SUBJECT : User guide of the LoRaWAN indoor TH sensor

PRODUCT : 50-70-053-000 LoRaWAN indoor TH

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History

DATE	REVISION	OBJET	AUTHOR
07/02/18	0	Creation	NJC
12/02/18	1	« Confighuration of the application layer » section added	NJC

Contents

1. ABOUT THIS DOCUMENT

This user guide contains some useful informations, characteristics about the device, and examples of use. The aim is to provide the new user with essential knowledge in order to make the device work quickly. This user guide is not exhaustive. Please refer to the reference documentation for more information. This user guide is provided for informational purposes only. It is not a contractual nor a technical reference. Characteristics and features of the device can change at any time without notice.

2. REFERENCE DOCUMENTS

Reference documentation for this device :
50-70-053_SPG_Capteur_TH_LoRaWAN_ICT_V0_X_Y.doc

You can find more informations on the technical aspects of the device on:
http://support.nke-watteco.com/

3. DEVICE CHARACTERISTICS

The LoRaWAN indoor TH sensor is designed to :

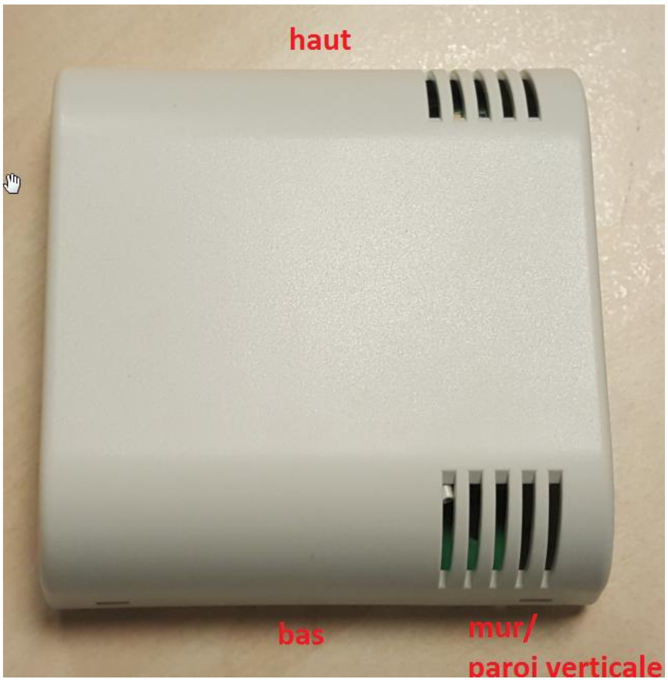
- Measure the ambiant temperature
- Measure the hygrometry

It is designed for an indoor usage (e.g.: private housing, offices, …).

4. INSTALLATION

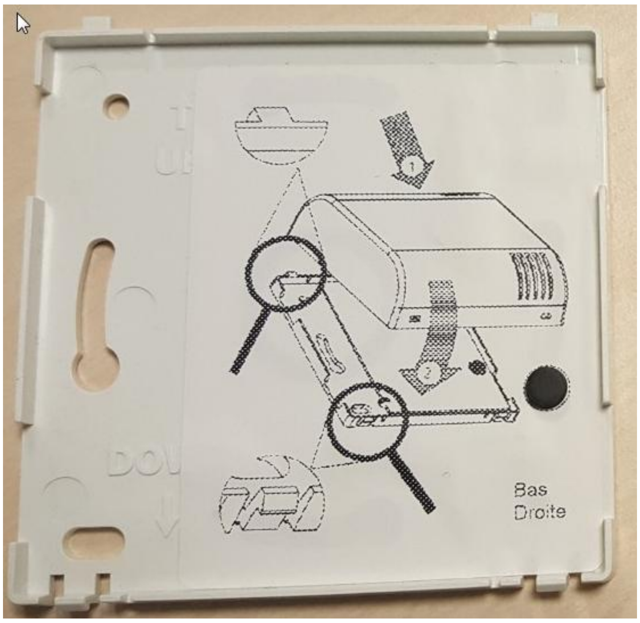
Metallic objects/surfaces are likely to reduce or disrupt radio frequency signals. The sensor must be fixed to at least one meter form any metallic object or surface.

There is how the LoRaWAN indoor TH sensor looks like:



Picture 1 Sensor fixed on a vertical wall

First, fix the lid of the sensor to the wall using the screw kit provided. Then fix the case holding the electronic card to the lid, following the instructions shown on the tag into the lid:



Picture 2 Lid of the case to fix with the screw kit, showing mounting instructions

Nota : Check the radio coverage before installing the sensor. The radio coverage can be disrupt or reduced by various obsacles between the LoRa gatteway and the sensor (buildings, embankments, hills, etc.).

