



# **CELS'O**

## **USER GUIDE**



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## DOCUMENT HISTORY

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July 2016	1.1	Update
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# 1 INTRODUCTION

This document describes the installation and operation of the Cels'O sensor. Please refer to the website <http://support.nke-watteco.com/> for all general information and more detailed explanations.

## 1.1 GENERAL DESCRIPTION

Cels'O allows the measurement of temperature over a wide range of values. The remote sensor can measure from -30°C to + 35°C with the following levels of **precision**:

Temperature range	Precision
[-40°C ; -34°C]	+/-1.5°C
[-33°C ; +9°C]	+/-1.0°C
[+10°C ; +37°C]	+/-0.5°C

Its casing is rated IP66.

Three different functions are available in Cels'o:

1. **Data logger**: measures and records at a specific resolution the temperature on periodicity and/or on variation. Sends all recorded measurements on periodicity in a “batch” report. *By default the resolution is set to 0.1°C, the periodicity of recording is set to 15 minutes, and the report is sent every hour.*
2. **Alarm**: possibility to set an alarm on variation of temperature. The measurement is made every minute. The “standard” report is used for this feature. The **resolution is 0.01°C**. *By default the alarm is set on a variation of 5°C.*
3. **History**: records the temperature every hour with a **resolution of 1°C**. Possibility to request this **30-day** history using a specific command.

Its **resolution is 0.1°C** by default for a “batch” report and **0.01°C** for a “standard” report.

## 1.2 INSTALLATION

There are two LEDs on the device, and a button activated by a magnet, as shown on the following picture:

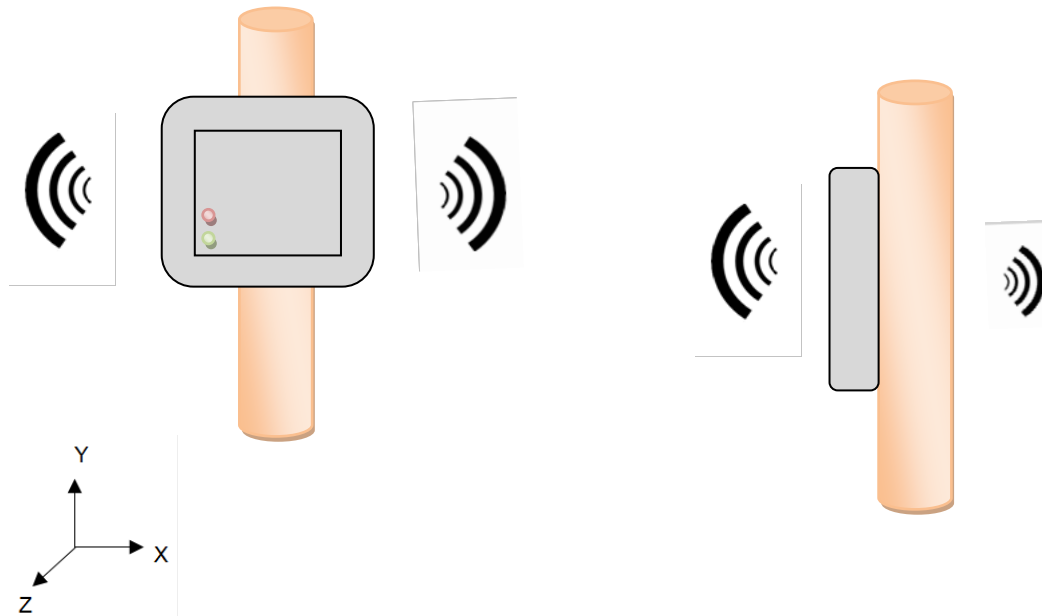


The set of features is described in this table:

Action	Magnet	Leds
Switch ON	1 second	/ go to association /
Switch OFF	5 seconds	
New Association	3 times	/ go to association /
Association	/	
Association Success	/	
Magnet passages	/	Fast red blinking

### 1.3 RADIO PROPAGATION

In order for the sensor to operate correctly, the number of obstacles should be limited in order to avoid excessive radio wave attenuation. It is also important to place the sensor as high as possible. The Cels'O device should be positioned as below to achieve the best radio propagation:



## 2 APPLICATIVE LAYER

The Cels'O device is a Class A device. It integrates these following clusters:

Cluster	Cluster name	Managed attributes
0x0000	Basic	All
0x0050	Configuration	All
0x8004	LoRaWAN	All
0x0402	Temperature Measurement	All

### 2.1 DEFAULT PARAMETERS

A default configuration is set:

- The device measures the temperature every 15 minutes and sends a report every hour, including the last 4 measurements with a resolution of 0.1°C. The batch configuration is:
  - Tag size : 1
  - Resolution: 10
  - Label: 0
- The device automatically sends a report when a variation of 5 °C is measured.
- The device reports the battery voltage in the “batch” once a week. The batch configuration is:
  - Tag size : 1
  - Resolution: 100
  - Label: 1

To decode the batch, *br\_uncompress* must be used with the following command:

```
echo "26150060a08981dc5e817101" | ./br_uncompress -a 1 0,10,7 1,100,6
```



### 2.1.1 EXAMPLES OF NEW CONFIGURATION

To change the default configuration, you can for example send the following frame on port 125:

Sending report on new variation of temperature (10°C):

11 06 04 02 00 00 00 29 80 01 FF FF 03 E8

*80 01: minimum time elapsed since last "sending", to accept "sending" a new sample. 1 minute in this case. It is the periodicity of measurement too.*

*FF FF: no periodicity report*

*03 E8: 1000 = 10°C is the variation on which a report will be sent*

Change the periodicity of temperature recording in the batch:

11 06 04 02 15 00 00 00 80 0A 80 3C 00 00 00 0A 01

*80 0A: periodicity for recording. 10 minutes in this case*

*80 3C: periodicity for batch sending. 60 minutes in this case*

## 2.2 EXAMPLES

### 2.2.1 DATA LOGGER: BATCH REPORT

The following payload is received: 100140803634010c0cb47ba1772fd4ee850c. The first bit of the first Byte is 0 so the report is a batch.

With *br\_uncompress*, the result is:

cnt: 1	
180016	→ Timestamp in seconds of the sending
177313 0 2400	→ measurement of temperature (label 0), measured at 177313 seconds. The value is 24°C
178213 0 2410	→ measurement of temperature (label 0), measured at 178213 seconds. The value is 24.1°C
179113 0 2400	
180013 0 2400	

### 2.2.2 ALARM: STANDARD REPORT

The following payload is received: **110A04020000290761**. The first bit of the first Byte is **1** so the report is standard.

The signed last two bytes give the temperature: **0x0761 = 18.89°C**

## 2.3 HISTORICAL RECORDING OF TEMPERATURE

Every hour, a temperature is recorded at the 1°C resolution. The recording keeps the last 30 days of temperature measurements.

New commands are integrated in the cluster temperature to retrieve this historical data.

### 2.3.1 COMMAND TO SEND

This command is done to retrieve the recorded temperatures. The start index and the end index of the temperature that will be retrieved must be indicated. The index step is one hour.

Flag	commandID	ClusterID	Cmd	Index Start	Index End
11	50	0402	10	xxxx	yyyy

**Index Start:** Index of start corresponding to the  $n^{\text{th}}$  recorded sample. From 0 to 719, 0 being the last recorded sample.

**Index End:** Index of end corresponding to the  $n^{\text{th}}$  recorded sample. From 0 to 719, 0 being the last recorded sample.

Necessary **Index End >= Index Start**. If **Index End = Index Start = 0xffff** then all recorded measurements are sent.

### 2.3.2 COMMAND OF RESPONSE

The response generates one or several frames, depending on the number of samples to be sent.

In each frame the first sample is delta-timestamped. This delta-timestamp corresponds to the number of minutes between the measurement of the first sample and the sending of a frame. A simplified Tag Length Value compression is used.

Flag	Command ID	Cluster ID	Cmd	N°Frame	Delta TimeStamp First Sample (minutes)	NBRepeatedValue [0]	Value [0]	NBRepeatedValue [n]	Value [n]	...
11	50	0402	11	0xnt	0xmmm	0xnn	0xvv	0xnn	0xvv	...

**N°Frame:**  $n+1$  corresponds to the number of frames sent;  $t+1$  corresponds to the number of frames to be sent

**Delta TimeStamp First Sample (minutes):** number of minutes when the first **Value[0]** has been measured. (unsigned short)

**NBRepeatedValue[]:** number of times the **Value[]** is repeated by step of one hour. (unsigned char)

**Value[]:** Value in °C. (signed char)

2.3.2.1 ERROR FRAME:

There are two possible errors:

Flag	commandID	ClusterID	Cmd
11	50	0402	87   89

**0x87:** invalid field Start > End ; Start > 719 ou End > 719 ; no available sample.

**0x89:** Not enough buffer to send all samples.

2.3.2.2 EXAMPLE

The Cels'O sends two frames:

11 50 0402 11 01 000a 0a EC 05 E9

- ⇒ frame 1 of 2
- ⇒ Timestamp of the last recorded sample = Timestamp of receipt – 10 minutes
- ⇒ There are 10 values to -20°C then 5 values to -23°C

11 50 0402 11 11 038E 01 00 03 05

- ⇒ frame 2 of 2
- ⇒ Timestamp of the last recorded sample = Timestamp of receipt – 910 minutes
- ⇒ There is 1 value to 0°C then 3 values to 5°C

So the result is:

minutes	-10	-70	-130	-190	-250	-310	-370	-430	-490	-550	-610	-670	-730	-790	-850	-910	-970	-1030	-1090
Temperature	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-23	-23	-23	-23	-23	0	5	5	5

## 2.4 CONSUMPTION

Transmission periodicity	Measurement periodicity	Battery life*
1 hour	15 minutes	7 years

\* measured at -30°C in SF12

## 2.5 ERRATA

- In revision v3.4.0.3903.0:

Function: Historical recording

Issue: The field *Delta TimeStamp First Sample* on the command response is wrong when the request is on an *Index Start* up to 18.

Workaround: on all response frames after a request, a calculated number of minutes must be added to the *Delta TimeStamp First Sample*. The New *Delta TimeStamp First Sample* begins:

*New Delta TimeStamp First Sample* =

$$\text{Delta TimeStamp First Sample} + \text{Floor}[\text{Index Start} * 3600 / 65535] * (65535 / 60)$$