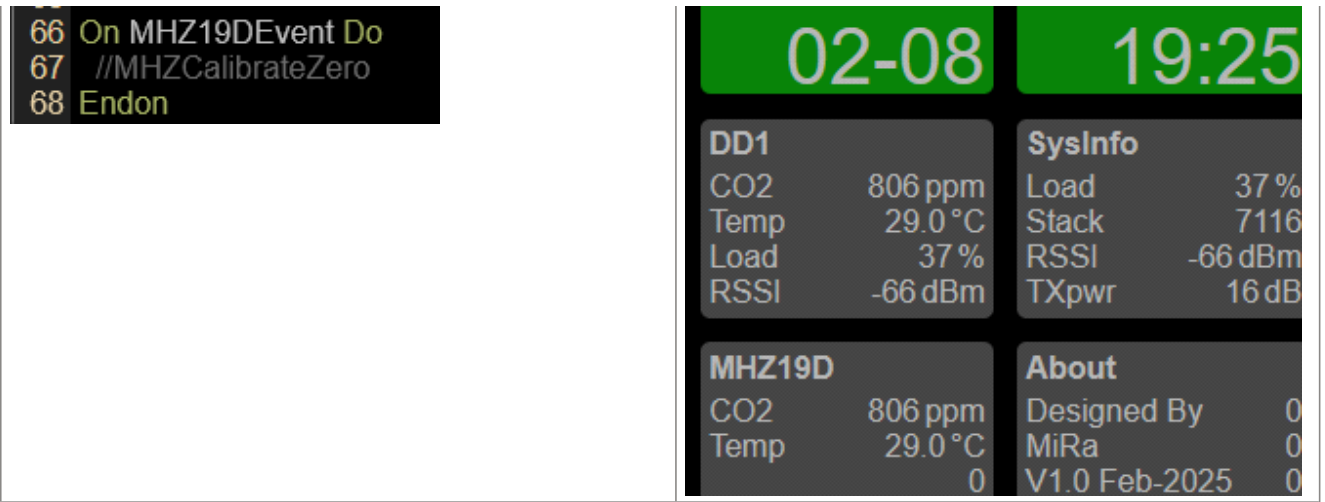

Connection to Tuya / SmartLife
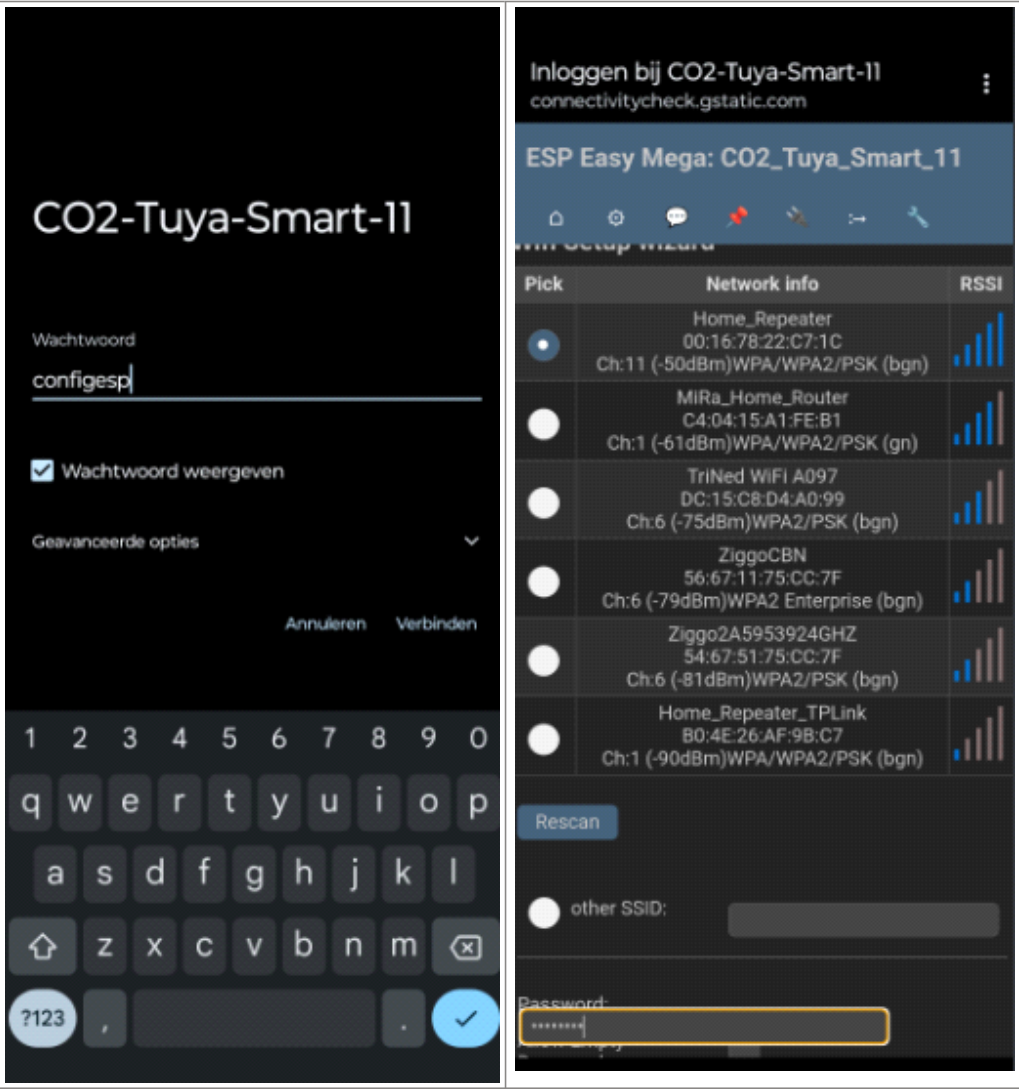
See original instruction manual.
This connection should be made, otherwise the CO2 readings are not stable.

