

## TECHNICAL REFERENCE MANUAL

NEMOSENSE V23-3



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# 1. Introduction

Dewesoft NEMOSENSE is a family of low power devices designed for remote monitoring. NEMOSENSE devices acquire data, store it to an internal memory and send it to the server when connection is available.

The initial variant of the NEMOSENSE devices released is NEMOSENSE-3xMEMS-ACC. Its physical interface is PoE (power over ethernet). 3xMEMS-ACC stands for an integrated triaxial MEMS accelerometer as a measurement front end. The NEMOSENSE platform allows different physical interfaces and measurement interfaces to be released in future hardware variants.

# 2. Operational principle

NEMOSENSE is automatically powered up if the power is delivered to the device. On power-up, the following sequence occurs:

1. Initialization phase - lasts only a few seconds
2. Configuration mode - device acts as HTTP server on default IP and can be configured using the NEMOSENSE Config Tool App.
3. Operational mode - after the configuration is stored the operational mode starts which consists of the following phases
  - a. Firmware upgrade mode - device tries to receive a firmware upgrade from the FOTA server for 60 seconds
  - b. Measurement mode - the final mode of the start-up sequence and device stays in measurement mode indefinitely (i.e. until the device receives a restart command from the MQTT server or there is a power loss)

The device can only be interfaced over a TCP/IP network through its sole ethernet port.

## 3. Getting started with NEMOSENSE

This chapter will help you to install the software, configure your NEMOSENSE device to send the data over TCP/IP to your or 3rd party server using the Dewesoft Historian software package. We will also show you how to access the data using Grafana.

To follow the steps, you need the following hardware:

- your NEMOSENSE device
- Your PC
- PoE Switch or a non-powered Ethernet Switch and PoE Injector
- Ethernet CAT6 cable to connect your NEMOSENSE device to your computer for configuration purposes

And the following software packages:

- The Dewesoft NEMOSENSE Config Tool App
- The Dewesoft Historian software (includes MQTT broker, InfluxDB database and Grafana web GUI)

### Dewesoft NEMOSENSE Config Tool App

Download the Dewesoft NEMOSENSE Config Tool App from [this link](#).

### Dewesoft Historian software

Install the Dewesoft Historian software by following the instructions [here](#)



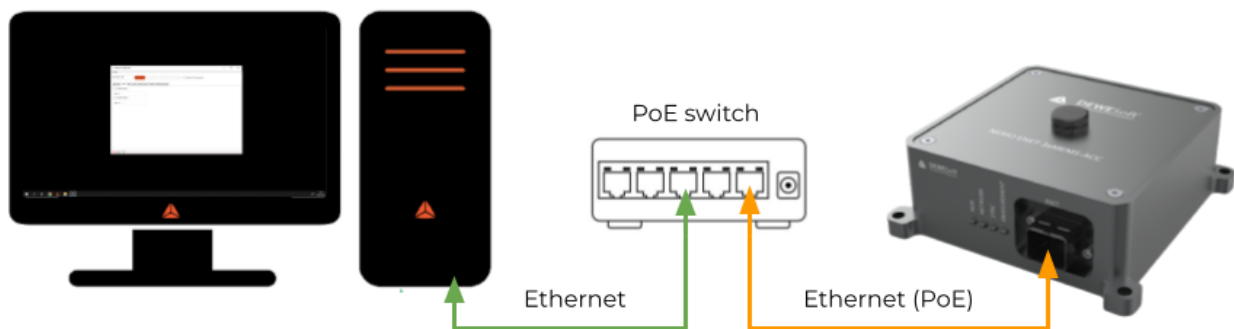
**Note:** the MQTT client is already running on the NEMOSENSE device, so there is no need to install it again. Therefore, skip the section: DewesoftX MQTT client.

## Configuration mode

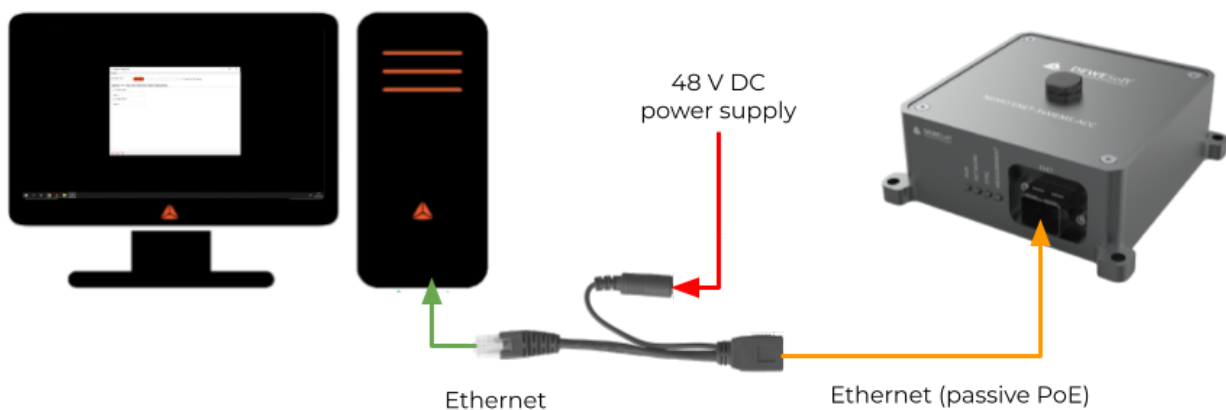
Connect your PC to your local network. Connect NEMOSENSE with an Ethernet cable to the same network over the PoE\* Network Switch and run the Dewesoft NEMOSENSE Config Tool App.

