Wireless Multi Sensor Mk3

Manual

Overview

The Wireless Multi Sensor Mk3 (from now on WMS) use the 433MHz frequency band to transmit sensor readings over the air. The WMS is compatible with Tellstick DUO, Tellstick NET and RFXtrx433(E) transceivers.
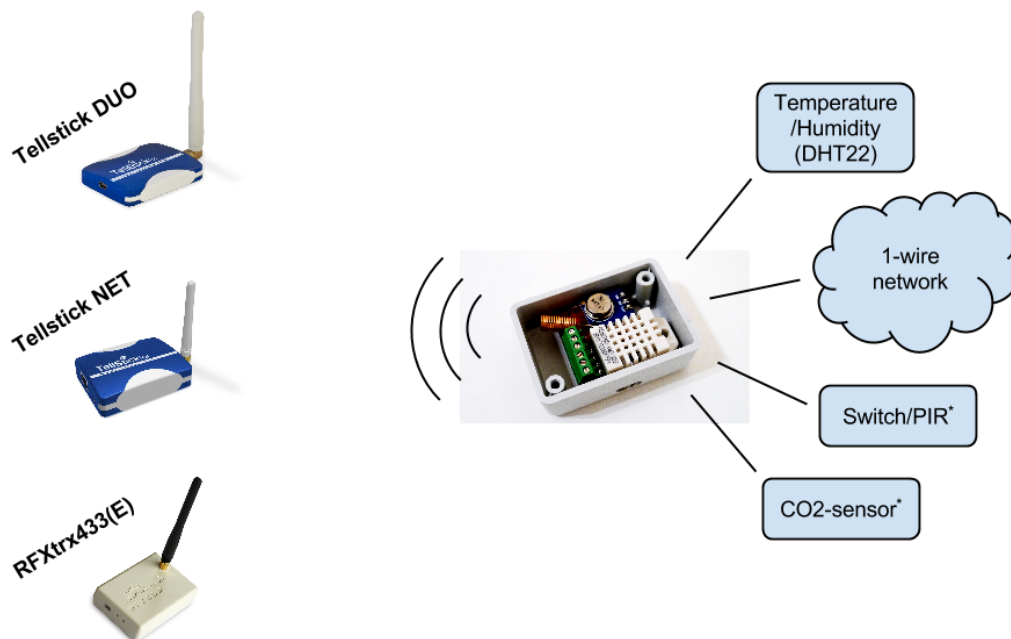
* The Event input can only be of the type Event OR 1kHz PWM input (CO_2 sensor).

It is a true multi sensor in the sense that it is possible to connect multiple sensors to one single WMS. The WMS will query all connected sensors once a minute, and transmit each reading, one by one over the air. At the receiving end this will be seen as several separate sensors.

The WMS have 3 inputs. Each input will be explained in more detail below, but first a short summary of the inputs,

- ❏ Event / CO_2 sensor input. There are two variants of the WMS. This sensor input is EITHER configured as an event based input for sensors/switches, such as a window/door opening or closing, vibration sensors, tilt sensors OR configured as a CO_2 sensor input.
- ❏ Temperature/Humidity-sensor input. This is specifically intended for the DHT22 sensor and similar sensors.
- ❏ 1-Wire bus. The WMS support several different 1-Wire devices such as thermometers, AD-converters and Thermocouple-to-digital converter.

At power-on, the sensor will send a burst of ON-event packages to help verify that the WMS is detected by your transceiver (Tellstick DUO, Tellstick NET or RFXtrx433(E)).
The WMS will be identified as a Nexa LMST-606 (AC/arctech) door switch and as a Viking Temperature/Humidity (FineOffset) sensor.
If there are 1-wire devices connected on the 1-wire bus, they will be seen shortly after power-on.
If there is a DHT22 connected, it will be seen shortly after power-on.