Connecting to Home WiFi		
Every time the device is powered up, and it cannot contact to a home network, it will start a WIFI Access Point. If the device is not connected to your home network yet: On your smartphone (most easy), connect to the Access Point, Log in, select the correct network and provide the network password. If the connection didn't succeed, reconnect the power to get the device in the Access Point mode.		

Version	Date	History
1.0	Feb-2025	Orignal Release

		Based on original ESP_Easy_mega_20231225 Custom build ESP_Easy_mega_20250106_custom_ESP32c3_4M316k_CDC Jan 6 2025
		TODO (ideas for future improvements • Fetch the Temperature and RH from the AHT20 sensor • Better 5 V coupling so you don't need the Tuya connection • Take over the complete display control • Get rid of the original processor

Temperature Correction

The temperature measured is often too high, due to the heat generated by the electronics.

If the device is on a permanent position, you can correct the temperature in the device settings by changing the formula. Here on the right a 10 degrees correction is made,

Values

#	Name	Formula ?
1	CO2?ppm	
2	Temp?°C	%value%-10

CO2 Calibration

Leave the device for at least 15 minutes in a room where the CO2 is equal to the outside CO2 level.

Then in the web-interface to the Tools-tab, you can enter the command "mhzCalibrateZero" and the CO2 sensor will be reset tot 400 ppm.

If you uncomment line 67 in the Rule tab, you can also perform a CO2-Calibration by pressing the MHZ19D button in the web-interface.

```
66 On MHZ19DEvent Do
67   //MHZCalibrateZero
68 Endon
```

Tools

Command

```
mhzCalibrateZero
```

Submit ? i

Note: the relative humidity during calibration should be below 60%, otherwise the humidity will lead to a wrong calibration (a high humidity will also absorb the infrared light in the sensor)