*\*In case you don't have the PoE Switch you can inject power by using so-called PoE Injectors. 48 V is needed.*

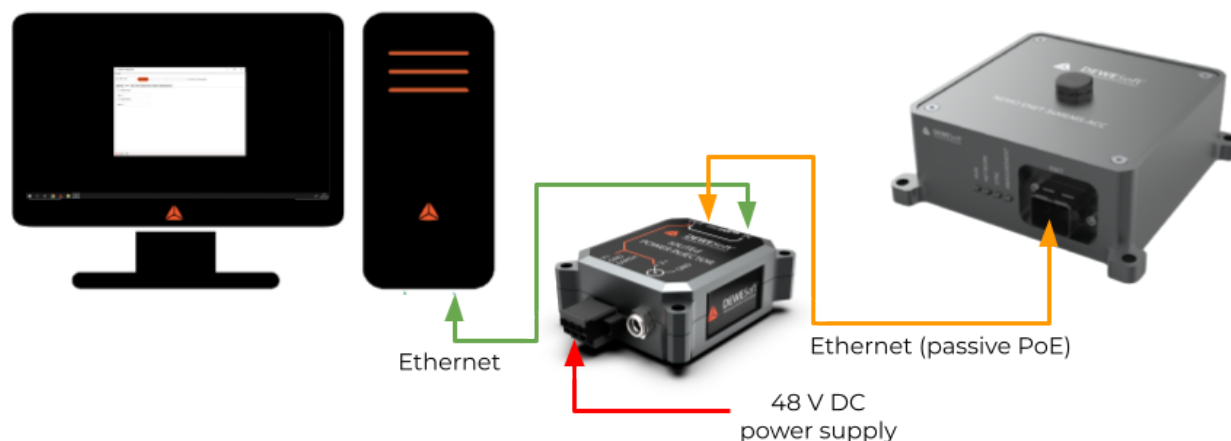
Make sure to set the IP address of your PC to the same subnet as the NEMOSENSE default configuration address (192.168.11.XXX), for example you can set your PC's IP to: 192.168.11.94 (same subnet but different IP to the NEMOSENSE device).