Manual changelog

Rev.4
- ● MH-Z19 variant must have a pull-up if no MH-Z19-sensor is connected

Rev.2
- ● Clarified that there are two different WMS types; Event and CO2
- ● Updated information about transmission interval default setting
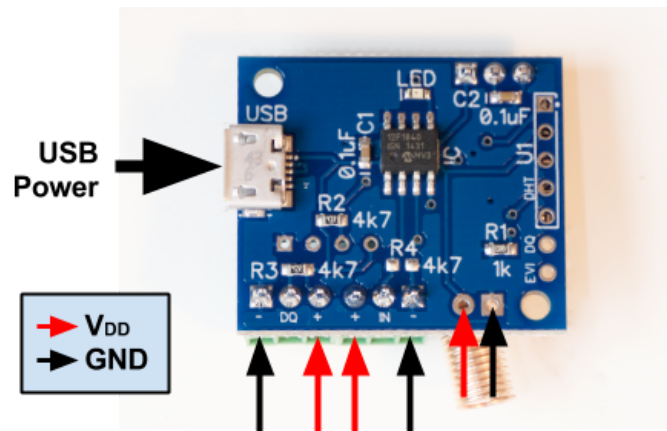- ● Updated information about how to change the default settings in EEPROM

Rev.1
- ● First released WMS Mk3 revision

Input details

Powering the WMS

The WMS can be powered in several ways.

The most convenient way is through the micro USB port. An alternative way is to solder cables to the soldering points to the right of the screw terminals. A third option is to use any of the screw terminal points. This could be a very convenient way to both feed power to the WMS at the same time as one power the 1-wire network. In the case the power supply is external to the WMS box, this is a way to avoid making an extra hole in the box just to power the WMS.
See the chapter Specification for details regarding voltage levels (V_{DD}).

Event Input

Any sensor that is capable of outputting some kind of on/off signal (0V to 5V), or capable of acting as a on/off switch, can be connected to the Event Input.

When the input (**IN**) goes high, there will be an ON packet sent. When the input (**IN**) goes low there will be an OFF package sent.
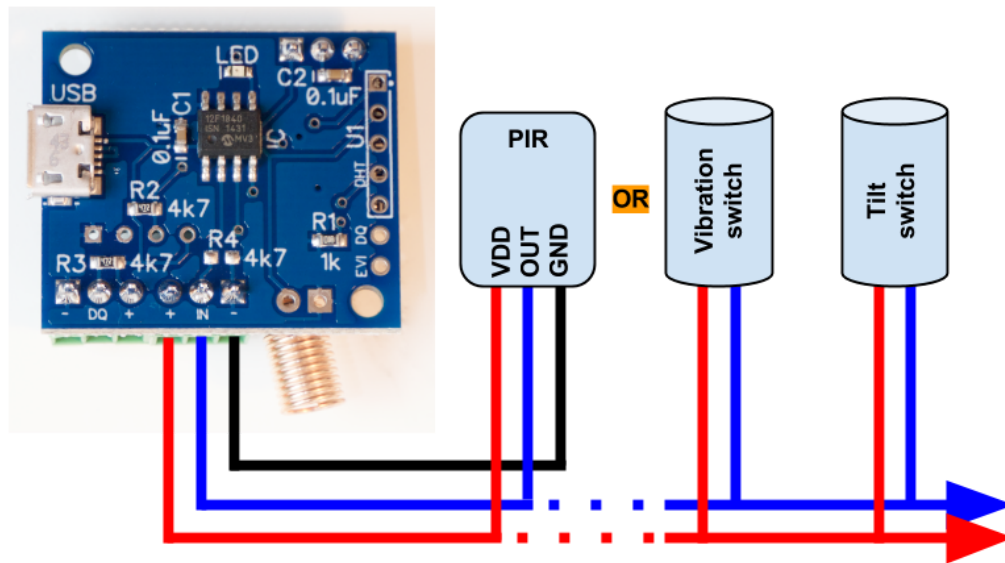
Supported sensors

- ❏ Switches
- ❏ Vibration sensor
- ❏ Tilt sensor

Output

A Nexa package similar to the one sent from the LMST-606.
To be able to decode the package the **AC** protocol need to be Enabled on the RFXtrx433(E)
When the WMS is powered on it will send an ON package within a few seconds after start up.

Protocol: AC/arctech

On change: In the event that the (**IN**) input change from Low to High, the WMS will send an ON signal. In the event that the (**IN**) input change from High to Low, the WMS will send an OFF signal.

Any Event that will occur in the middle of the WMS is transmitting, it will not be detected. This means that for Events to be registered they can not be less than 0.5 second apart.

Advanced

The Sensor Identification code can be altered by changing EEPROM address 0x03.

CO₂ Input

The CO_2 sensors S8 from SenseAir and MH-Z19 from Winsen are supported.