MQTT messaging

In line 13 of Rules the MQTT message is constructed.
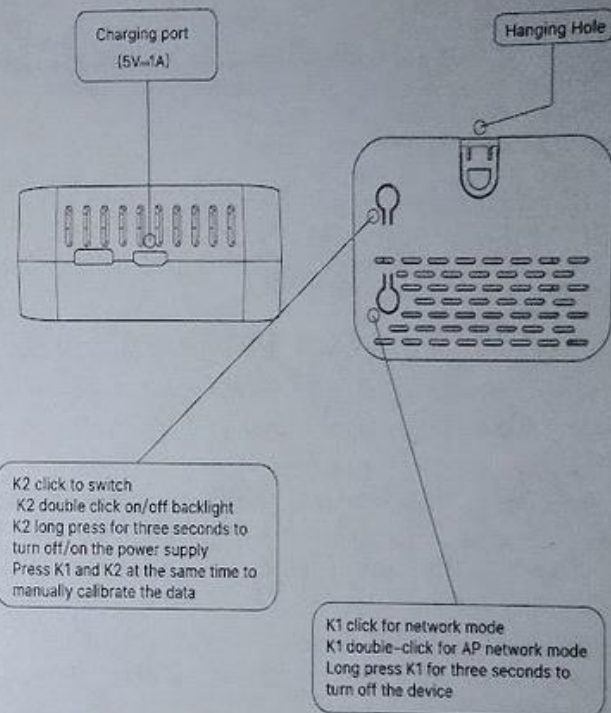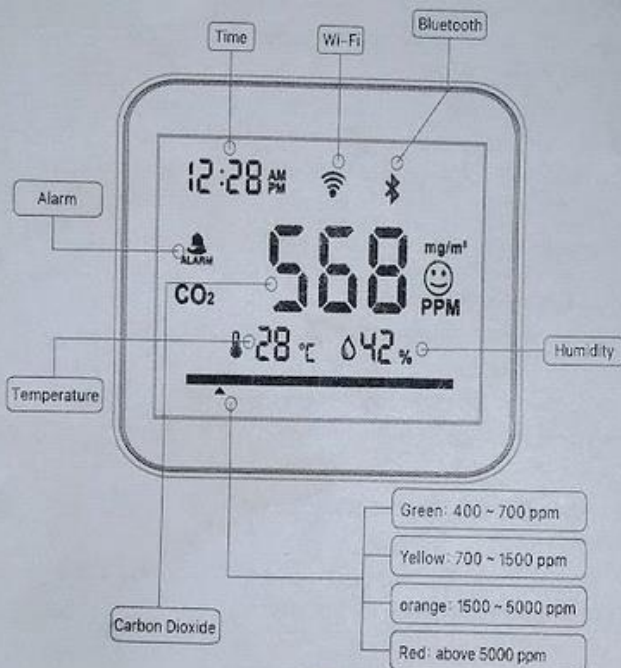The MQTT message will be sent every time a new value of the CO2 sensor is fetched.

The address of the MQTT broker is set through the Controller-tab | MQTT-Controller

```
10 On MHZ19D#All Do
11   TaskValueSet,30,1,%eventvalue1%
12   TaskValueSet,30,2,%eventvalue2%
13   Publish,huis/ergens/%sysname%/Sensors,'{"CO2":%eventvalue1%, "Temp":%eventvalue2% }'
14   LogEntry,""====> Publish"
15 Endon
```

Product Introduction

Time   Wi-Fi   Bluetooth

Alarm

12:28 AM/PM

🔔 ALARM

CO₂ 568 mg/m³ PPM ☺

🌡 28 ℃ 💧 42 %

Humidity

Temperature

Carbon Dioxide

Green: 400 ~ 700 ppm
Yellow: 700 ~ 1500 ppm
orange: 1500 ~ 5000 ppm
Red: above 5000 ppm

Charging port
(5V⎓1A)

Hanging Hole

K2 click to switch
K2 double click on/off backlight
K2 long press for three seconds to
turn off/on the power supply
Press K1 and K2 at the same time to
manually calibrate the data

K1 click for network mode
K1 double-click for AP network mode
Long press K1 for three seconds to
turn off the device

Specification

WiFi Smart CO2 Detector
Power:5V1A
CO2Sensor:400-5000PPm
Accuracy:±(50ppm+5%reading value)
Humidity sensor:0-100%RH
Accuracy±2%RH(25℃) Working
Temperature:-10℃~+50℃0~95%RH -10~+65℃accuracy+0.3℃
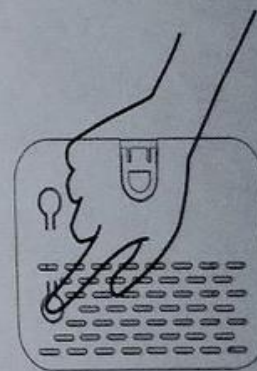Communication protocol:WiFi

How to connect to the app

Scan and download before using

1. Please confirm you have enabled the phone Bluetooth, 2.4G
WiFi and location service.

2. Open Smart Life APP,click "Add Device"on the home page or
click the icon "+"on the top right.

3. Long press the "🌡" button until the "📶" icon flashes on the screen, and the device enters the network configuration state.

