TEMPERATURE HUMIDITY LUX SENSOR

USER GUIDE

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Embedded software is based on Nke Watteco proprietary drivers and applicative code and operates on the Contiki kernel from the SICS (Swedish Institute of Computer Science).

http://www.nke-watteco.com/

DOCUMENT HISTORY

Date	Revision	Modification Description
October 2015	1.0	First revision
November 2015	1.1	Adding the US mode part in consumtion and FCC label
December 2015	1.2	Adding the complete FCC ID of the device

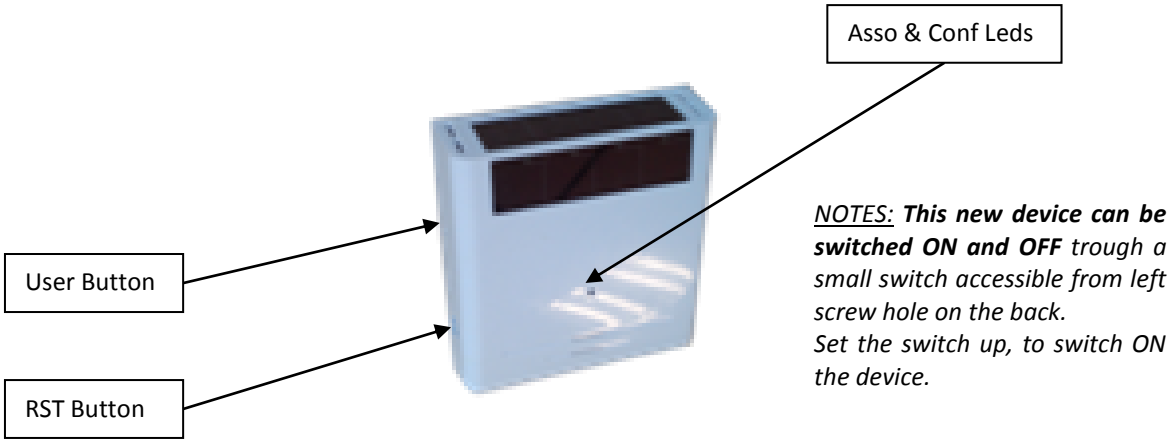
CONTENTS

1 INTRODUCTION

This document describes the usage of the THr sensor. It is necessary to read the Application Layer Description guide and the LoRaWAN Sensors Behavior on Public LoRaWAN Networks guide in prerequisite for all generic information or to have more details.

1.1 GENERAL DESCRIPTION

The THr sensor uses a disposable ½ AA 3.6V battery and a rechargeable battery as power supply.



2 HUMAN MACHINE INTERFACE

There is two leds on the THr device:

- Green: blinking until the association to a network is done.
- Red: blinking in the configuration mode.

A button user is available to enter in configuration mode by pushing once on it. The pushing during 10 seconds on the User button makes a reset factory.

3 APPLICATIVE LAYER

The THr device is a sleepy Class A device. It integrates these following clusters:

Cluster	*Cluster name*	*Managed attributes*
0x0000	Basic	All
0x0050	Configuration	All
0x0402	Temperature Measurement	All
0x0405	Relative Humidity Measurements	All
0x000c	Analog Input	All

The Illuminance is indicated in the Analog Input Cluster in % of a maximal luminosity reached. The value is given by step of 10%.

A physical measurement is done all the 30 seconds for Temperature and Relative Humidity, 16 seconds for Illuminance, 10 minutes for level of battery.

4 CONSUMPTION

4.1 EUROPE MODE

Estimateur durée de vie capteur Pile

Taille trame PHY Tx	75	Octets
Taille trame PHY Rx (ACK)	15	Octets
Périodicité émission	Period	s
Duty cycle souhaité	0.10%	
Pile :		
Capacité théorique	1100	mAh
Capacité utile	935	mAh
Consommation radio:		
En emission	35	mA
En réception	10	mA
Mesure (Rx)		
Période mesure	30	s
Durée mesure	0	s
Conso mesure active	0	mA
Conso base (endormi) :	0.006	mA

SF	Débit (bps)
7	5470
8	3125
9	1760
10	980
11	440
12	250

Consommation par report acquité

SF	7	8	9	10	11	12
dTx (s)	0.11	0.19	0.34	0.61	1.36	2.40
dRx (s)	0.02	0.04	0.07	0.12	0.27	0.48
Conso (uAh)	1.13	1.97	3.50	6.29	14.02	24.67

