

**WIRELESS FAMILY DEVICES  
ZB-CONNECTION  
End Device ZED-TID  
(product code: ZED-TID-M)**

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## 1) GENERAL DEVICE CHARACTERISTICS

ZED-TID belongs to ZB-Connection devices family.

It has two inputs for temperature sensors and two digital inputs.

It has the fundamental task of acquiring its inputs, and sending the data it acquires and generates at regular intervals, to a compatible Gateway.

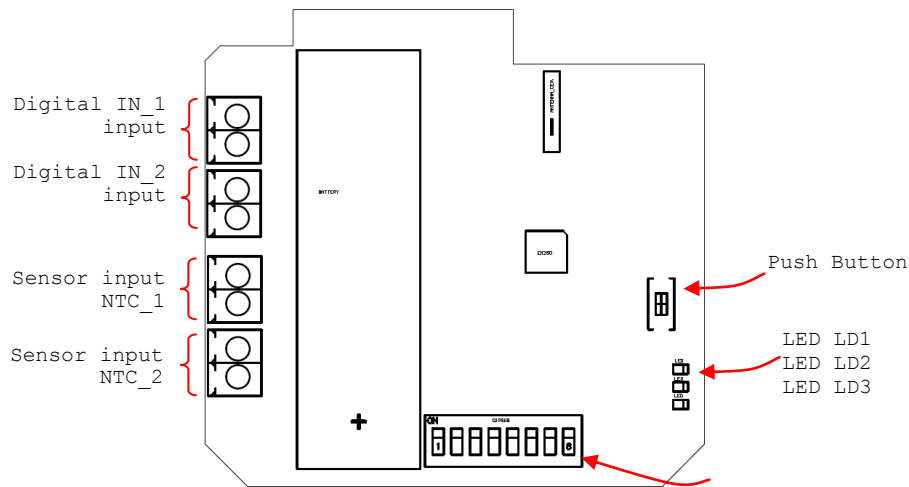
The device must be supplied with a 3.6V battery.

Its role in the network is End-Device.

## 2) ELECTRICAL DEVICE CHARACTERISTICS

POWER SUPPLY:	3.6V battery
WIRELESS CHARACTERISTICS:	2405 MHz ÷ 2480 MHz DSSS Modulation Nominal transmission Power +3dBm IEEE 802.15.4 compliant Stack EmberZNet3.5.x Stack version 0 Proprietary profile ID Proprietary encryption key
TEMPERATURE SENSOR INPUT:	NTC SENSOR TYPE 103AT (10K a 25°C; beta=3435K) Measurement range -50°C ÷ +100°C Reading resolution 0,1°C Reading accuracy ±0,5°C
DIGITAL INPUT FEATURES:	electronic type not insulated inputs for clean contact (low current reed switch).
OPERATING CONDITIONS:	-20÷+55 °C +10÷30°C for nominal battery duration
BATTERY DURATION:	> 3 years (+10°C÷30°C transmission time > 3 minutes).
CONNECTIONS:	Pull-out terminals (3,81 mm pitch)
PROTECTION DEGREE:	IP 55

## 3) CARD LAYOUT AND CONNECTION DIAGRAM



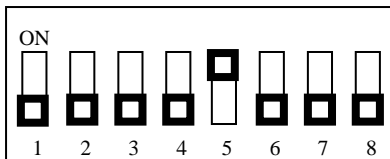
## 4) DEVICE ADDRESSING

The device can be addressed by DipSwitch. Valid addresses range from 16 and 127. The DipSwitch is read only when switching the circuit board on; a modification in the Dipswitch's position is taken into consideration only after that device has been reset. In order to reset the device, remove the battery from the device, press the pushbutton so that to make the residual energy in the circuit run out, then install the battery.

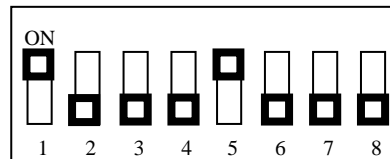
Set the DipSwitch before switching the circuit board on and before it has gone onto the network.

The DipSwitch is read as follows:  
DIP1 = least significant bit; ON=1.

