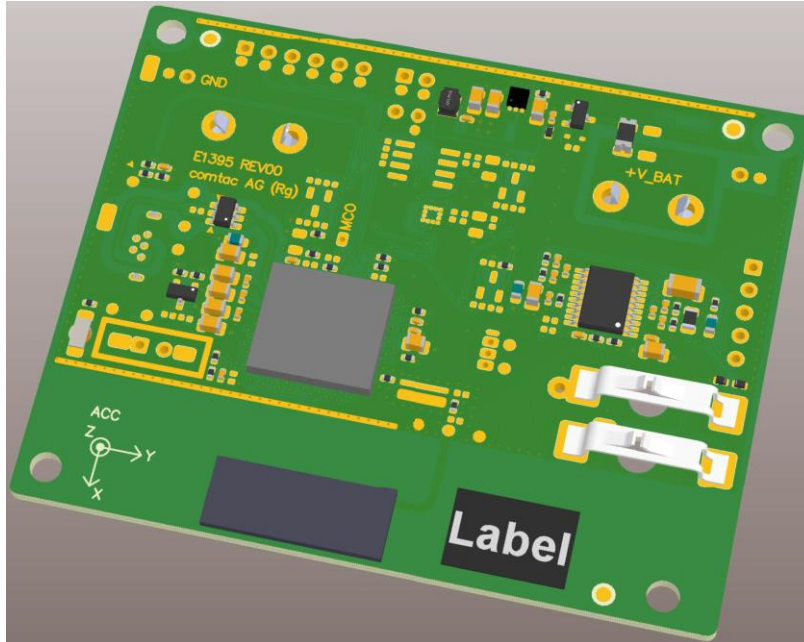


E1395 CM-3 SW Specs

REV03



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REV-History

REVNr	Author	Description
REV00	2018-10-29-Ra	Create file
REV01	2018-11-08-Ra	Payload parameters updated
REV02	2018-11-16-Ra	CFG File format added, device settings updated
REV03	2019-01-24-Ra	Changes from V00.01 added, dynamic AppKEY added, changes marked in green

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1 Functionality LED

The CM3 has 1 status LED (orange). The blinking of the LED varies depending on the device mode or status. The table below shows the different LED blinking modes for the orange LED:

LED	Blink duration	Meaning
Orange	1 x 100 ms	LoRa TxRx successful
	2 x 25 ms	LoRa busy or device not joined
	1 x 1 s	CM3 has been initialized

2 Uplinks (Payload Version V00)

The CM3 supports 3 different types of uplinks:

- 1) Uplink Port 3: Application Data [**DATA**, unconfirmed]
- 2) Uplink Port 100: Configuration Data [**CONFIG**, unconfirmed]
- 3) Uplink Port 101: Info Data [**INFO**, unconfirmed]

2.1 Uplink Port 3 (DATA)

The device's DATA payload is dynamic. Depending on the Payload ID, the size of the payload changes. The first 4 Bytes are always sent (so called header). All DATA Uplinks are sent unconfirmed.

Byte No. [0...X]	Function	Comment
0	Payload Version	Payload Version used by device
1	Status Byte	0 0 BAT LOW Last TEMP valid EXT MEM ACC TEMP I2C TEMP PT100 TEMP PT100: 1 TEMP PT100 placed 0 TEMP PT100 not placed TEMP I2C: 1 TEMP I2C placed 0 TEMP I2C not placed ACC: 1 ACC placed 0 ACC not placed EXT MEM: 1 EXT MEM placed 0 EXT MEM not placed Last TEMP Valid: 1 Last TEMP measurement valid 0 Last TEMP measurement invalid BAT LOW: 1 Low Battery flag set 0 Low Battery flag reset
2	Status Byte	0 0 INFO REQ CONFIG RX BUTTON ALARMING HISTORY ASYNC ASYNC: 1 ASYNCHRONOUS Event set 0 SYNCHRONOUS Event set HISTORY 1 HISTORY Event flag set (SYNC) 0 HISTORY Event flag reset ALARMING: 1 ALARMING Event flag set (SYNC) 0 ALARMING Event flag reset BUTTON: 1 BUTTON Event flag set (ASYNC) 0 BUTTON Event flag reset CONFIG RX: 1 CONFIG RX Event flag set (ASYNC) 0 CONFIG RX Event flag reset INFO REQ: 1 INFO REQ Event flag set (ASYNC) 0 INFO REQ Event flag reset
3	Battery voltage	Battery voltage in 0.5% steps (from 0 to 200 [uint8])
4	Payload ID	Application Payload ID as defined in chapter 2.1.1
5-X	Payload Data	Application Payload Data corresponding to Payload ID