*Connecting NEMOSENSE to PC over a PoE switch*

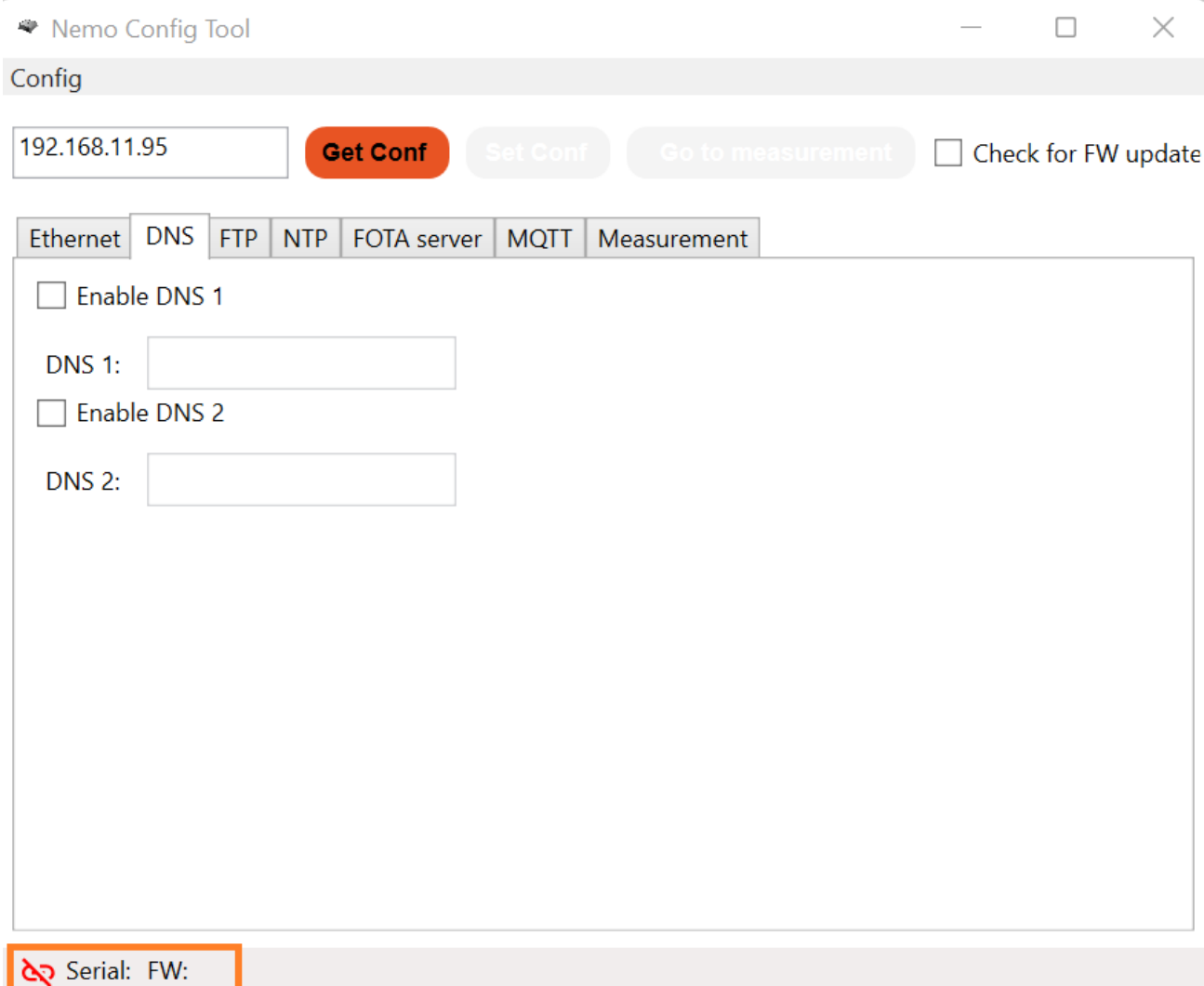


*Connecting NEMOSENSE to PC over a passive PoE injector*



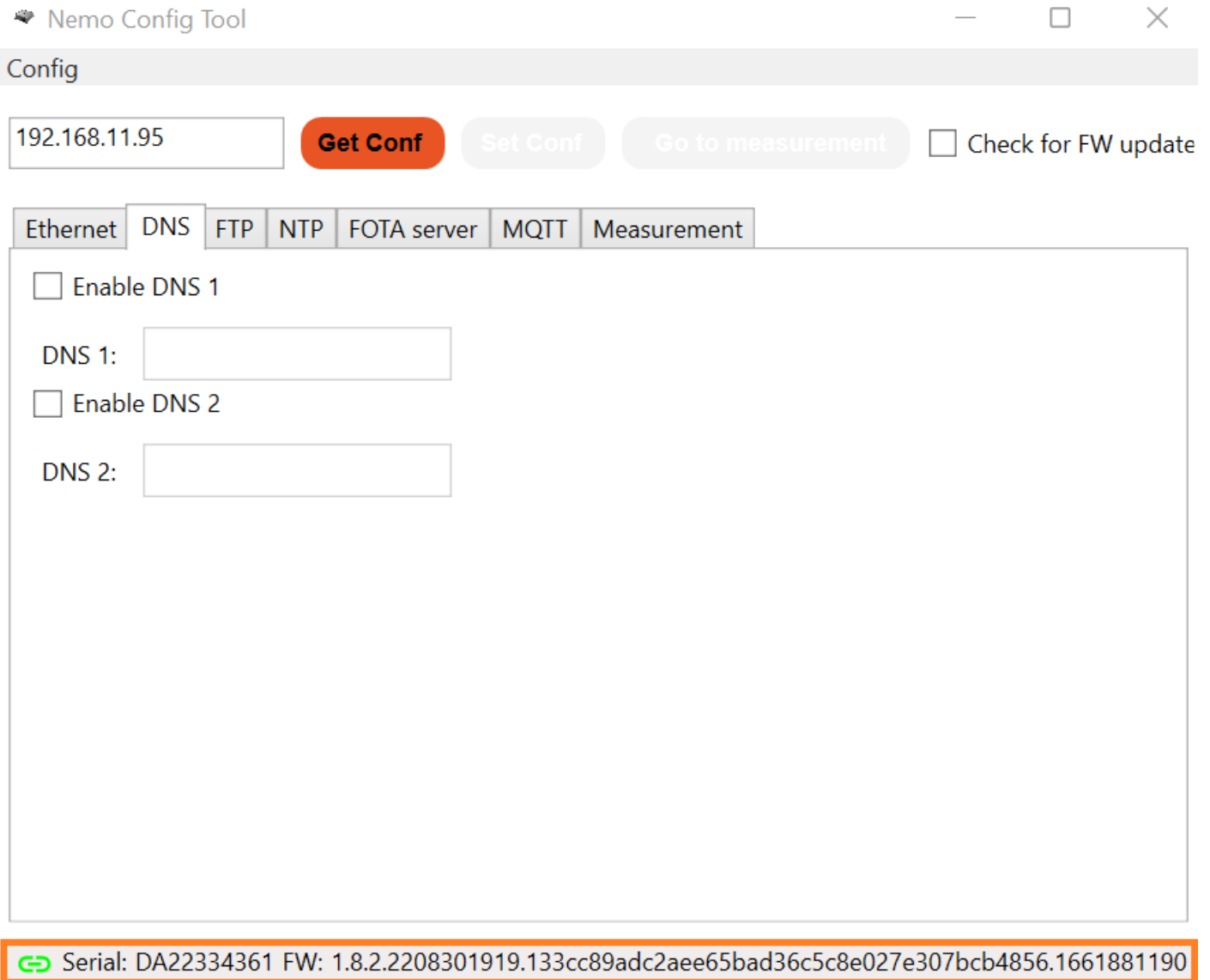
*Connecting NEMOSENSE to PC over the IOLITE-POWER-INJECTOR*

After running the NEMOSENSEConfigApp.exe file, the following screen will appear:



If the device is not in the configuration mode the device serial number and the FW version are NOT displayed in the bottom left corner (like on the above screenshot). Unplug the device and plug it again to restart the configuration process.

After the restart the Serial number and the Firmware version should be displayed meaning that the device is ready to be configured.



The screenshot shows the 'Nemo Config Tool' window. At the top, there's a title bar with a gear icon, the text 'Nemo Config Tool', and standard window controls. Below the title bar is a 'Config' header. Underneath, there's an IP address field containing '192.168.11.95', followed by three buttons: 'Get Conf' (highlighted in orange), 'Set Conf' (disabled), and 'Go to measurement' (disabled). To the right of these buttons is a checkbox labeled 'Check for FW update'. Below this section is a tabbed interface with tabs for 'Ethernet', 'DNS', 'FTP', 'NTP', 'FOTA server', 'MQTT', and 'Measurement'. The 'DNS' tab is currently selected. Inside the 'DNS' tab, there are two sections: 'Enable DNS 1' with a checkbox and a text field for 'DNS 1:', and 'Enable DNS 2' with a checkbox and a text field for 'DNS 2:'. At the bottom of the window, there's a status bar with a green link icon and the text 'Serial: DA22334361 FW: 1.8.2.2208301919.133cc89adc2aee65bad36c5c8e027e307bcb4856.1661881190'.

To start the configuration and get the latest parameters, press the *Get Conf* button. After you've done that, the *Set Conf* and *Go to measurement* buttons will be enabled.

Nemo Config Tool

Config

192.168.11.95 **Get Conf** **Set Conf** **Go to measurement** ☐ Check for FW update