4. Click "Add"when searching devices, choose your 2.4G WiFi by entering password for clicking "Next"to wait for successful device adding.

5. Click "Done"and enter the device page to enjoy smart life with home automation.

Note:

Note: 1. During the connection process, it is necessary to ensure that the device and the mobile phone are within 30 meters during the connection process, as Wi-Fi is short-distance connection.

2. During the connection process, make sure that the device and the mobile phone are in the same Wi-Fi environment, and only support the 2.4GHz Wi-Fi signal

Q&A

Question:Why these carbon dioxide detector can only detect carbon dioxide concentration above 400ppm?

Answer:Because this co2 meter only suitable for indoor carbon dioxide concentration detection.As we all know co2 is an important part of the air. Main function of the product is to alarm when the carbon dioxide concentration exceeds the standard,such as when indoor people are crowded or room closed for a long time without ventilation. So this indoor carbon dioxide detector with a co2 detection starting concentration of 400ppm.

Question:Does it include usb cable?

Answer:Our product package includes 1x CO2 Detector, 1x USB Charging Cable, 1x User Manual.

Question:How often are you supposed to calibrate this? Readings seem irratic

Answer:Calibrate when you think the device reading is inaccurate.
We recommend that you calibrate your device when you first receive it.

Question:Does it have a "hold" function? So can you put it into an environment, leave it for a period of time, and it stores or fixes the reading?

Answer:Place the detector in an open environment. After shutdown, long press the K1 and K2 buttons at the same time , the detector will enter the calibration state.
This CO2 detector does not have the function of storing data for the time being.

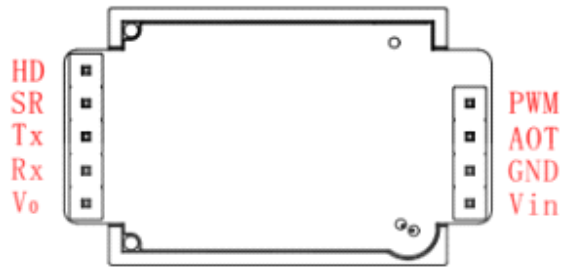Question:Does an audible alarm sound if/when co2 levels become dangerous?

Answer:Have alarm sound. When carbon dioxide levels exceed normal,it will have sound to remind you .

MHZ19 pinning

HD
SR
Tx

PWM
AOT

Pins connection type table3.

| Pin	Pin Definition
Vin	Positive pole of power (Vin)
GND	Negative pole of power (GND)

Pin	Pin Definition
Vin	Positive pole of power (Vin)
GND	Negative pole of power (GND)
PWM	PWM
Hd	HD(zero point calibration, low level lasting for over 7s is effective)
Rx	UART(RXD)TTL Level data input
Tx	UART(TXD)TTL Level data output

Remove R112

R112 (an 0 Ohm resistor connected to the Rx of the MHZ19D) is removed.

The orginal micro-processor sends "set auto-calibrate" command at regular time intervals.

Now the ESP32 sends the commands to the MHZ-19D, including calibration commands if initiated by the user.
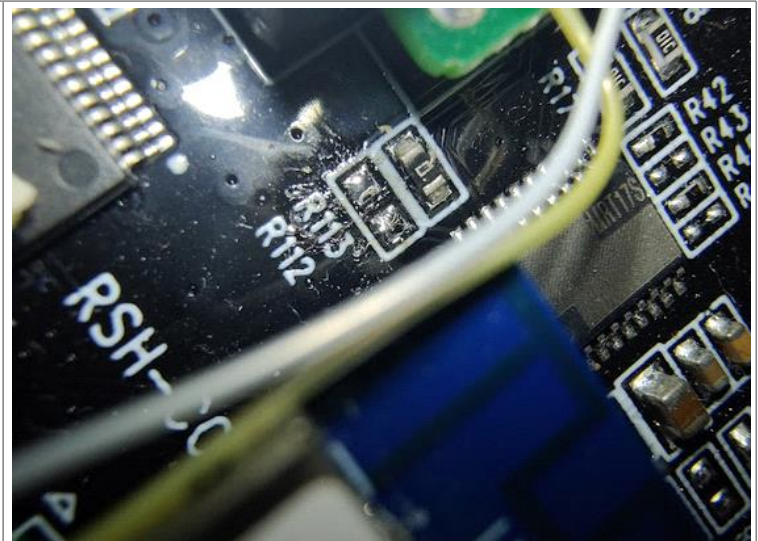
Connect Power to ESP32