5. UTILIZATION

5.1. UI components

This sensor includes the following UI components:

- Reed switch (ILS).
- Buzzer.
- Green LED, glowing through the top-right opening.

When a magnet is placed in front of the « ILS » mark, the sensor produce a slightly intermittent feedback sound that signifies the reed switch is beeing activated. The location of the reed switch noticed by an « ILS » tag on the right of the sensor case.

5.2. Set the sensor in working mode

If you are using a private network, you should start up your gateway as a first step. If you don't know it, should familiarize yourself with it before starting the sensor. We advise to provision the network with the sensor's identification information before you start up the sensors. This aims to reduce the time taken by the pairing procedure.

5.2.1. Set the sensor in the working mode

Place a magnet in front of the reed switch for 1 second.

A tune is played during around 1 second: 2 short tones, the first is deep and the second high-pitched.

5.2.2.Pairing to a network

Then, the sensor launches the pairing process: the green LED blinks 250 milliseconds each 5 seconds until the end of the pairing process. The pairing process won't stop until the sensor is successfully paired to a network. When the sensor successfully pairs to a network, the green LED is switched on for 3 seconds to confirm the sensor has been successfully paired to a network. Then, the sensor is in the working mode. The green LED and the buzzer stay switched off.

Remark 1: we use a green LED instead of the buzzer to signal a network pairing is in process. This enables to avoid noise pollution when this sensor is set up in an occupied room.

See the « Test mode: check whether a sensor is switched on or off » section to determine if the sensor is in storage mode or in working mode.

5.3. Set the sensor in storage mode

Place a magnet in front of the reed switch for 5 second.

A tune is played during around 1 second: 2 short tones, the first is high-pitched and the second is deep.

See the « Test mode: check whether a sensor is switched on or off » section to determine if the sensor is in storage mode or in working mode.

5.4. Factory reset

The reset factory feature resets the network and the application parameters at their initial value as defined by the manufacuter. E.g. : data about the paired network are deleted and attribute values like counters are reset to 0.

Make the following sequence, by activating the reed switch with a magnet:
2 short activations + one long activation of 7 seconds (at least).

Remark: make this 3 activations (2 short + 1 long) without a pause during all the sequence. If the sequence is fragmented, it will not work.

The factory reset is confirmed by a tune: 3 tones, from deep to high-pitched, played 3 times. Then the sensor reboots.

5.5. Pairing reset

The pairing reset feature resets the pairing state and launch a new pairing process. The application parameters are kept.

Make the following sequence, by activating the reed switch with a magnet:
3 short activations.

The sensor launches the network pairing process, like it does when it is set in working mode.

5.6. Test mode: check whether a sensor is in worling or storage mode

You can check whether the sensor is in working or storage mode by activating the reed switch with a magnet, following this sequence:
One short activation.

If the sensor is in storage mode, nothing happens: the sensor stays in storage mode.

If the sensor is in working mode, it switches in test mode:

- The sensor sends one void frame (heartbeat) per minute.
- The reports are temporarily deactived during the test mode. Next report is postponed of the duration the test mode has been activated.

- The buzzer sounds 2 quite loud high-pitched tones (with the second that persists a little bit more than the first) every 3 seconds.
- The first void frame (heartbeat) is sent 10 seconds after activating the test mode.
- The test mode automatically turns off after 10 minutes if it is not deactived before by the user.

The characteristic bips emited during this test mode happens only if the sensor is in worling mode. That enables to check directly the current mode (working or storage) of the sensor.

To deactivate the test mode, repeat the same sequence than to activate it.

5.7. Configuration of the application layer

To know how work the sensor « out of the box » see the « DATA PROCESSING > How reports work » section.

The application layer, and in particular the report configuration, can be modified through ZCL-like commands sent to the sensor. See the support website at:
http://support.nke-watteco.com/

This sensor embeds the following clusters:
- Basic
- Configuration
- LoRaWAN
- Relative humidity measurements
- Temperature measurements
- Binary input (for the open/close case alarm feature)

Here is an example of reconfiguring the TH sensor:

ZCL-like command	Description
115000500203	Configuration cluster: remove all the existing configuration
11060402000000029803C803C0000	Temperature measurement cluster: Report the Measured value attribute every 1 hour.
11060405000000021803C803C0000	Relative humidity measurement cluster: Report the Measured value attribute every 1 hour.
1106000F000055108001000001	Binary input: report the Present value attribute when its value change (boolean) and at a maximum of once per minute.

