Wireless Multi Sensor Mk3

Manual

Overview Manual changelog Input details Powering the WMS **Event Input** Supported sensors <u>Output</u> <u>Advanced</u> CO2 Input Supported sensors <u>Output</u> <u>Advanced</u> Temperature/Humidity sensor input Supported sensors <u>Output</u> Advanced 1-Wire device input Supported 1-Wire devices <u>Output</u> DS1820, DS18B20, DS18S20, DS1822 DS2450 MAX31855 Specification **Dimensions**

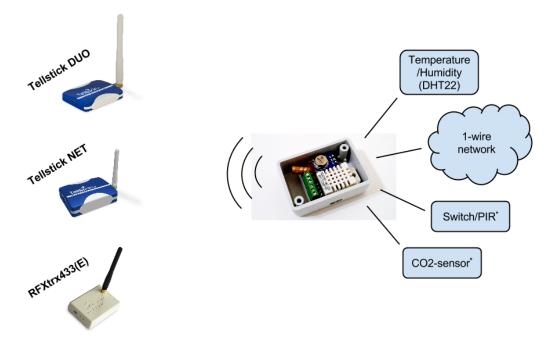
Add-on

<u>Appendix</u>

Changing WMS firmware configuration parameters Programming the WMS

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 / CO₂ 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 CO₂ 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

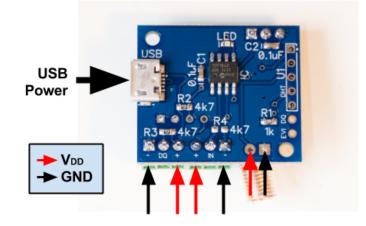
Rev.1

• First released WMS Mk3 revision

Input details

Powering the WMS

The WMS can be powered in several ways.

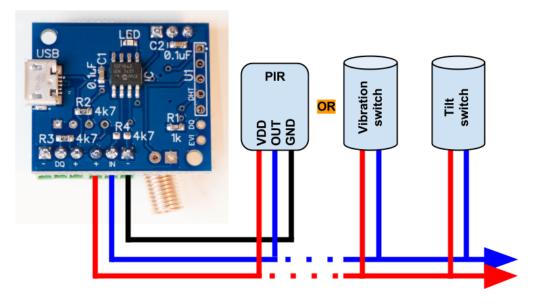


The most convenient way is through the micro USB port. An alternative way is to solder cables to the soldering points to the right of the screw terminals. A third option is to use any of the screw terminal points. This could be a very convenient way to both feed power to the WMS at the same time as one 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 <u>Specification</u> for details regarding voltage levels (VDD).

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.

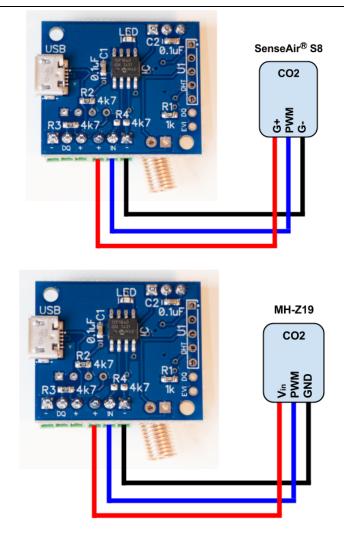
Advanced

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

CO₂ Input

The CO₂ 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 <u>S8</u> from <u>SenseAir</u>®
- CO2 sensor <u>MH-Z19</u> from <u>Winsensor</u>

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 <u>DHT22</u> sensor. The sensor comes in different packages and have different names. AM2302 is a wired version of the DHT22. <u>RHT03</u> 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

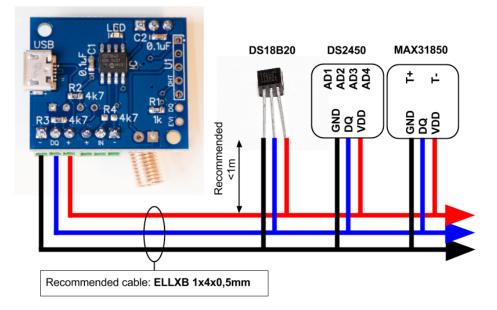
1-Wire is a very commonly used bus that have the strength of only needing one signal wire to do all the communication between the 1-Wire devices. Another strength is that the cable connecting all the sensors can be very long.

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, <u>Guidelines for reliable long line 1-Wire networks</u>

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

NOTE! 1-Wire parasite mode is not supported.

foogadgets



Supported 1-Wire devices

- DS18B20
- DS1820
- DS18S20
- DS1822
- DS2450 (4 channel AD-converter)
- □ <u>MAX31850</u> (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.

<u>DS2450</u>

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.