Ethernet DNS FTP NTP FOTA server MQTT Measurement

☐ Enable DHCP

☐ Reboot every 24 hours if no connection

IP: 192.168.1.11

Mask: 255.255.255.0

Gateway: 192.168.1.1

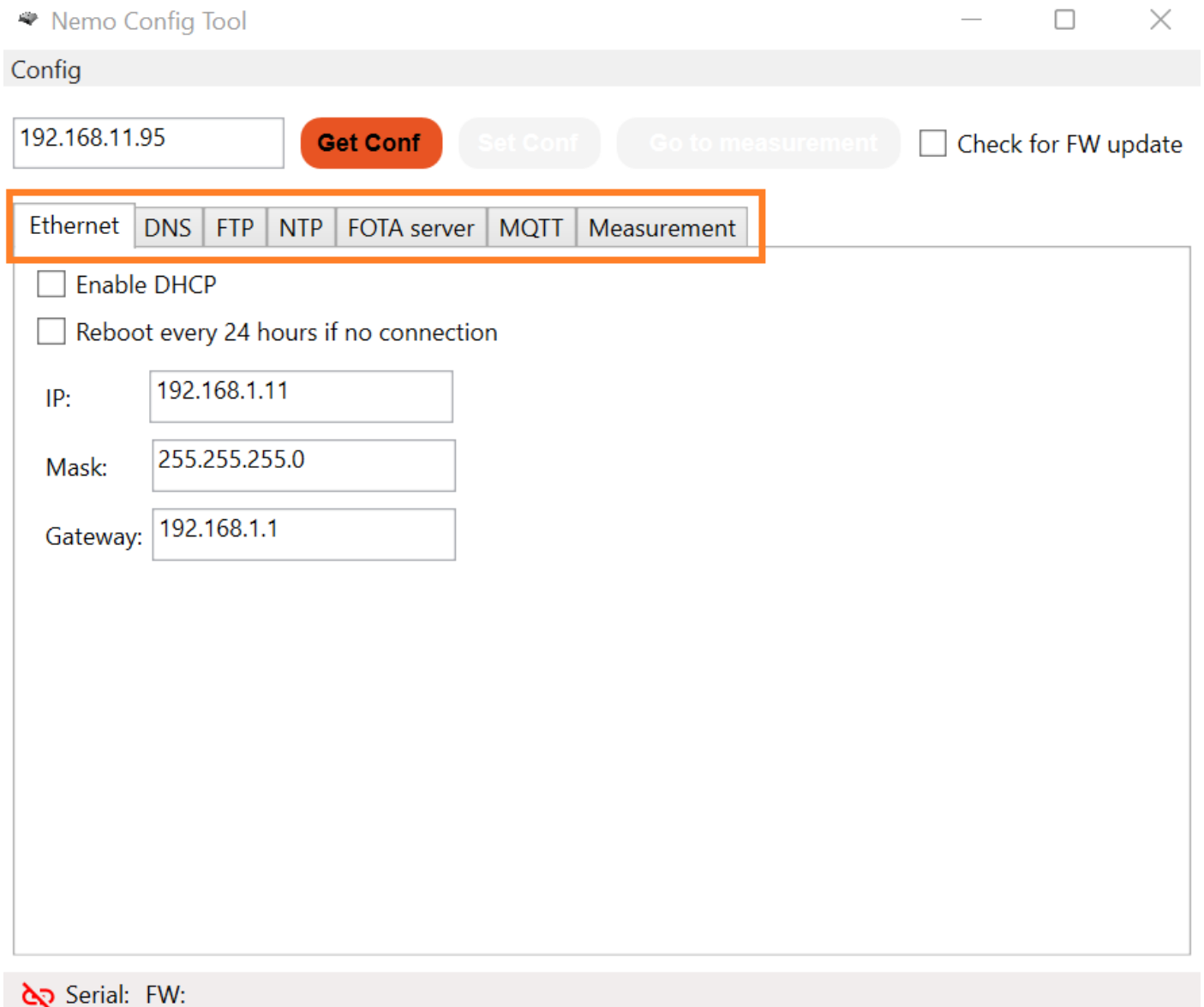
Serial: DA22334361 FW: 1.8.2.2208301919.133cc89adc2aee65bad36c5c8e027e307bcb4856.1661881190

In the top left corner the static (hard coded) IP of the HTTP server running on the NEMOSENSE device is displayed. It can only be accessed during configuration mode:

- default configuration HTTP server IP: **192.168.11.95**



Note the following tabs in the config tool: Ethernet, DNS, FTP, NTP, FOTA server, MQTT and Measurement. Those tabs allow you to select the settings of the NEMOSENSE device **which will apply when the device is in measurement mode**.



Nemo Config Tool

Config

192.168.11.95 **Get Conf** Set Conf Go to measurement ☐ Check for FW update

Ethernet DNS FTP NTP FOTA server MQTT Measurement

☐ Enable DHCP

☐ Reboot every 24 hours if no connection

IP: 192.168.1.11

Mask: 255.255.255.0

Gateway: 192.168.1.1

Serial: FW:

The **Ethernet tab** offers the ability to set the device to have a static or dynamic (DHCP) IP. It also offers the possibility to reboot the device every 24 hours if no connection is available.

The **DNS** tab offers configuration of several DNS servers when the devices are connected to a local network.

The **FTP tab** (File transfer protocol) enables the possibility of transferring .csv files over the FTP protocol. It is a password-protected FTP. It requires the use of a username and password, but the data transfer itself is not encrypted.

The **NTP tab** offers the option to have all the devices connected to the same network synchronized to an NTP server. The IP and the port number of the NTP server need to be defined.

The **FOTA server tab** (Firmware over the air) it offers the option to update the device firmware remotely. IP and Port of the FOTA server need to be defined.

The **MQTT tab** allows the configuration of the MQTT client running on the NEMOSENSE device. The device communicates with the MQTT broker installed on the server. The functionality can be enabled or disabled in the NEMOSENSE config tool app. IP and Port of the MQTT broker need to be defined.

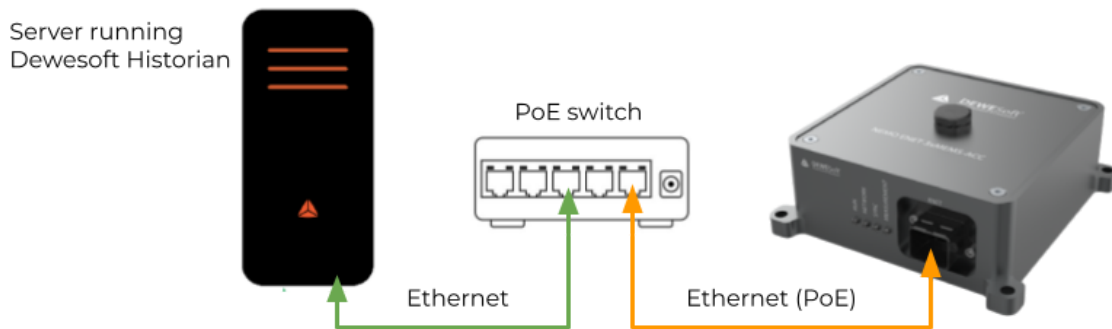
The **Measurement tab** allows the selection of the supported Sample rate (S/s) options. When in measurement mode, the device continuously acquires the data from the sensor at the specified sample rate.