Respect Duty cycle

Period(s)/SF	7	8	9	10	11	12
60	Non	Non	Non	Non	Non	Non
120	Oui	Non	Non	Non	Non	Non
600	Oui	Oui	Oui	Non	Non	Non
3600	Oui	Oui	Oui	Oui	Oui	Oui
7200	Oui	Oui	Oui	Oui	Oui	Oui
14400	Oui	Oui	Oui	Oui	Oui	Oui
86400	Oui	Oui	Oui	Oui	Oui	Oui

Longévité estimée sans lumière (En années)

Period(s)/SF	7	8	9	10	11	12
60	1.45	0.86	0.49	0.28	0.13	0.07
120	2.68	1.64	0.96	0.55	0.25	0.14
600	8.36	5.98	3.95	2.44	1.18	0.69
3600	14.98	13.39	11.23	8.68	5.33	3.48
7200	16.26	15.28	13.77	11.67	8.21	5.82
14400	16.99	16.44	15.52	14.09	11.23	8.77
86400	17.65	17.55	17.37	17.04	16.21	15.19

Longévité estimée avec lumière [200 lux moyen](En années)

Period(s)/SF	7	8	9	10	11	12
60	1.99	1.02	0.54	0.29	0.13	0.07
120	5.38	2.36	1.17	0.61	0.26	0.15
600	INF	INF	15.20	4.49	1.52	0.80
3600	INF	INF	INF	INF	#####	10.01
7200	INF	INF	INF	INF	INF	INF
14400	INF	INF	INF	INF	INF	INF
86400	INF	INF	INF	INF	INF	INF

4.2 US MODE

Battery sensor: life time Estimator

PHY Frame Size Tx	45	Octets
PHY Frame Size Rx (ACK)	15	Octets
Transmission period	Period	s
Battery :		
Theoritical capacity	**1200**	mAh
Actual capacity	1020	mAh
Radio Consumption:		
Transmission	40	mA
Reception	10	mA
Measuring (Rx)		
Measuring Period	**60**	s
Measuring duration	0	s
Active measuring consumption	0	mA
Basic consumption (sleeping) :	0,004	mA

Consumption per report acknowledged — ***500 kHz***

SF	7	8	9	10	8
dTx (s)	0,07	0,12	0,20	0,37	0,03
dRx (s)	0,01	0,01	0,02	0,03	0,01
Conso (uAh)	0,75	1,31	2,32	4,17	0,35

Estimated Lifetime (Years)

Period(s)/SF	7	8	9	10	8
60	2,39	1,41	0,81	0,46	4,70
120	4,41	2,70	1,58	0,90	8,09
600	13,73	9,83	6,50	4,01	19,15
3600	24,53	21,94	18,42	14,26	26,79
7200	26,63	25,02	22,56	19,14	27,90
14400	27,81	26,91	25,42	23,09	28,49
86400	28,88	28,72	28,42	27,90	29,00

Estimated Life time with light [200 lux in average] (Years)

Period(s)/SF	7	8	9	10	8
60	4,04	1,87	0,94	0,50	24,26
120	18,21	5,02	2,17	1,07	INF
600	INF	INF	INF	12,93	INF
3600	INF	INF	INF	INF	INF
7200	INF	INF	INF	INF	INF
14400	INF	INF	INF	INF	INF
86400	INF	INF	INF	INF	INF

SF (at 125 kHz)	BaudRate (bps)	Equivalent LoRaWAN DR
7	5470	**DR 3**
8	3125	**DR 2**
9	1760	**DR 1**
10	980	**DR 0**
11	440	**NA**
12	250	**NA**

SF (at 500 kHz)	BaudRate (bps)	Equivalent LoRaWAN DR
7	21900	**DR 13**
8	12500	**DR 12**
9	7000	**DR 11**
10	3900	**DR 10**
11	1760	**DR 9**
12	980	**DR 8**

5 EXAMPLES

In the following example, 6lowpan header has been removed for an eayest understanding. See 6LOWPAN LAYER OVER LORAWAN™ in the LoRaWAN Sensors Behavior on Public LoRaWAN Networks guide, for more details.

5.1 CONFIGURE A BATCH REPORT ON TEMPERATURE, HUMIDITY, AND VOLTAGE BATTERY

Specification: Timestamp and *record the temperature with a resolution of 1°C, a value has to be saved at least all the 6 hours or on a variation of 1°C.* Timestamp and r*ecord the relative Humidity with a resolution of 5%, a value has to be saved at least all the 6 hours or on variation of 5%.* Timestamp and r*ecord all voltage power sources with a resolution of 0.1V, a value has to be saved at least all the 24 hours. All datas have to be concatenated and sent at maximum all the 24 hours.*

Solution: The solution to concatenate several different physical values in the same frame is to use the batch reporting. For the batch it is necessary to know the number of physical measure will be sent to choose a label for each of them and the size of these labels.