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 _{DS245}	50	
Example: T _{DS2450} = 96.5°C	⇒	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

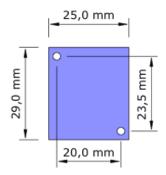
Voltage:	Min 3V Max 5.5V (Sensor dependent. See Table 1)
Input connectors:	Micro USB, Screw terminals, soldering pads for (DHT22)
Frequency:	433.92 MHz
Protocols:	Improved Fineoffset including CRC-protected data and Nexa
	AC/arctech
Supported transceivers:	Tellstick DUO, Tellstick NET and RFXtrx433(E)
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 <u>Hammond</u> (Part.no.1551GBK) is a perfect fit for the WMS.

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**
- Dickit3 with Pickit3 Programmer Software from Microchip
- □ Basic knowledge in handling electronics
- **D** 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

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>CO₂ Input</u>

The following parameters exist on the WMS;

Table 2

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

Device: PIC12F675 Configuration: 010C User IDs: FF FF FF FF Code Protect Checksum: 010B OSCCAL: 3450 BandGap: 0000 Reading device: Program Memory EE UserIDs Config Done. VDD PICkit 2 On 5,0 * Program Memory Ease Blank Check //MCLR 5,0 * Program Memory Enabled Hex Only Source: Read from PIC12F675 000 0000 0000 0000 0000 0000 0000 0000 010 0000	User IDs:	FF FF FF			Confine					
User IDs: FF FF FF FF FF Checksum: 010B OSCCAL: 3450 BandGap: 0000 Reading device: Program Memory EE UserIDs Config Done. VDD PICkit 2 0n 5,0		12.000.000	FF				IOC			
Reading device: Program Memory EE UserIDs Config Done. VDD PICkit 2 On 5,0 Program Memory Enabled Hex Only Source: Read from PIC12F675 O00 0000 0000 0000 0000 0000 0000 0000	Checksum:	010B			Code F	Protect				
Program Memory EE UserIDs Config Done. VIDC PICkit 2 Read 4. Write Verify Erase Blank Check VDD PICkit 2 Program Memory Enabled Hex Only Source: Read from PIC12F675 000 0000 0000 0000 0000 0000 0000 010 0000 0000 0000 0000 0000 0000 0000 010 0000 0000 0000 0000 0000 0000 0000 010 0000 0000 0000 0000 0000 0000 0000 0000 011 0000<					OSCC/	AL: 3450		BandGap:	0000	
Read 4. Write Verify Erase Blank Check VD PICkit 2 On /MCLR 5,0 Program Memory Source: Read from PIC12F675 000 0000 0000 0000 0000 0000 0000 010 0000 0000 0000 0000 0000 0000 0000 010 0000 0000 0000 0000 0000 0000 0000 010 0000 0000 0000 0000 0000 0000 0000 011 0000 0000 0000 0000 0000 0000 0000 012 0000 0000 0000 0000 0000 0000 0000 018 0000 0000 0000 0000 0000 0000 0000 020 0000 0000 0000 0000 0000 0000 0000 028 0000 0000 0000 0000 0000 0000 0000 0000 038 0000 0000			. EE U	serlDs	Config	. Done.	5	Mic	ROCH	116
Read 4 Write Venfy Erase Blank Check MCLR 3,0 P Program Memory Enabled Hex Only Source: Read from PIC12F675 000 0000	· · · · g· -····				g-		VD	D PICkit 2		
Program Memory Source: Read from PIC12F675 000 0000 <	Read	Write	Verify	Error		ank Check		40.000	5,0	*
Enabled Hex Only Source: Read from PIC12F675 000 0000	T		veniy			ant check		J/MCLR		
000 0000				C	Deadfree	- DIC12EC	75			
008 0000		Hex Un	y •	Source.	Nead from	n FIC 12F0	5			
010 0000	000	0000	0000	0000	0000	0000	0000	0000	0000	
018 0000	800	0000	0000	0000	0000	0000	0000	0000	0000	
020 0000	010	0000	0000	0000	0000	0000	0000	0000	0000	
028 0000	018	0000	0000	0000	0000	0000	0000	0000	0000	
030 0000	1000									
038 0000	028	0000	0000	0000	0000	0000	0000	0000	0000	
040 0000	020	0000	0000	0000	0000	0000	0000	0000	0000	
048 0000			10.00							
050 00000 0000 0000	038	0000	0000							
058 0000	038 040	0000	0000	0000	0000	0000	0000	0000	0000	
EEPROM Data Image: Colspan="2">Auto Import Hex Only Image: Colspan="2">Mite and Read EEPROM data only. Image: Colspan="2">Auto Import Hex Only Image: Colspan="2">Od. 00 01 00 02 00 9C 01 18 01 FF	038 040 048	0000	0000	0000 0000	0000	0000	0000	0000	0000	
Image: Construction of the construc	038 040 048 050	0000 0000 0000 0000	0000 0000 0000 0000	0000 0000 0000	0000 0000 0000	0000 0000 0000	0000 0000 0000	0000 0000 0000	0000 0000 0000	
Image: Construction of the construc	038 040 048 050	0000 0000 0000 0000	0000 0000 0000 0000	0000 0000 0000	0000 0000 0000	0000 0000 0000	0000 0000 0000	0000 0000 0000	0000 0000 0000	Ŧ
10 FF	038 040 048 050 058	0000 0000 0000 0000 0000	0000 0000 0000 0000	0000 0000 0000	0000 0000 0000	0000 0000 0000	0000 0000 0000	0000 0000 0000 0000	0000	-
20 FF	038 040 048 050 058 EEPROM I	0000 0000 0000 0000 0000 0000 Data	0000 0000 0000 0000 0000	0000 0000 0000 0000	0000 0000 0000 0000	0000 0000 0000 0000	0000 0000 0000 0000	0000 0000 0000 0000	0000 0000 0000 0000	
	038 040 048 050 058 EEPROM I	0000 0000 0000 0000 0000 Data Hex On	0000 0000 0000 0000 0000	0000 0000 0000 0000 Write ar	0000 0000 0000 0000	0000 0000 0000 0000	0000 0000 0000 0000	0000 0000 0000 0000 +1	0000 0000 0000 0000 to Import H Write Device	ce +
	038 040 048 050 058 EEPROM I	0000 0000 0000 0000 0000 Data Hex On	0000 0000 0000 0000 0000 0000	0000 0000 0000 0000 Write ar	0000 0000 0000 0000 nd Read Ef	0000 0000 0000 0000 EPROM data	0000 0000 0000 0000 a only.	0000 0000 0000 0000 +1	0000 0000 0000 0000 to Import H Write Device	ce +