Once the settings are properly set press the **Set Conf** button and then press the **Go To Measurement** button. The device will switch from the configuration mode to the operational mode. Configuration of the device is no longer available.

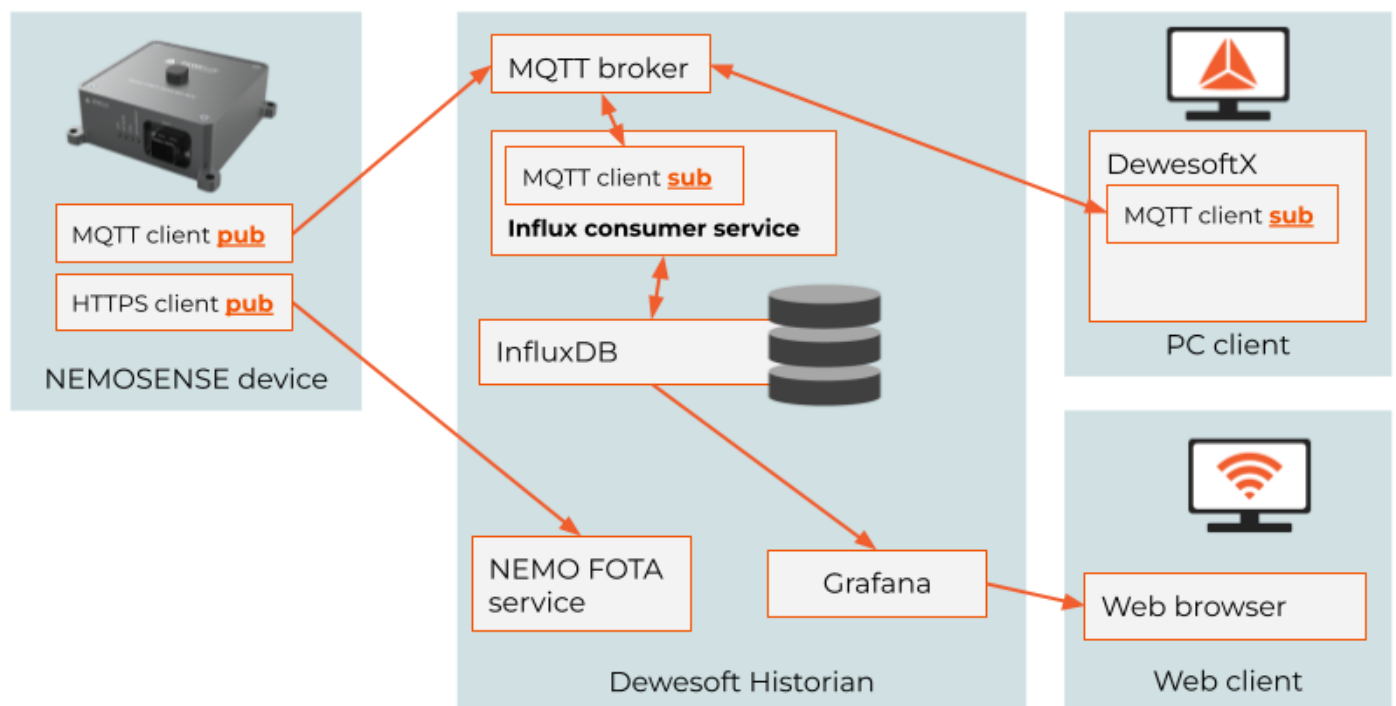
If you need to reconfigure the device using the Config Tool app, the device needs to be restarted (i.e. power-cycled) to enter the configuration mode.

## Operational mode (measurement)

When the device is in operational mode, the configuration HTTP server is not active anymore. The device operates as a TCP/IP device with the IP as defined in the Ethernet settings. This can be either a fixed IP or DHCP.



Connection diagram of NEMOSENSE device in operational / measurement mode



Communication block diagram of NEMOSENSE device in measurement mode connected to Dewesoft Historian

When in measurement mode, the device continuously acquires the data from the sensor at the specified sample rate. The data is saved to a data file (.csv) in internal memory every 10 minutes. After each file is complete, it is sent to the server either over FTP or MQTT.

If the connection to the server is lost, the device will transmit the files when the connection is available. The oldest files are always transmitted first. The device will gradually transmit all old files and catch up to transmit the latest files. The files on the internal memory are only overwritten when the memory is full.

(with a standard 16 GB memory this occurs after approximately 1 month of measurement at up to 125 S/s).

## Synchronization

The device supports NTP synchronization. The devices are synced at production time to the factory NTP server. Even when powered off, there is a very precise RTC clock on the device that keeps track of the time. Therefore when the device is powered up again, it will have reasonably accurate absolute time.

If the NTP time is available at the start of the measurement mode (i.e. the device can reach the NTP server that is configured), it will immediately jump-sync its time to the NTP time and start the measurement.

If the device cannot reach the NTP server, it will start the measurement without additional synchronization. If the NTP server is reached later on during the measurement, the device will compare its time to the NTP time and the following will occur:

- If the time difference is less than 10 seconds, the device will gradually steer its clock to the NTP time and the measurement will not stop
- If the time difference is more than 10 seconds, the device will restart the measurement in jump-sync its clock to the NTP time

When the NTP time is available, the device continuously steers its clock to the NTP time. The sync difference between NEMOSENSE devices on the same network with a local NTP server is typically within 10 ms. This value depends mainly on the latency of the network.

## Meaning of LEDs

There are four LEDs on the front panel of the NEMOSENSE device next to the RJ45 connector.

1. RUN LED (orange)

When on, it Indicates that the device is powered and running.