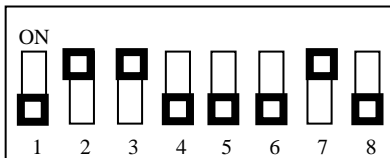
Examples:



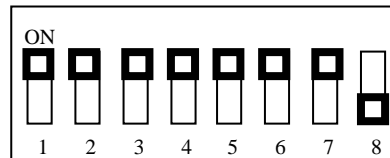
Address =16



Address =17



Address =70



Address =127

**Attention:** Be careful when assigning addresses. Two devices with the same address would put their data into the same container in the Gateway and this would generate ambiguity which would be difficult to identify in subsequent network operations.

## **5) ASSOCIATING THE DEVICE TO A COMPATIBLE NETWORK**

The process to follow when join ZED-TID node to a network is the same as for all ZB-Connection end-devices.

The association process is activated by pressing the push button.

The association process is enabling only if the device is not already part of a network, i.e. if it is a new device or if it has been voluntarily disassociated.

- 5.1) Press the push button, led LD2 turns on and node starts the scanning process of all 16 radio channels in order to find an "open" compatible network (i.e. a ZB-Connection network). The scan process takes about 20 seconds; if the device detects an available network, all 3 leds flash quickly and afterward they turn off (network opening is performed by suitably stimulating the Gateway, for more information refer to the Gateway document);
- 5.2) otherwise, if the scan process ends without having found any available network, the device goes in a power-safe mode waiting for new push-button stimulating.

## **6) DISASSOCIATING THE DEVICE FROM THE NETWORK**

Disassociating the device involves losing the network parameters and consequently leaving the network of which it had been a part.

Moreover device loads to the default value all of its operating parameters (HoldingRegister).

Disassociation can be commanded in two ways:

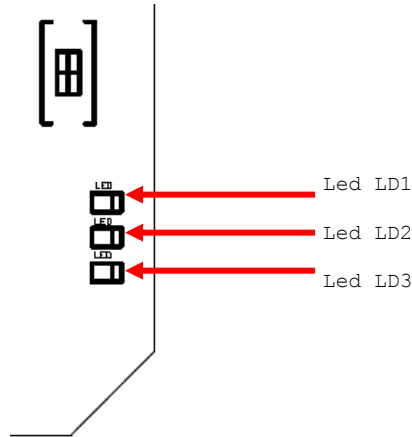
- 1) Receipt of the appropriate command password.
- 2) Holding the pushbutton on the card down for at least 6 seconds. Disassociation using the push-button is only possible within 20 seconds from when the device is switched on.

## 7) DEVICE LED/PUSH BUTTON INTERFACE

ZED-TID has three leds through which it shows information about its operating state.

The device has also a push button which is used to activate the joining process, to activate disassociation and to stimulate the device in order to send data to the Gateway.

Nomenclature of ZED-TID leds:



### Behaviour of leds at the start-up:

At the reset of ZED-TID all leds lighted for 2 seconds, then all leds flash fast for another half seconds.

At the end of flashing device starts the normal functioning.

### How leds work when ZED-TID is NOT joined with a network:

All leds off

### How leds work when ZED-TID is joined with a network:

Usually all leds off.

Led LD1 briefly switched on at acquisition of the probes and at transmission of a message towards the gateway.

LD2 LED briefly switched on at receiving of an answer from the gateway.

### Behaviour of leds during joining process

Led LD1 switched on for whole joining process.

Fast blinking of all leds at the successful association with a network.

### Radio Link Quality Analysis

The device has a functional mode that permits to know the radio link quality, counting the number of blink of led LD3.

This functional mode is activate by pressing the button (only if node is joined to a network).

This functional mode continues for 60 seconds.

When this mode is active node ignores normal transmit time and transmits a message each 5 seconds.

When this mode is active, after the successful communication process node analyzes the signal strength (Rssi) associated to the message received from Gateway.

Based on this value node performs one, two or three flashes of LED LD3.