2.1.1 Application Payload IDs and Data structure

The following payload IDs and Data types are defined:

Payload ID	Function	Structure	Size in Bytes w/o ID	Size in Bytes w/ ID
01	EVENT	- 2 Bytes: Temperature NOW (MSB first, signed [int16]) EXAMPLE: +1000 (RAW) -> +10.00 °C -500(RAW) -> -5.00 °C INVALID VALUE (sent if Meas invalid): +250000 (RAW) -> +250.00°C	2	3
02	HISTORY	- 2 Bytes: Temperature NOW - 2 Bytes: Temperature (NOW – 1*TempMeasRate) - 2 Bytes: Temperature (NOW – 2*TempMeasRate) - 2 Bytes: Temperature (NOW – 3*TempMeasRate) - 2 Bytes: Temperature (NOW – 4*TempMeasRate) - 2 Bytes: Temperature (NOW – 5*TempMeasRate) - 2 Bytes: Temperature (NOW – 6*TempMeasRate) - 2 Bytes: Temperature (NOW – 7*TempMeasRate) *All Temperature values are MSB first and signed (int16). *TempMeasRate -> see chapter 4.2 EXAMPLE: +1000 (RAW) -> +10.00 °C -500(RAW) -> -5.00 °C INVALID VALUE (sent if Meas invalid / or jet to be done [INIT VALUE]): +250000 (RAW) -> +250.00°C	16	17

2.2 Uplink Port 100 (CONFIG)

The CONFIG payload is defined as follows:

Byte No. [0...X]	Function	Comment
0	Payload Version	Payload Version used by device
1	Status Byte	0 0 BAT LOW Last TEMP valid EXT MEM ACC TEMP I2C TEMP PT100 TEMP PT100: 1 TEMP PT100 placed 0 TEMP PT100 not placed TEMP I2C: 1 TEMP I2C placed 0 TEMP I2C not placed ACC: 1 ACC placed 0 ACC not placed EXT MEM: 1 EXT MEM placed 0 EXT MEM not placed Last TEMP Valid: 1 Last TEMP measurement valid 0 Last TEMP measurement invalid BAT LOW: 1 Low Battery flag set 0 Low Battery flag reset
2	Status Byte	0 0 INFO REQ CONFIG RX BUTTON ALARMING HISTORY ASYNC ASYNC: 1 ASYNCHRONOUS Event set 0 SYNCHRONOUS Event set HISTORY 1 HISTORY Event flag set (SYNC) 0 HISTORY Event flag reset ALARMING: 1 ALARMING Event flag set (SYNC) 0 ALARMING Event flag reset BUTTON: 1 BUTTON Event flag set (ASYNC) 0 BUTTON Event flag reset CONFIG RX: 1 CONFIG RX Event flag set (ASYNC) 0 CONFIG RX Event flag reset INFO REQ: 1 INFO REQ Event flag set (ASYNC) 0 INFO REQ Event flag reset
3	Battery voltage	Battery voltage in 0.5% steps (from 0 to 200 [uint8])
4-5	Temp Meas Rate	Temperature measurement rate in minutes (from 0 to 50000 [uint16], MSB first)
6	History trigger	Trigger for HISTORY Event (History uplink sent every History trigger * Temp Meas Rate, from 0 to 8 [uint8])
7	Temp Threshold	Temperature threshold for ALARMING Event (Alarming uplink sent every Temp Meas Rate if temp difference > threshold, from 0 to 255 [uint8], where 0 means ALARMING always ON (Alarming sent every Meas Rate) and 10 means 1.0°C, Max. Threshold 25.5°C)
8-9	Temp Offset	Temperature offset used when calculating actual temperature with the PT100 sensor (from -5000 to 5000 [int16], where +100 [RAW] means +1.00°C and -100[RAW] means -1.00°C)