2. NETWORK LED (blue)

The LED communicates an error code by flashing 1-time, 2-times, 3-times etc. according to the plan below. Example: if there are NTP and FOTA server errors, the LED will flash 3-times, then stay off for a second, and flash 4-times. The pattern will repeat indefinitely.

- a. LED is on: all network functions operate correctly
- b. LED flashes once: no TCP/IP connection to the server
- c. LED flashes twice: no FTP / MQTT connection to the server
- d. LED flashes three times: no NTP connection
- e. LED flashes four times: no connection to FOTA server

3. SYNC LED (red)

In normal operation the LED will flash every three seconds. The flash is synced to the absolute clock of the device. This means that two devices should blink at the same time if they are synced and the flashing of the SYNC LED can indicate to the user if a group of devices is synced together or not.

If the SYNC led is ON permanently, this indicates an internal error. Device needs to be power-cycled and it is strongly suggested that the user contacts Dewesoft support.

4. MEASUREMENT LED (green)

When on, it indicates that the device is measuring and storing the data to the SD card.

## MQTT topics and payloads

NEMOSENSE device can send data over MQTT to a specified broker. The topics and payloads are defined by the [SparkPlugB](#) specification. By the specification NEMOSENSE is defining strings for a groupID, nodeID and a deviceID. The groupID is fixed and is a string with the value "Dewesoft", the nodeID is also fixed and has a value of "NemoNode". The last string for deviceID is set to the *serial number* of NEMOSENSE.

An example of the topic that would be used for NEMOSENSE with serial number DA12345678 to send data would be: *spBv1.0/Dewesoft/DDATA/NemoNode/DA12345678*

For sending data NEMOSENSE defines 3 types of metrics and all three are of type Dataset. This simply just means that the data is sent as an encoded data table.

The first metric is for sending the accelerometer measurements of NEMOSENSE. As mentioned this metric is of type Dataset and sends data as a table with four columns called

- "ACC\_X",
- "ACC\_Y",
- "ACC\_Z",
- "Timestamp"

The first three columns are the actual measurements of type double precision and the last one is the UTC timestamp from the moment when the measurement was taken, this value is of type UINT64.

Example of such a metric is shown below. Note that this example uses JSON for easier representation, but the actual payload is binary encoded:

```
{
  "timestamp": 1655984340,
  "metrics": [{
    "name": "Direct",
    "alias": 0,
    "timestamp": 1655984340,
    "dataType": "DataSet",
    "hasMetadata": false,
    "metadata": {
    }
    "dataset": {
      "numOfColumns": 4,
      "columns": [
        "ACC_X",
```

```
        "ACC_Y",
        "ACC_Z",
        "Timestamp"
    ],
    "types": [
        "Double",
        "Double",
        "Double",
        "UINT64"
    ],
    "rows": [[
        1.30,
        2.3,
        4.5,
        1655984320
    ], [
        1.30,
        2.3,
        4.5,
        1655984330
    ]]
    }
}
},
"seq": 22
}
```

The second metric is used for sending diagnostics data from NEMOSENSE for this the following columns are used:

- "ACC\_IS\_SAMPLING\_SESSION\_ACTIVE",
- "ACC\_SAMPLING\_SESSION\_START\_TIME\_us",
- "ACC\_UNIX\_TIMESTAMP\_ERR\_RAW\_us",
- "ACC\_UNIX\_TIMESTAMP\_ERR\_FILTERED\_us",
- "ACC\_SAMPLING\_FREQ\_TUNNING\_VAL\_ppm",
- "ETH\_IS\_CONNECTION\_OK",
- "ETH\_NO\_CONNECTION\_TIME\_min",
- "FTP\_IS\_CONNECTION\_OK",
- "MAIN\_HEAP\_CURRENT\_SIZE\_bytes",

- "MAIN\_HEAP\_RESERVED\_SIZE\_bytes",
- "MQTT\_IS\_CONNECTION\_OK",
- "MQTT\_LAST\_FILE\_SENDING\_TIME\_sec",
- "NTP\_IS\_CONNECTION\_OK",
- "NTP\_LAST\_RX\_NTP\_UNIX\_TIME\_us",
- "SD\_NUM\_OF\_FILES",
- "Timestamp"

All these columns are of type double precision except the last one which is UINT64.

Example of such a metric is shown. Note that this example uses JSON for easier representation but the actual payload is binary encoded:

```
{
  "timestamp": 1655984340,
  "metrics": [{
    "name": "Direct",
    "alias": 0,
    "timestamp": 1655984340,
    "dataType": "DataSet",
    "hasMetadata": false,
    "metadata": {
    }
    "dataset": {
      "numOfColumns": 4,
      "columns": [
        "ACC_IS_SAMPLING_SESSION_ACTIVE",
        "ACC_SAMPLING_SESSION_START_TIME_us",
        "ACC_UNIX_TIMESTAMP_ERR_RAW_us",
        "ACC_UNIX_TIMESTAMP_ERR_FILTERED_us",
        "ACC_SAMPLING_FREQ_TUNNING_VAL_ppm",
        "ETH_IS_CONNECTION_OK",
        "ETH_NO_CONNECTION_TIME_min",
        "FTP_IS_CONNECTION_OK",
        "MAIN_HEAP_CURRENT_SIZE_bytes",
        "MAIN_HEAP_RESERVED_SIZE_bytes",
        "MQTT_IS_CONNECTION_OK",
        "MQTT_LAST_FILE_SENDING_TIME_sec",
        "NTP_IS_CONNECTION_OK",
        "NTP_LAST_RX_NTP_UNIX_TIME_us",
        "SD_NUM_OF_FILES",
        "Timestamp"
      ]
    }
  ]
}
```

```
],  
  "types": [  
    "Double",  
    "Double",  
    "Double",  
    "Double",  
    "Double",  
    "Double",  
    "Double",  
    "Double",  
    "Double",  
    "Double",  
    "Double",  
    "Double",  
    "Double",  
    "Double",  
    "Double",  
    "UINT64"  
  ],  
  "rows": [[  
    1.30,  
    2.3,  
    4.5,  
    1.30,  
    2.3,  
    4.5,  
    1.30,  
    2.3,  
    4.5,  
    1.30,  
    2.3,  
    4.5,  
    1.30,  
    2.3,  
    4.5,  
    1655984320  
  ], [  
    1.30,
```



```

        2.3,
        4.5,
        1.30,
        2.3,
        4.5,
        1.30,
        2.3,
        4.5,
        1.30,
        2.3,
        4.5,
        1.30,
        2.3,
        4.5,
        1655984330
    ]]
}
}
}],
"seq": 22
}

```

The last metric is used to send temperature measurements taken by NEMOSENSE. This metric contains only two columns: one for the temperature measurement called “ACC\_TEMPERATURE\_degC” and the second column for the timestamp in UTC when the measurement was taken.