> **NOTE!** The CO_2-sensors consumes relatively much power. 300mA peak and 30 mA average. This shortens the battery lifetime considerably and it is thus recommended to use a USB mobile charger or similar if a CO_2 sensor is being used.
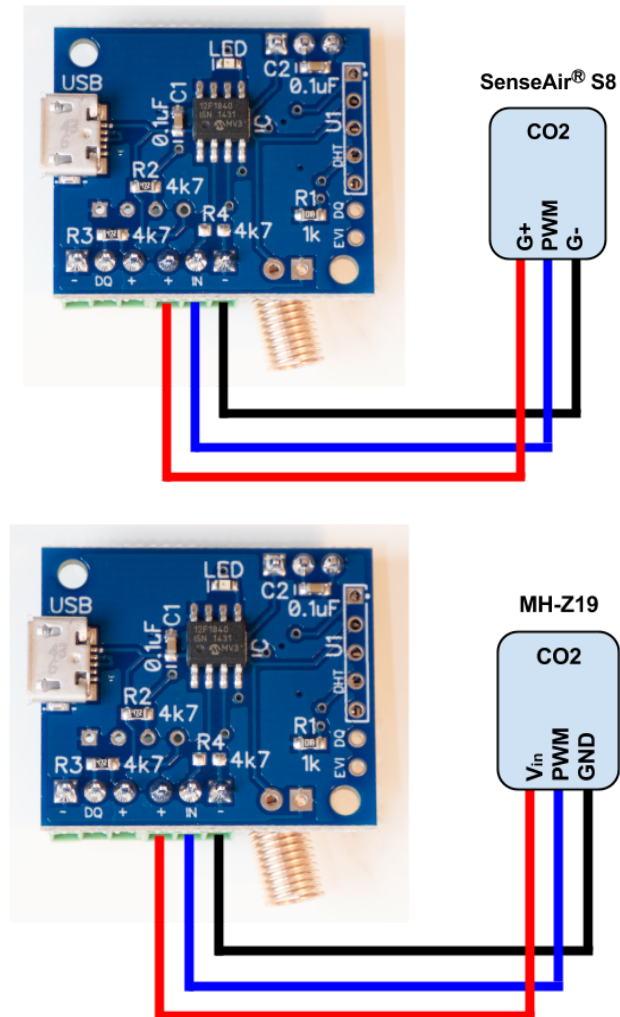
NOTE! Make sure you have the right CO2 variant of the WMS Mk3

Supported sensors

- ❏ CO2 sensor S8 from SenseAir®
- ❏ CO2 sensor MH-Z19 from Winsensor

Output

Protocol: FineOffset
Type: temperature sensor
Range: 0.0-100.0°C (0-2000 ppm)
Conversion:

$$CO_2 = T_{CO2} * 20$$

Example: $T_{CO2} = 35.2°C$ ⇒ $CO_2 = 35.2 * 20 = 704$ ppm

Advanced

If the WMS type MH-Z19 have no CO2 sensor connected, a pull-up resistor must be connected in order for the WMS to work correctly.

Temperature/Humidity sensor input

This input is specifically designed to be used for the DHT22 sensor. The sensor comes in different packages and have different names. AM2302 is a wired version of the DHT22. RHT03 is another name of the DHT22. This sensor can be connected with a cable up to 100m.

Supported sensors

- ❏ DHT22
- ❏ AM2302
- ❏ RHT03

Output

Fineoffset temperature/humidity sensor

Advanced

The Sensor Identification code can be altered by changing EEPROM address 0x04.

1-Wire device input

1-Wire is a very commonly used bus that have the strength of only needing one signal wire to do all the communication between the 1-Wire devices. Another strength is that the cable connecting all the sensors can be very long.
The total length of a 1-Wire network can be 100 - 200 meter long. Maxim Integrated have a good guide of how to dimension the 1-Wire network, Guidelines for reliable long line 1-Wire networks

The WMS has been tested in a 1-wire network with ~75m cable and 30 1-Wire devices connected at the same time.

NOTE! 1-Wire parasite mode is not supported.