This is not the best connection, but it's good enough. It works in both directions, you can either power the ESP32-C3 through the USB-C-connector or power the device through the micro-USB-connector.

You must find a better way if you want to measure CO_2 without connecting to the Tuya server.

Rx, Tx Connections

Here you see the Rx and Tx connections.

Some ESP32-C3 have very bad antenna designs, where the antenna signal reflects in the transmitter. In that case it's impossible to make a WiFi connection, even if there's a strong WIFI signal from the home network. The blue wire (about 6.5 cm) connected over the ceramic antenna will improve the WIFI signal significantly and solve the WIFI connect problems.

Cache Reader is disabled, because it's only used to downlaod all teh collected data in Cache Controller.

ESP Easy Mega: CO2_Tuya_Smart_11

⌂Main ⚙Config 💬Controllers 📌Hardware 🏠Devices ↪Rules 🔧Tools

	Task	Enabled	Device	Name	Port	Ctr (IDX)	GPIO	Values
Add	1							
Add	2							
Edit	3	✓	Generic - Dummy Device	DD1		③		CO2?ppm: 775 Temp?°C: 21.0 Load?%: 41 RSSI?dBm: -66
Add	4							
Add	5							
Add	6							
Add	7							
Edit	8	✓	Generic - System Info	SysInfo				Load?%: 41 Stack: 7116 RSSI?dBm: -66 TXpwr?dB: 16
Edit	9	✓	Gases - CO2 MH-Z19	MHZ19D	HW Serial1	①	RX: GPIO-21 TX: GPIO-20	CO2?ppm: 775 Temp?°C: 21.0 _: 0
Edit	10	✗	Generic - Cache Reader	CacheReader				FileNr: 0 FilePos: 0

ESP Easy Mega: CO2_Tuya_Smart_11

⌂Main ⚙Config 💬Controllers 📌Hardware 🔦Devices :→Ru

Task Settings

Device:	Gases - CO2 MH-Z19 ❓ ℹ
Name:	MHZ19D
Enabled:	☑

Sensor

Serial Port:	HW Serial1 ▾
ESP RX GPIO ← TX:	GPIO-21 ▾
ESP TX GPIO → RX:	GPIO-20 ▾

Device Settings

Auto Base Calibration:	ABC disabled ▾
Filter:	Fast Response ▾
Checksum (pass/fail/reset):	136/0/1
Detected:	MH-Z19B