Example of such a metric is shown below. Note that this example uses JSON for easier representation but the actual payload is binary encoded:

```

{
  "timestamp": 1655984340,
  "metrics": [{
    "name": "Direct",
    "alias": 0,
    "timestamp": 1655984340,
    "dataType": "DataSet",
    "hasMetadata": false,
    "metadata": {
    }
    "dataset": {
      "numOfColumns": 4,

```

```
        "columns": [
            "ACC_X",
            "Timestamp"
        ],
        "types": [
            "Double",
            "UINT64"
        ],
        "rows": [[
            45.5,
            1655984320
        ]]
    }
}
}],
"seq": 22
}
```

## 4. Specifications

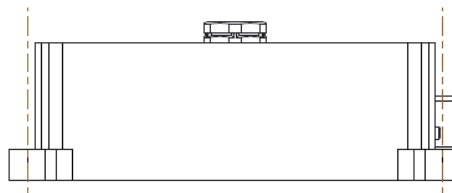
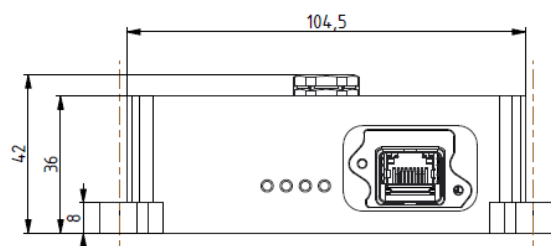
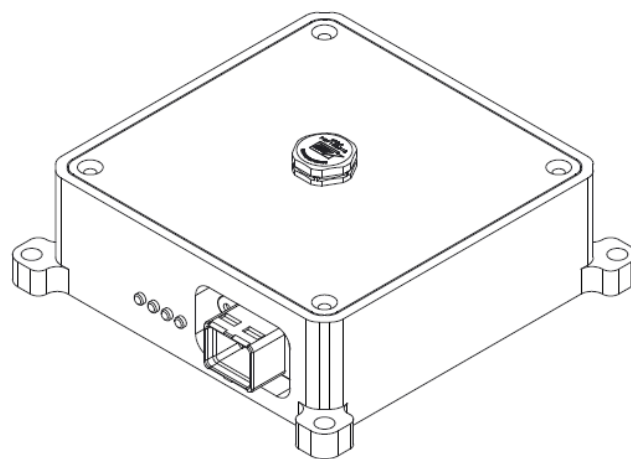
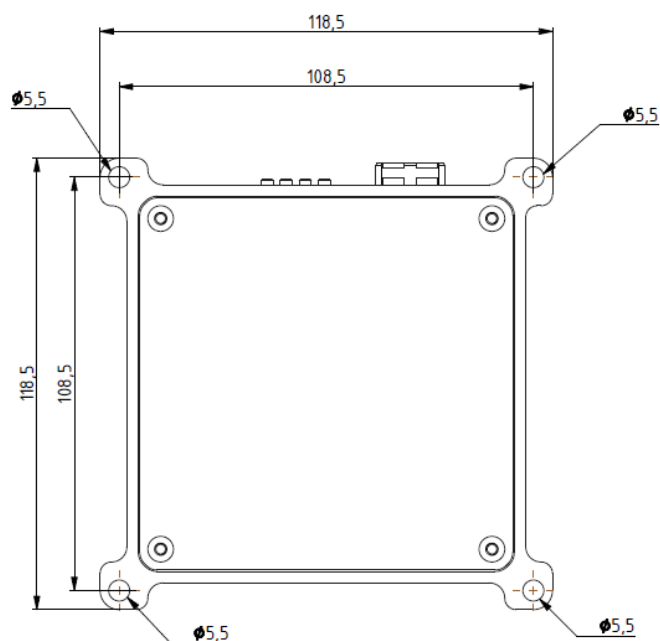
### General device specifications: NEMOSENSE

	NEMOSENSE
Physical interface	Ethernet
Connector	RJ45 Harting push-pull
Internal storage	16 GB memory
Data file formats	CSV
Data transfer protocols	MQTT, FTP
Device management protocols	MQTT, HTTPS
Synchronization	NTP
Synchronization delay	10 ms (LAN)
Power supply	48 V PoE
Power consumption	1.3 W
Operating temperature	-20..60 °C
Storage temperature	-20..60 °C
IP rating	IP67
Dimensions	119 x 119 x 42 mm
Weight	500 g
Rev: 1593518446	

## Measurement specifications: 3xMEMS-ACC

NEMOSENSE	3xMEMS-ACC		
	Min.	Typ.	Max.
Measurement ranges		+2 g	
-3 dB bandwidth at 31.25 S/s		6 Hz	
Sample rate	31.25 S/s		125 S/s
Dynamic range		96 dB	
Noise density (lowest range)		25 $\mu\text{g}/\sqrt{\text{Hz}}$	
Residual noise (+2 g range, 6 Hz bandwidth)		50 $\mu\text{g}$ RMS	
Calibrated offset error		+4 mg	
Calibrated gain error		+0.2 %	
Offset temperature drift (-20 .. 60 degC)	-0.15 mg / degC	+0.02 mg / degC	0.15 mg / degC
Sensitivity temperature drift (-20 .. 60 degC)		+0.01 % / degC	
Linearity error (smallest range)		0.1 % FS	
Crossaxis sensitivity		1 %	

## Dimensional drawing: NEMOSENSE-3xMEMS-ACC



## About this document

This is the users manual for NEMOSENSE device family.