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Recommended cable: **ELLXB 1x4x0,5mm**
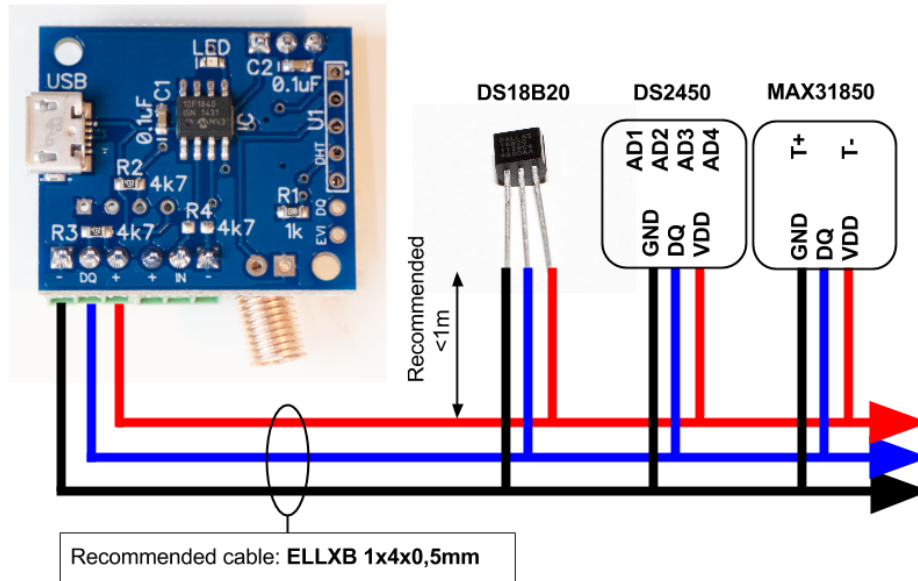
Supported 1-Wire devices

- ❏ DS18B20
- ❏ DS1820
- ❏ DS18S20
- ❏ DS1822
- ❏ DS2450 (4 channel AD-converter)
- ❏ MAX31850 (Thermocouple amplifier)

If you find a sensor module that is based on any of the above 1-wire devices, it is compatible with the WMS.

Output

DS1820, DS18B20, DS18S20, DS1822

Presented as a FineOffset temperature sensor.
The sensorID is automatically generated and conserved after a power outage.
Communication between the 1-wire sensor and the WMS is validated with a checksum.

DS2450

Presented as a Fineoffset temperature sensor.
The sensorID is automatically generated and conserved after a power outage.
There will be 4 consecutive sensorID:s generated to present each Analog-Digital channel output.
An analog signal 0.0V - 5.12V[1] will be transmitted by the WMS as a temperature from 0.0°C to 204.7°C. The temperature is linearly proportional to the input voltage.

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[1] DS2450 is configured with the Input Range register (IR) set to 1 which sets the maximum output value 2048 at 5.12V.

$$V_{AD} = 5.12 / 204.8 * T_{DS2450}$$

Example: $T_{DS2450} = 96.5°C$ $\Rightarrow$ $V_{AD} = 5.12/204.8 * 96.5 = 2.41V$

MAX31855

Presented as a Fineoffset temperature sensor.
The sensorID is automatically generated and conserved after a power outage.
Communication between the sensor and the WMS is validated with a checksum.
Since the maximum possible temperature is 204.7°C for the fineoffset protocol, the
temperature has been divided by a factor of 10 before transmitted by the WMS. A
received value of 10.2°C corresponds to an actual temperature of 102°C

Specification

Voltage: Min 3V   Max 5.5V (Sensor dependent. See Table 1)
Input connectors: Micro USB, Screw terminals, soldering pads for (DHT22)
Frequency: 433.92 MHz
Protocols: Improved **Fineoffset** including CRC-protected data and Nexa
                              AC/arctech
Supported transceivers: Tellstick DUO, Tellstick NET and RFXtrx433(E)
RF power: 13 dBmW@2.4V, 15 dBmW@3V, 20 dBmW@5V
                              20 dBmW is equal to 100 mW

Sensor	Min Voltage	Max Voltage
DHT22 / AM2302 / RHT03	3.3V	5.5V
SenseAir® S8 (CO2-sensor)	4.5V	5.25V
DS18X20,DS1822,DS1820	3V	5V
MAX31855	3.3V	5V

Table 1

Dimensions

The external dimensions of the WMS Mk3 is 25x29 mm.
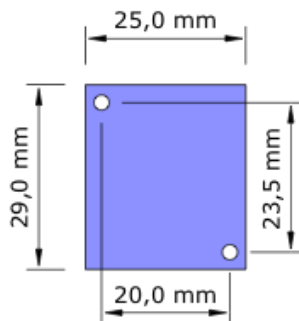
Add-on

Box from Hammond (Part.no.1551GBK) is a perfect fit for the WMS.