⌂Main ⚙Config 💬Controllers 📌Hardware 🔌Devices :→Rules 🔧Tools

Rules

Rules Set 1 ⌄ (?) (i)

```
 1  // This file has both a section for SCD_Sensor and MHZ19D
 2  // Copy the CO2 and Temperature Value to the large Tile
 3  On SCD_Sensor#All Do
 4    TaskValueSet,30,1,%eventvalue1%
 5    TaskValueSet,30,2,%eventvalue3%
 6    Publish,huis/ergens/%sysname%/Sensors,'{"CO2":%eventvalue1%, "RH":%eventvalue2%, "Temp":%eventvalue3%}'
 7    LogEntry,""====> Publish"
 8  Endon
 9
10  On MHZ19D#All Do
11    TaskValueSet,30,1,%eventvalue1%
12    TaskValueSet,30,2,%eventvalue2%
13    Publish,huis/ergens/%sysname%/Sensors,'{"CO2":%eventvalue1%, "Temp":%eventvalue2% }'
14    LogEntry,""====> Publish"
15  Endon
16
17  // Store Values in Cache
18  On Rules#Timer=7 Do
19    timerSet,7,120
20    Let,4,%unixtime%+3600
21
22    TaskValueSet,DD1,1,[MHZ19D#CO2?ppm]
23    TaskValueSet,DD1,2,[MHZ19D#Temp?°C]
24    TaskValueSet,DD1,3,[SysInfo#Load?%]
25    TaskValueSet,DD1,4,[SysInfo#RSSI?dBm]
26
27    // Store all values in the cache (with an identical timestamp)
28    TaskRunAt,DD1,[int#4]
29  Endon
30
31  On System#Boot Do
32    timerSet,8,20      //Wifi Timer
33    Let,8,1
34    timerSet,7,10      //Cache Timer
35   TaskEnable 9   // ONLY for MHZ19
36  Endon
37
```

```
38  // Switch AP-mode off, when connected to an existing network
39  On WiFi#Connected Do
40    LogEntry "+++++++++++ + %ssid%"
41    WiFiMode Sta
42    TimerSet,8,0  // Disable Timer
43    Let,8,0
44  Endon
45
46  // When connection to the network gets lost, start a Timer which will switch to AP-mode
47  On WiFi#Disconnected Do
48    LogEntry,"-----------------"
49    If [INT#8]==0
50      LogEntry " >>>> Start Timer 600 Sec>>>>'"
51      timerSet,8,30  //600
52      Let,8,1
53    Endif
54  Endon
55
56  // Timer test if wifi is  connected, and if not wil  enter AP+STA mode
57  On Rules#Timer=8 Do
58    //LogEntry "WIFI Status [0,1,3,7]: %iswifi%"
59    If %iswifi% < 3
60      LogEntry "LOST"
61      //WiFiMode AP+STA
62      WiFiMode AP
63    Endif
64  Endon
65
66  On MHZ19DEvent Do
67    //MHZCalibrateZero
68  Endon
```

Rules Set 1

// This file has both a section for SCD_Sensor and MHZ19D
// Copy the CO2 and Temperature Value to the large Tile
On SCD_Sensor#All Do
  TaskValueSet,30,1,%eventvalue1%
  TaskValueSet,30,2,%eventvalue3%
  Publish,huis/ergens/%sysname%/Sensors,'{"CO2":%eventvalue1%, "RH":%eventvalue2%, "Temp":%eventvalue3%}'
  LogEntry,'"====> Publish"
Endon

On MHZ19D#All Do
  TaskValueSet,30,1,%eventvalue1%
  TaskValueSet,30,2,%eventvalue2%
  Publish,huis/ergens/%sysname%/Sensors,'{"CO2":%eventvalue1%, "Temp":%eventvalue2% }'
  LogEntry,'"====> Publish"
Endon

// Store Values in Cache
On Rules#Timer=7 Do
  timerSet,7,120
  Let,4,%unixtime%+3600

  TaskValueSet,DD1,1,[MHZ19D#CO2?ppm]
  TaskValueSet,DD1,2,[MHZ19D#Temp?°C]
  TaskValueSet,DD1,3,[SysInfo#Load?%]
  TaskValueSet,DD1,4,[SysInfo#RSSI?dBm]

  // Store all values in the cache (with an identical timestamp)
  TaskRunAt,DD1,[int#4]
Endon

```
On System#Boot Do
  timerSet,8,20     //Wifi Timer
  Let,8,1
  timerSet,7,10     //Cache Timer
 TaskEnable 9    // ONLY for MHZ19
Endon

// Switch AP-mode off, when connected to an existing network
On WiFi#Connected Do
  LogEntry "++++++++++++ + %ssid%"
  WiFiMode Sta
  TimerSet,8,0   // Disable Timer
  Let,8,0
Endon

// When connection to the network gets lost, start a Timer which will switch to AP-mode
On WiFi#Disconnected Do
  LogEntry,"----------------------"
  If [INT#8]==0
    LogEntry " >>>> Start Timer 600 Sec>>>>"'
    timerSet,8,30  //600
    Let,8,1
  Endif
Endon

// Timer test if wifi is  connected, and if not wil  enter AP+STA mode
On Rules#Timer=8 Do
  //LogEntry "WIFI Status [0,1,3,7]: %iswifi%"
  If %iswifi% < 3
    LogEntry "LOST"
    //WiFiMode AP+STA
    WiFiMode AP
  Endif
Endon

On MHZ19DEvent Do
  //MHZCalibrateZero
Endon


Feb 2025, Stef Mientki
```