2.3 Uplink Port 101 (INFO)

The INFO payload is defined as follows:

Byte No. [0...X]	Function	Comment
0	Payload Version	Payload Version used by device
1	Status Byte	0 0 BAT LOW Last TEMP valid EXT MEM ACC TEMP I2C TEMP PT100 TEMP PT100: 1 TEMP PT100 placed 0 TEMP PT100 not placed TEMP I2C: 1 TEMP I2C placed 0 TEMP I2C not placed ACC: 1 ACC placed 0 ACC not placed EXT MEM: 1 EXT MEM placed 0 EXT MEM not placed Last TEMP Valid: 1 Last TEMP measurement valid 0 Last TEMP measurement invalid BAT LOW: 1 Low Battery flag set 0 Low Battery flag reset
2	Status Byte	0 0 INFO REQ CONFIG RX BUTTON ALARMING HISTORY ASYNC ASYNC: 1 ASYNCHRONOUS Event set 0 SYNCHRONOUS Event set HISTORY 1 HISTORY Event flag set (SYNC) 0 HISTORY Event flag reset ALARMING: 1 ALARMING Event flag set (SYNC) 0 ALARMING Event flag reset BUTTON: 1 BUTTON Event flag set (ASYNC) 0 BUTTON Event flag reset CONFIG RX: 1 CONFIG RX Event flag set (ASYNC) 0 CONFIG RX Event flag reset INFO REQ: 1 INFO REQ Event flag set (ASYNC) 0 INFO REQ Event flag reset
3	Battery voltage	Battery voltage in 0.5% steps (from 0 to 200)
4	APP MAIN VERSION	From 00 to 99 (uint8)
5	APP MINOR VERSION	From 00 to 99 (uint8)

3 Downlinks (Payload Version V00)

Downlinks can be received on either port 100 (CONFIG) or 101 (INFO). With a downlink message on port 100, the user has the possibility to change the device and sensor configurations. With a downlink message on port 101, the user has the possibility to request an INFO Uplink (see chapter 2.3).

3.1 Downlink Port 101 (INFO)

The payload structure of an INFO downlink is defined as follows:

Byte No. [0...X]	Function	Comment
0	INFO Request	True for any value != 0

3.2 Downlink Port 100 (CONFIG)

The payload structure of a CONFIG downlink is defined as follows:

Byte No. [0...X]	Function	Comment
1-2	Temp Meas Rate	Temperature measurement rate in minutes (from 0 to 50000 [uint16], MSB first)
3	History trigger	Trigger for HISTORY Event (History uplink sent every History trigger * Temp Meas Rate, from 0 to 8 [uint8])
4	Temp Threshold	Temperature threshold for ALARMING Event (Alarming uplink sent every Temp Meas Rate if temp difference > threshold, from 0 to 255 [uint8], where 0 means ALARMING always ON (Alarming sent every Meas Rate) and 10 means 1.0°C, Max. Threshold 25.5°C
5-6	Temp Offset	Temperature offset used when calculating actual temperature with the PT100 sensor (from -5000 to 5000 [int16], where +100 [RAW] means +1.00°C and -100[RAW] means -1.00°C)

Note that changes in the settings will not take effect until the next uplink (due to Class A, RX only after TX).

4 CFG.TXT File

When plugging in a USB cable to the CM-3, a new drive (CM3) can be seen on the computer. Inside this drive, a CFG.TXT file can be found. The LoRa and the device settings can be configured with this file.