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Appendix

In this chapter it is described how the firmware configuration in the WMS can be updated to better fit the existing home automation system.

Prerequisites
- ❏ **PC** with **Windows** and a free **USB-port**
- ❏ **Pickit3** with **Pickit3 Programmer Software** from Microchip
- ❏ Basic knowledge in handling electronics
- ❏ **Pickit3 firmware that supports the PIC12F1840 microprocessor.**

> **NOTE!** Disconnect any sensor connected to the Event input or the 1-Wire input while accessing the WMS Firmware configuration parameters.

Make sure you can connect the Pickit3 to the WMS in an electrically robust way. The pinout of the Pickit3 is compatible with the WMS programming interface U1. The dot on the WMS marks pin number 1.
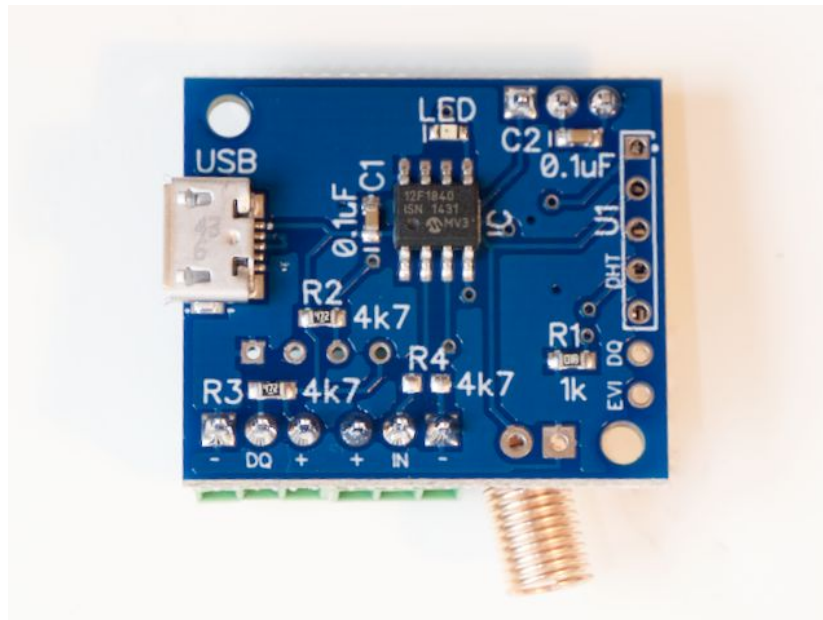
U1 is located along the right side of the WMS, opposite side of the micro USB port.

Changing WMS firmware configuration parameters

The following parameters exist on the WMS;

| EEPROM Address	Parameter	Default value
0x0	Reserved (DO NOT CHANGE)	**0**
0x1	Version (DO NOT CHANGE)	Not applicable
0x2	Variant (DO NOT CHANGE)	Not applicable
0x3	Event sensor ID	**201 (0xC9)** This will generate a random number but consistent between battery change.
0x4	DHT sensor ID	**1 (0x01)**
0x5	CO_2 sensor ID	**2 (0x02)**
0x6	Packet re-sends	**1 (0x01)** No resends
0x7	Time between the transmissions	**7 (0x07)** The amount of ~8.5s periods to sleep between transmissions 7 gives around 60s. Min value 2 (0x2) Max value 255 (0xff) => 255*8.5s = 36 minutes This value can be further increased on demand.
0x8	Enable CO_2 sensor	**Not used for the WMS mk3** **0** Event Input **1** 1kHz PWM Input (CO2) Is by default configured as an Event input. Setting this to 1 (0x1) will enable 1kHz PWM input. See also <u>CO_2 Input</u>

Table 2

To update any of the parameters above you need to connect the Pickit3 to the WMS.

1. Write the new value in HEX in the correct address. First position to the left, is address 0x00.
2. Make sure the **EEPROM Data** Enabled checkbox is ticked
3. Make sure the **Program Memory** Enabled checkbox is NOT ticked
4. Press the **Write** button

The Progress/Status window will change to a green background if the update was successful.

Programming the WMS

It is possible to update the firmware if needed.