Every change on the default configuration must respect the legal duty cycle (for example the most restrictive in EU is 0.1%, so in SF12 it is around 1 frame each hour).

A factory reset removes any personalized configuration and set the default Batch configuration again.

Please note that this is a Class A LoRaWAN sensor. The command frames will be sent to the sensor only successively to the reception of a frame from the sensor. To speed up this process you can use the « test mode ».

6. DATA PROCESSING

6.1. How reports work

Depending the kind of data to report, the nke Watteco LoRaWAN sensors use an nke Watteco proprietary compression and aggregation protocol named « Batch » or a ZCL-like protocol (based on the ZCL standard, but with some differencies). On this sensor, the reports are described as follow:

Reported value (unit)	Report kind (details)
Ambiant temperature (1/100 of Celsius degrees)	Batch (a record/30min, a transmission/h)
Hygrometry (1/100 of %)	Batch (a record/30min, a transmission/h)
Battery voltage (mV)	Batch (a record/7j, a transmission/7j)
State of the opening/closing case detector (boolean)	ZCL-Like (a transmission on event, and max once per minute)

Remark 1: to summarise the table shown above, the sensor transmits a Batch frame every hours. The first Batch frame is sent one hour after the pairing with the network is successfully done. In the case the sensor case is opened / close by pulling out / putting back the lid, a ZCL-like frame (alarm) is sent. In addition to these Batch frames, the sensor can send void frames. These frames are beacons / heartbeats usefull to the network.

Remark 2: a record corresponds to a sample of the measured physical value. It can also be called a sample.

6.2. Uncompress Batch reports with br uncompress

6.2.1. Download the needed piece of software

The br_uncompress piece of software enables to uncompress the Batchs reports. It can be downloaded here:
http://support.nke-watteco.com/downloads/

The zip contains:

- br_uncompress-WIN.exe : a pre-compiled executable for Windows shell
- wtc-br_uncompress-aaaammdd.zip : the source code of the br_uncompress piece of software

If you want to use the piece of software on a system that is not compatible with the pre-compiled executable, you can compile your own executable form the source code. The needed compilation ligne can be found in the header of the br_uncompress.c source file.

6.2.2. Use the br_uncompress piece of software

The br_uncompress piece of software enables to uncompress Batch frames sent by LoRaWAN nke Watteco sensors.
Remark: this piece of software can't uncompress encrypted frames. The frames must be decrypted by the network before being uncmpress by this piece of software.
Some parameters are needed to describe the content of the Batch frames that will be uncompressed. In the case of the indoor TH sensor, these parameters are :

- For the TH 50-70-053-000 : « -a 2 0,1,7 1,1,6 2,1,6 »
- For the TH 50-70-053-001 : « -a 2 0,10,7 1,100,6 2,1,6 »

6.2.3. Example 1: hourly preiodic Batch frame of a 50-70-053-000

Here, the frame contains measured values of the TH sensor.

```
$ echo "220000C081938297B457C0140108D009645E1968B707" | ./br_uncompress.exe -a 2 0,1,7 1,1,6 2,1,6
Scan args:
 S00: 0,1.000000,7
Scan args:
 S01: 1,1.000000,6
Scan args:
 S02: 2,1.000000,6
nb_of_type_measure: 2
batch requested: 0
no sample: 0
cts: 1
cnt: 0
 tag: 0, index 0  timestamp: 1870 Measure: 2654 Coding type: 2, Coding table 0
 tag: 1, index 1  bi: 0 sz: 7 timestamp: 1870 Measure: 2712 Coding type: 2, Coding table 0
common time stamp
 number of sample: 2
 TimeStamp Coding(0-A/1-B/2-C): 0
bi: 0 sz: 2 timestamp: 1870
bi: 10 sz: 11 raw: 777  timestamp: 3670
 tag: 0 index: 0
```

```
0. available: 1 coding table: 0 bi: 0 sz: 2
1. available: 1 coding table: 0 bi: 4 sz: 4 RawValue: 7  Value: 2632  TimeStamp: 3670
 tag: 1 index: 1
0. available: 1 coding table: 0 bi: 0 sz: 2
1. available: 1 coding table: 0 bi: 8 sz: 8 RawValue: 118  Value: 2339  TimeStamp: 3670
TimeStamp of the sending
bi: 0 sz: 7 timestamp: 3670

UNCOMPRESS SERIE
cnt: 0
3670
1870 0 2654
3670 0 2632

1870 1 2712
3670 1 2339
```