Important: Changes in the CFG-File are applied **only after a reset!** Keeping the button (or reed switch) pressed (active) for **more than 3 seconds** will reset the device (only usable in application mode, please reset with power-up in bootloader mode). **Disconnecting the USB cable while powered up will also reset device.**

```
App.vers.:00.01

Lora Config (LoRaMac version 441):
PrivateNetwork=0 (0: Public Network, 1: Private Network)
ADR=1 (0: ADR OFF, 1: ADR ON)

OTAA (OverTheAirActivation):
DevEUI=3934353767377B15 [READ ONLY]

Datarate (0..5; SF12..SF7):
DefDatarate=0
Rx2DefDatarate=0

Device Parameters:
TempMeasRate=15 (minutes, max. 50000)
HistoryTrigger=4 (counts, max. 8)

Sensor Thresholds:
TempThres=0 (50 -> 5.0°C / max. 255)

Temperature Offset:
TempOffset=0 (+100 -> +1.00°C / -5000 to 5000)
```

4.1 LoRa settings

With the LoRa settings it is possible to select a network type (**PrivateNetwork** variable). By default, the device is configured for usage in public networks.

The **DevEUI** parameter needed for OTAA is READ ONLY, which means the user can't change it (**Unique ID given by comtac**).

The **AppEUI** (required for OTAA) is a hardcoded value and valid for all CM3 devices. This value should only be retrieved by request.

[FOR CM3 ONLY → AppEUI: 70B3D5FFFE297027]

The **AppKEY** (required for OTAA) is generated by the devices themselves and is **UNIQUE** for every device. This value should only be retrieved by request.

The LoRaMac's native ADR (Adaptive Data Rate) is turned on by default. The **DefDatarate** is the default data rate used for all Uplinks (if ADR off & for Join requests), whereas the **Rx2DefDatarate** is the data rate used for the RX2-Window (At the moment, two values are supported by most providers → 0 [SF12] or 3 [SF9]).

WARNING: When adding a device to a network, the selected RX2-Window value must match the settings of the network for it to work properly!

4.2 Device and sensor settings

With the device and sensor settings, different parameters can be configured. According to these parameters, the device might change its functionality.

The temperature measurement rate of the CM3 is set to 15 minutes by default (**TempMeasRate**).

With the **HistoryTrigger** variable, an interval for history uplinks can be set (see chapter 2.1). The history interval is calculated by multiplying the trigger with the measurement rate. A history uplink has a limit of 8 temperature values (maximum **HistoryTrigger** = 8).

With the **TempThres** variable, alarming uplinks (see chapter 2.1) can be configured. By default, this variable is set to 0 (alarming sent after every measurement).

Usage example -> By setting this variable to 5 (0.5°C), the device only sends an alarming uplink when the difference between the actual and last measurement is higher than the set threshold. Otherwise, no alarming uplink is sent.