3 flashes of LD3 --> Rssi of received message  $\geq$  -65dB (optimal level)

2 flashes of LD3 --> Rssi of received message  $\geq$  -85dB (medium level)

1 flash of LD3 --> Rssi of received message  $<$  -85dB (low level)

# 4-noks s.r.l.

## **8) DEFAULT PARAMETERS**

The device has five operating parameters, which are saved in a non-volatile memory and at the time of initialization are loaded with the default values. Default parameter loading also takes place following device disassociation.

<b>Parameter</b>	<b>DEFAULT</b>	<b>unit</b>
Transmission time	60	[sec]
Sensor 1 low temperature alarm threshold	-50,0	[°C]
Sensor 1 high temperature alarm threshold	+100,0	[°C]
Sensor 2 low temperature alarm threshold	-50,0	[°C]
Sensor 2 high temperature alarm threshold	+100,0	[°C]

## **9) DESCRIPTION OF THE ACQUISITION PROCESS**

The device envisages the acquisition of all values before transmitting its status to the Gateway.

For this reason the device's sampling interval is equal to the Transmission Time.

## **10) DESCRIPTION OF THE ALARM MANAGEMENT PROCESS**

The device compares the temperature detected to the parameters that define alarm limits.

There are no alarm signal activation delays. The relevant fault flag is activated as soon as the value acquired is higher than the upper limit or lower than the lower limit.

```
If Temperature 1 > High Temperature Limit 1 --> High temp. alarm flag 1 = 1
If Temperature 1 <= High Temperature Limit 1 --> High temp. alarm flag 1 = 0
If Temperature 1 < Low temperature limit 1 --> Low temp. alarm flag 1 = 1
If Temperature 1 >= Low temperature limit 1 --> Low temp. alarm flag 1 = 0
```

```
If Temperature 2 > High Temperature Limit 2 --> High temp. alarm flag 2 = 1
If Temperature 2 <= High Temperature Limit 2 --> High temp. alarm flag 2 = 0
If Temperature 2 < Low temperature limit 2 --> Low temp. alarm flag 2 = 1
If Temperature 2 >= Low temperature limit 2 --> Low temp. alarm flag 2 = 0
```

# 4-noks s.r.l.

## **11) MAPPING DEVICE DATA**

Like almost all ZB-Connection devices, ZED-TID shows its data through an agent. The agent of a particular device resides locally in the Gateway, and is made up by data sent via radio and by data generated by the Gateway itself.

The Gateway allows access in read and write mode to the agents relating to the devices belong to the network and the Gateway data through a serial interface and Modbus protocol.

Given the nature of the Modbus protocol, the data is split into four memory areas:

- InputRegister (16-bit variables in read only mode)
- InputStatus (1-bit variables in read only mode)
- HoldingRegister (16-bit generally non-volatile variables)
- CoilStatus (1-bit variables)

The Gateway is compatible with the most common modbus commands such as single and sequential reading of all memory spaces and single and sequential writing of all holding registers and coil statuses.

ZED-TID has the following data:

- (13+5) InputRegister
- 80 InputStatus
- (6+1) HoldingRegister
- 16 CoilStatus

### **11.1) ZED-TID INPUT REGISTERS**

InputRegister[0]	Type of device (=2)
InputRegister[1]	Firmware version (Major/Minor)
InputRegister[2]	Messages sent by device counter
InputRegister[3]	Level of the radio signal of the last message received by the device(2)
InputRegister[4]	Battery level (in thousandths of Volt)
InputRegister[5]	Not used
InputRegister[6]	NTC 1 sensor temperature (in tenths of degree centigrade)
InputRegister[7]	NTC 2 sensor temperature (in tenths of degree centigrade)
InputRegister[8]	Seconds passed since receiving last messages <sup>(1)</sup>
InputRegister[9]	Counter of messages received from Gateway <sup>(1)</sup>
InputRegister[10]	Gateway Receiving instant time (100 * hours + minutes) <sup>(1)</sup>
InputRegister[11]	Signal Level of the last message received from Gateway <sup>(1) (2)</sup>
InputRegister[12]	Device network address <sup>(1)</sup>
InputRegister[13]	Copy of InputStatus[0..15]
InputRegister[14]	Copy of InputStatus[16..31] (holdingRegister writing pending flag) <sup>(1)</sup>
InputRegister[15]	Copy of InputStatus[32..47] (not used) <sup>(1)</sup>
InputRegister[16]	Copy of InputStatus[48..63] (CoilStatus writing pending flag) <sup>(1)</sup>
InputRegister[17]	Copy of InputStatus[64..79] (general pending flag and presence flag) <sup>(1) (2)</sup>

(1) This data is not sent by the device but generated by the Gateway.