In that example, the frame to uncompress is: 220000C081938297B457C0140108D009645E1968B707
The command ligne used in the shell to uncompress the frame is:

```
$ echo "220000C081938297B457C0140108D009645E1968B707" | ./br_uncompress-WIN.exe -a 2 0,1,7 1,1,6 2,1,6
```

The next lignes are the result of the frame decompression.
In the last lignes, we can observe:

```
UNCOMPRESS SERIE
cnt: 0      Sequence number of this batch (cylic, form 0 to 7)
3670        Timestamp of the frame
1870 0 2654 Timestamp, tag and value for the 1st record of the ambiant temperature. T = 26,54C
3670 0 2632 Timestamp, tag and value for the 2nd record of the ambiant temperature. T = 26,32C

1870 1 2712 Timestamp, tag and value for the 1st record of the hygrometry. rH = 27,12%
3670 1 2339 Timestamp, tag and value for the 2nd record of the hygrometry. rH = 23,39%
```

The timestamp corresponds to the relative date in seconds (0 correspond with the start up of the sensor) when the frame has been sent. If we make the hypothesis the frame has been immediately received by the network (no disrupt), then the timestamp can be linked with the absolute date of the receipt of the frame. This enables to determine an absolute date for each record of the Batch.

The timestamp of each record corresponds to the relative date in seconds when the record has been done, in the same way than for the timestamp of the frame.

For example, if we receive this frame on 07/18/2017-17h31, we can consider the relative clock of the sensor was 3670 (=timestamp of the frame).

If we take a closer look at the records of the ambian temperature:
The first record has been done at 1870. This timestamp is consistently lower than the timestamp of the frame as it has been done before the frame was sent. By computing the difference, we can determine the delay to substract to the absolute date. This way, we obtain the absolute date of the record:
3670 – 1870 = 1800 seconds = 30 minutes.
We deduce that the absolute date of the record is 07/18/2017-17h01.

The same calculation can be done with timestamps form different frames. For example, it is possible to compute the delay between the first record of this Batch frame and the last record of the previous Batch frame.

The tag identifies the kind of the value. E.g., the tag 1 identifies an hygrometry value.

6.2.4. Example 2: hourly preiodic Batch frame of a 50-70-053-000 including the weekly battery voltage

In that example, the Batch frame contains the measured physical values of the TH sensor we saw in « Example 1 », and alsi the battery voltage that is transmitted weekly. We use the same parameters to uncompress the frame. Indeed these parameters already include that is neede to uncompress the battery voltage. The br_uncompress program just ignores the parameters for which there is no data to uncompress, like it is the case in « Example 1 ».

```
$ echo "320200004198C08DB457680EFF0E212100F9E496282B" | ./br_uncompress.exe -a 2 0,1,7 1,1,6 2,1,6
Scan args:
 S00: 0,1.000000,7
Scan args:
 S01: 1,1.000000,6
Scan args:
 S02: 2,1.000000,6
nb_of_type_measure: 3
batch requested: 0
no sample: 0
cts: 1
cnt: 2
 tag: 0, index 0  timestamp: 1121 Measure: 567 Coding type: 2, Coding table 0
 tag: 1, index 1  bi: 0 sz: 7 timestamp: 1121 Measure: 2765 Coding type: 1, Coding table 0
 tag: 2, index 2  bi: 4 sz: 3 raw: 15  timestamp: 1151 Measure: 3617 Coding type: 1, Coding table 0
common time stamp
 number of sample: 2
 TimeStamp Coding(0-A/1-B/2-C): 0
bi: 0 sz: 2 timestamp: 1121
bi: 4 sz: 4 raw: 15  timestamp: 1151
 tag: 0 index: 0
0. available: 1 coding table: 0 bi: 0 sz: 2
1. available: 1 coding table: 0 bi: 2 sz: 2 RawValue: 2  Value: 562  TimeStamp: 1151
 tag: 1 index: 1
0. available: 1 coding table: 0 bi: 0 sz: 2
1. available: 1 coding table: 0 bi: 0 sz: 2 Value: 2765  TimeStamp: 1151
 tag: 2 index: 2
0. available: 0
1. available: 1 coding table: 0 bi: 0 sz: 2
TimeStamp of the sending
bi: 1 sz: 5 raw: 1  timestamp: 1153

UNCOMPRESS SERIE
cnt: 2
1153
1121 0 567
1151 0 562

1121 1 2765
1151 1 2765

1151 2 3617
```

The uncompression result is very similar to that we saw in Example 1 ». There is just the battery voltage in addition, on the last line:

1151 2 3617 Timestamp, tag and value for the unique record of the battery voltage. Up = 3,617V