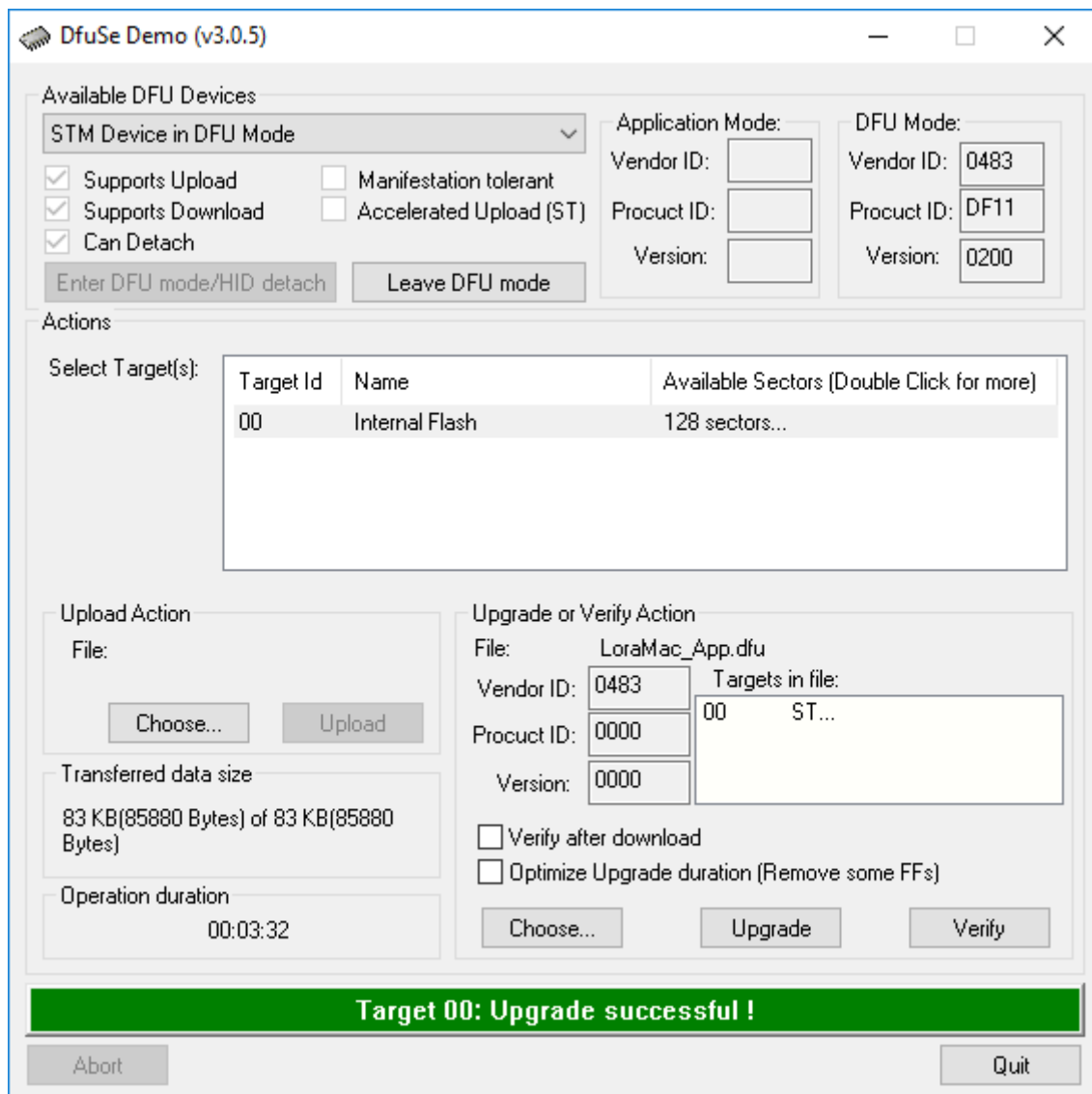
The **TempOffset** variable can be used to compensate the static error of the temperature measurement. By default, this variable is set to 0 (no static error compensation).

After Power-up the device starts by sending an INFO uplink followed by a CONFIG uplink (see chapters 2.3 and 2.2).

5 SW Update over the USB Bootloader

The CM3 can be updated via USB DFU Bootloader.

1. DFU tool «DFuSe demo» start (link → <http://www.st.com/en/development-tools/stsw-stm32080.html>).
2. Select the current DFU file by clicking on "Choose..." under **upgrade or verify action** (bottom right).
3. Press button at restart (power-up) with USB Cable connected to go to the bootloader mode.
4. The LED should now toggle every 500 ms.
5. The Device should appear under "available DFU devices".
6. Press "Upgrade" **upgrade or verify action** (bottom right), ignore any messages, and continue. The Update should last around 2 minutes.
7. Once Update is finished press "Leave DFU mode", disconnect the USB cable, and restart the device.



Important: After installing the DFU tool, check the UM0412.pdf file. The driver path must be searched manually for the first update (C:\Program files (x 86) \STMicroelectronics\Software\DfuSe v3.0.5\Bin\Driver\).