(2) The radio signal level value provides information on the energy value in relation to the last hop performed by the radio message. The value is expressed in dB+100, it varies from a minimum of 8 (very poor signal) to a maximum of 70 (maximum signal)

## 11.2) ZED-TID HOLDING REGISTERS

HoldingRegister[0]	Command password
HoldingRegister[1]	Transmission time (expressed in seconds)
HoldingRegister[2]	High Temperature threshold alarm 1 (expressed in tenths of degree centigrade)
HoldingRegister[3]	Low Temperature threshold alarm 1 (expressed in tenths of degree centigrade)
HoldingRegister[4]	High Temperature threshold alarm 2 (expressed in tenths of degree centigrade)
HoldingRegister[5]	Low Temperature threshold alarm 2 (expressed in tenths of degree centigrade)
HoldingRegister[6]	Copy of CoilStatus[0..15]

## 11.3) ZED-TID COIL STATUSES

CoilStatus[0]	Command password activation
CoilStatus[1]	Not used
...	...
CoilStatus[15]	Not used

## 11.4) ZED-TID INPUT STATUSES

InputStatus[0]	Sensor 1 high temperature alarm
InputStatus[1]	Sensor 1 low temperature alarm
InputStatus[2]	Sensor 2 high temperature alarm
InputStatus[3]	Sensor 2 low temperature alarm
InputStatus[4]	Status of digital input IN_1 (0=short circuited input; 1 = open input)
InputStatus[5]	Status of digital input IN_2 (0=short circuited input; 1 = open input)
InputStatus[6]	Not used
...	...
InputStatus[16]	HoldingRegister[0] writing pending <sup>(1)</sup>
InputStatus[17]	HoldingRegister[1] writing pending <sup>(1)</sup>
InputStatus[18]	HoldingRegister[2] writing pending <sup>(1)</sup>
InputStatus[19]	HoldingRegister[3] writing pending <sup>(1)</sup>
InputStatus[20]	HoldingRegister[4] writing pending <sup>(1)</sup>
InputStatus[21]	HoldingRegister[5] writing pending <sup>(1)</sup>
InputStatus[22]	HoldingRegister[6] writing pending <sup>(1)</sup>
InputStatus[23]	HoldingRegister[7] writing pending <sup>(1)</sup>
InputStatus[24]	HoldingRegister[8] writing pending <sup>(1)</sup>
InputStatus[25]	Not used
...	...
InputStatus[48]	CoilStatus[0..15] writing pending <sup>(1)</sup>
InputStatus[49]	Not used
...	...
InputStatus[64]	Device presence status (agent data validity) <sup>(2)</sup>
InputStatus[65]	General status of pending (logic OR of all writing pending) <sup>(1)</sup>
InputStatus[66]	Not used
...	...
InputStatus[79]	Not used

(1) These flags are managed by the Gateway and are set at the time a holding register or coil status group is written. They are reset at the time of effective receipt of the data by the device (which occurs immediately after transmission).

(2) the device presence flag is managed by the Gateway; it is set when the present data is valid. The flag is reset if the Gateway does not receive messages from the device for a time greater than four times the automatic transmission time.

## 13) SPECIAL COMMANDS - COMMAND PASSWORD

Command passwords can be used to give the device certain special commands. The command is performed when the CoilStatus[0] bit is set.

HoldingRegister[0] (HEX)	HoldingRegister[0] (DEC)	Action
0x1968	6504	Start device Bootloader
0x1970	6512	Device reset
0x1973	6515	Device disassociation