Connect the Pickit3 to the WMS. (*Image below show PICkit 2, but the PICkit 3 software is almost identical*)
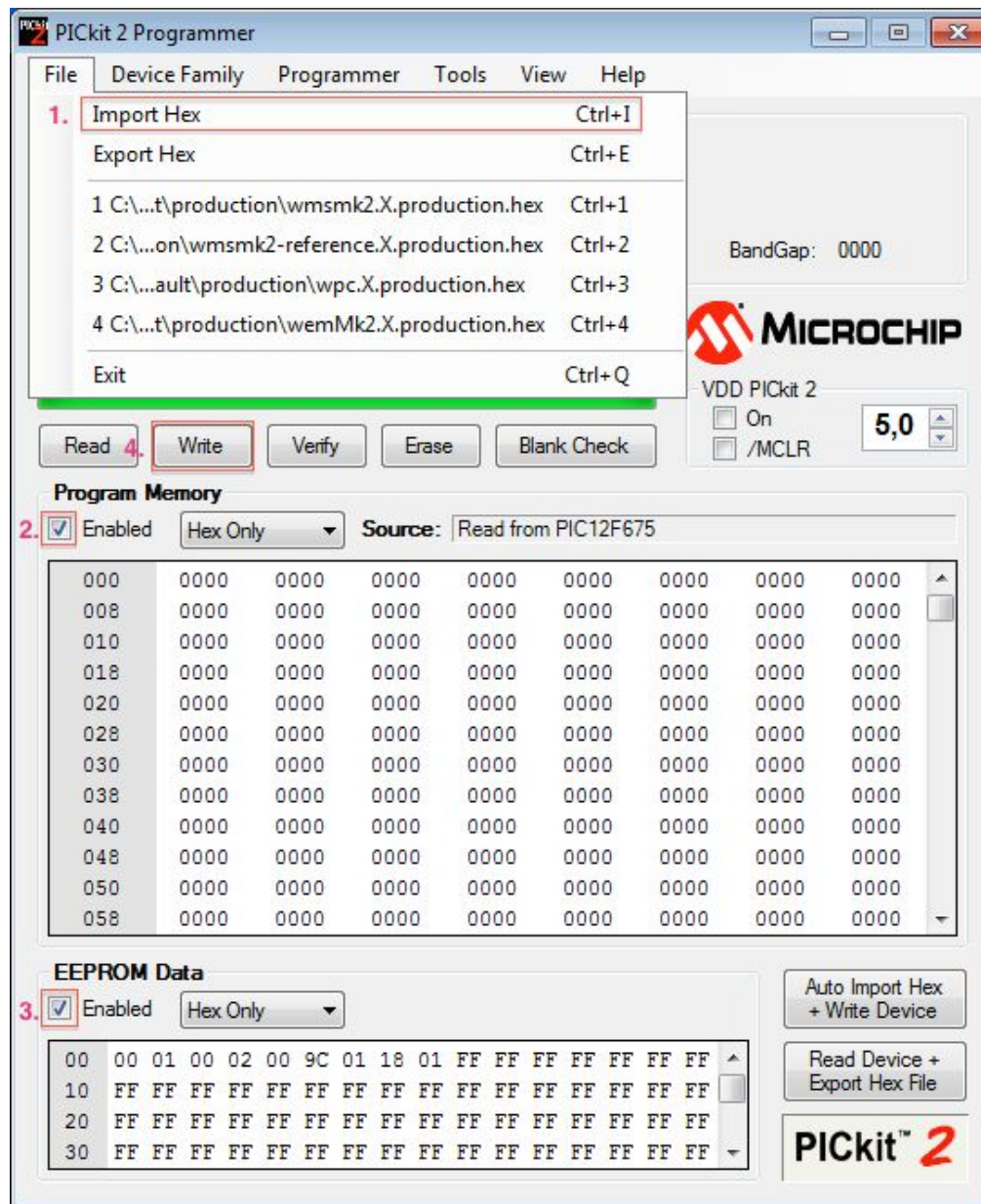
1. Locate the HEX-file and import it to the Pickit3 software
2. Make sure the **Program Memory** Enabled checkbox is ticked
3. Make sure the **EEPROM Data** Enabled checkbox is ticked
4. Press the **Write** button

The Progress/Status window will change to a green background if the update was successful.

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