There are 2 kinds of power sources in the sensor (Rechargeable battery and Disposable battery). So, with the temperature, the humidity and these 2 power sources, it is necessary to manage 4 different labels.

Number of Label	Tag Label	Tag Size
1 or 2	0 / 1	1
3 or 4	00 / 01 / 11 / 10	2
5 or 6 or 7 or 8	000 / 001 / 010 / 011 / 100 / 101 / 110 / 111	3
…		

The Tag Size to use for 4 labels is 2. Label 00 can be used for Temperature, Label 01 for Relative Humidity, Label 10 for level of Rechargeable Battery, and Label 11 for level of Disposable Battery.

To configure the batch, it is necessary to send a command of “Configure reporting” at each cluster.

For temperature the delta has to be set to 100=0x0064 (1°C), minimum to 30=0x001e (30 seconds), the maximum to 6*60=360=0x8168 (6 hours), the resolution to 100=0x0064 (1°C) and the tag to 0b00000010=0x02 (size 2 and label 0). The cluster to report is 0x0402 and the attribut 0x0000 (MeasuredValue).

Answer: *110604021500000000 1e81680064006402*

Response: *1107040200010000*

For relative humidity the delta has to be set to 500=0x01f4 (5%), minimum to 30=0x001e (30 seconds) ,the maximum to 6*60=360=0x8168 (6 hours), the resolution to 500=0x01f4 (5%) and the tag to 0b00001010=0x0a (size 2 and label 1). The cluster to report is 0x0405 and the attribut 0x0000 (MeasuredValue).

Answer: *1106040515000000001e816801f401f40a*

Response: *1107040500010000*

For Rechargeable Battery power sources the delta has to be set to 100=0x0064 (0.1V), minimum to 10=0x800a (10 minutes), the maximum to 24*60=1440=0x85A0 (24 hours), the resolution to 100=0x0064 (0.1V), the tag to 0b00010010=0x12 (size 2 and label 2), the field to 3=0x03. The same for Disposable Battery except the tag which has to be set to 0b00011010=0x1a (size 2 and label 3), and the field to 4=0x04. The cluster to report is 0x0050 and the attribut 0x0006 (Node power descriptor).

Answer: *1106005029000603800a85a0006400641204800a85a0006400641a*

Response: *1107005000010006*

To decode the batch reception, use the br_uncompress. Type for Temperature is I16 (7) and for others are U16 (6), so it is necessary to use this command:

```
echo "420500c0c04a0258b48fa08cef0a8ce10400100490ae215ab1b220b200" | br_uncompress/wtc-batch-report/br_uncompress -a 2 0,100,7 1,500,6 2,100,6 3,100,6
```

Result:

```
UNCOMPRESS SERIE
cnt: 5          #  Counter of the batch (from 0 to 7)
845             #  Timestamp in second of sending of the frame

                # Format of data is: TimeStamp  of Measure | Label | Value
811 0 2400      # TimeStamp: 811 s      Label 0: Temperature    Value: 24°C
841 0 2600      # TimeStamp: 841 s      Label 0: Temperature    Value: 26°C

811 1 4500      # TimeStamp: 811 s      Label 1: Humidity       Value: 45%
841 1 9000      # TimeStamp: 841 s      Label 1: Humidity       Value: 90%

844 2 0         # TimeStamp: 844 s      Label 2: Rechargeable   Value: 0

840 3 2700      # TimeStamp: 840 s      Label 3: Disposable     Value: 2.7V
```

⇨ With the batch only one frame of 29 applicatives bytes is sent, instead of 6 frames representing 66 applicatives bytes. With the MAC and 6lowpan header, 45 bytes for the batch are sent against 162 bytes for a standard report. The gain is around 70% in this simple case.

5.2 CONFIGURE A STANDARD REPORT ON THE ILLUMINANCE

Specification: *Report immediately the indication of illuminance all the 10% of variation. This measure has to be reported at least each hour.*

Solution: The indication of illuminance is the End Point 0, Cluster “Analog Input” is 0x000C, Attribut “PresentValue” is 0x0055. The maximum field has to be 0x0e10 to have a report all one hour and the minimum field has to be 0x0000 to have a report immediately after the right variation. The delta has to be configured to 10.0=0x41200000 (type is single precision [http://www.h-schmidt.net/FloatApplet/IEEE754.html] for a report all the 10% of variation.

Applicative payload is: *1106000c0000553900000e1041200000*

6 APPENDIX

6.1 FCC LABEL

FCC ID: 2AGTV50-70-006

TEMPERATURE/HUMIDITY SENSOR

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

⚠ ***Caution:*** **Changes or modifications not expressly approved by the party responsible for FCC compliance could void the user authority to operate the device. (Cf. FCC Part 15.21).**