- 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*)

File	Dev	ice	Fam	nily	Pr	ogra	amr	ner	Т	ools	1	View	/	Help)										
1.	Impo	rt H	ex										Ctr	rl+I											
	Export Hex			Ctrl+E																					
	1 C:\.	t\p	orod	uctio	on\v	vms	mk2	.X.p	orod	uctio	on.h	ex	Ctr	+1											
		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	n\wmsmk2-reference.X.production.hex Ctrl+2														D-	ndGap:	0000						
	3 C:\.												Ctr	1.2			Da	nuciap.	0000						
	4 C:\.	t\p	orod	uctio	on\v	vem	MK	X.p	orod	uctio	on.h	ex	Ctr	1+4			7	MIC	ROCI	-116					
	Exit												Ctrl	+Q		v	DD	PICkit 2							
		_		_	_		_	_		_	~					[		Dn	5,0						
Re	ad 4.		Write	,		Verify	(		Erase	•	E	Blank	c Che	eck		[		/MCLR	0,0	*					
Рго	gram	Mer	nory	,																					
<b>V</b>	Enable	d	Hex	c Only	y	-		iour	ce:	Rei	ad fr	om F	PIC1	2F67	5										
1	000		000	0	00	00		000	0	00	000		000	0	00	000		0000	0000						
	800		000	0	00	00		000	0	00	000		000	0	00	000		0000	0000						
1	010		000	0	00	00		0000		0000 0000			0000 00		0000 000		0000								
	018		000	3	100	00		0000		0000			0000		00	000		0000	0000						
	020		000	5	13.7	00		0000				55131		20101 2010	0000		S 52	0000			000		0000	0000	
	028		000	1	1000	00		0000		0000			0000			000		0000	0000						
	030		000	1		00		000	2.0		000		000	-		000		0000	0000						
	038		000	-		00		000	-		000		000	-		000		0000	0000						
	040		000	-		00		000	-		000		000	-	-	000		0000	0000						
	048		000	-		00		000			000		000	-	1	000		0000	0000						
3	050		000	-	1000	000		000			000		000		1	000		0000	0000						
	058		000	0	00	000		000	U	00	000		000	U	U	000		0000	0000	-					
EE	PROM	l Da	ta				_											A	uto Import I	Hex					
-	Enable	d	Hex	c Only	Y	•												+	Write Devi	ice					
-		01	00	02	00	9C	01	18	01	FF	FF	FF	FF	FF	FF	FF	*		Read Devic	-					
	2.7	01			-		1010	FF	FF	FF	FF	FF	FF	FF	FF	FF		E	export Hex I	nie					
	FF	FF	FF FF	FF FF	FF	FF	FF	FF FF		FF		FF		FF	FF		-	_							

- 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.

Wireless Multi Sensor Mk3