### Legend

The following symbols and formats will be used throughout the document.



#### Important

It gives you important information about the subject.  
Please read carefully!



#### Hint

It gives you a hint or provides additional information about a subject.



#### Example

Gives you an example of a specific subject.

### Online versions

#### Device Technical Reference Manual

The most recent version of this manual can be downloaded from our homepage:

<https://downloads.dewesoft.com/manuals/dewesoft-nemosense-technical-reference-manual-en.pdf>

In the *Hardware Manuals* section click the download link for the *Device® technical reference manual*.

#### DEWESoft® User Manual (Not Yet Supported with NEMOSENSE)

The DEWESoft® User Manual document provides basics and additional information and examples for working with DEWESoft® and certain parts of the program.

The latest version of the DEWESoft® tutorials can be found here:

<https://download.dewesoft.com/list/manuals-brochures/software-manuals>

In the Software Manuals section click the download link of the DEWESoft X User Manual entry.

## Warranty information

### Notice

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The copy of the specific warranty terms applicable to your Dewesoft product and replacement parts can be obtained from your local sales and service office. To find a local dealer for your country, please visit <https://dewesoft.com/support/distributors>.

## Calibration

Every instrument needs to be calibrated at regular intervals. The standard norm across nearly every industry is annual calibration. Before your Dewesoft data acquisition system is delivered, it is calibrated. Detailed calibration reports for your Dewesoft system can be requested. We retain them for at least one year, after system delivery.

## Support

Dewesoft has a team of people ready to assist you if you have any questions or any technical difficulties regarding the system. For any support please contact your local distributor first or Dewesoft directly.

Dewesoft d.o.o.  
Gabrsko 11a  
1420 Trbovlje Slovenia

Europe Tel.: +386 356 25 300  
Web: <http://www.dewesoft.com>  
Email: [Support@dewesoft.com](mailto:Support@dewesoft.com)  
The telephone hotline is available Monday to Friday from 07:00 to 16:00 CET (GMT +1:00)

## Service/repair

The team of Dewesoft also performs any kinds of repairs to your system to assure a safe and proper operation in the future. For information regarding service and repairs please contact your local distributor first or Dewesoft directly on <https://dewesoft.com/support/rma-service>.

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## Printing History

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# Safety instructions

Your safety is our primary concern! Please be safe!

## Safety symbols in the manual



### Warning

Calls attention to a procedure, practice, or condition that could cause the body injury or death



### Caution

Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

## General Safety Instructions



### Warning

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Dewesoft d.o.o. assumes no liability for the customer's failure to comply with these requirements.

All accessories shown in this document are available as an option and will not be shipped as standard parts.



## Environmental Considerations

Information about the environmental impact of the product.

## Product End-of-Life Handling

Observe the following guidelines when recycling a Dewesoft system:

## System and Components Recycling

Production of these components required the extraction and use of natural resources. The substances contained in the system could be harmful to your health and to the environment if the system is improperly handled at its end of life! Please recycle this product in an appropriate way to avoid unnecessary pollution of the environment and to keep natural resources.



This symbol indicates that this system complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). Please find further information about recycling on the Dewesoft web site [www.dewesoft.com](http://www.dewesoft.com)



Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment and is outside the scope of the 2002/95/EC RoHS Directive. However, we take care of our environment and the product is lead-free.

## General safety and hazard warnings for all Dewesoft systems

Safety of the operator and the unit depend on following these rules.

- Use this system under the terms of the specifications only to avoid any possible danger.
- Read your manual before operating the system.
- Observe local laws when using the instrument.
- DO NOT touch internal wiring!
- DO NOT use higher supply voltage than specified!
- Use only original plugs and cables for harnessing.
- You may not connect higher voltages than rated to any connectors.
- The power cable and connector serve as Power-Breaker.
- Maintenance must be executed by qualified staff only.
- During the use of the system, it might be possible to access other parts of a more comprehensive system. Please read and follow the safety instructions provided in the manuals of all other components regarding warning and security advice for using the system.
- With this product, only use the power cable delivered or defined for the host country.
- DO NOT connect or disconnect sensors, probes or test leads, as these parts are connected to a voltage supply unit.
- Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), a non-interruptible safety earth ground must be provided from the mains power source to the product input wiring terminals.
- Please note the characteristics and indicators on the system to avoid fire or electric shocks. Before connecting the system, please read the corresponding specifications in the product manual carefully.

- The inputs must not, unless otherwise noted (CATx identification), be connected to the main circuit of category II, III and IV.
- The power cord separates the system from the power supply. Do not block the power cord, since it has to be accessible for the users.
- DO NOT use the system if equipment covers or shields are removed.
- If you assume the system is damaged, get it examined by authorized personnel only.
- Adverse environmental conditions are Moisture or high humidity Dust, flammable gases, fumes or dissolver Thunderstorm or thunderstorm conditions (except assembly PNA) Electrostatic fields, etc.
- The measurement category can be adjusted depending on module configuration.
- Any other use than described above may damage your system and is attended with dangers like short-circuiting, fire or electric shocks.
- The whole system must not be changed, rebuilt or opened.
- DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until the safe operation can be verified by service-trained personnel. If necessary, return the product to Dewesoft sales and service office for service and repair to ensure that safety features are maintained.
- If you assume a more riskless use is not provided anymore, the system has to be rendered inoperative and should be protected against inadvertent operation. It is assumed that a more riskless operation is not possible anymore if the system is damaged obviously or causes strange noises. The system does not work anymore. The system has been exposed to long storage in adverse environments. The system has been exposed to heavy shipment strain.
- Warranty void if damages caused by disregarding this manual. For consequential damages, NO liability will be assumed!
- Warranty void if damage to property or persons caused by improper use or disregarding the safety instructions.
- Unauthorized changing or rebuilding the system is prohibited due to safety and permission reasons (CE).
- Be careful with voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a perilous electric shock by touching the wiring.
- The product heats during operation. Make sure there is adequate ventilation. Ventilation slots must not be covered!
- Only fuses of the specified type and nominal current may be used. The use of patched fuses is prohibited.
- Prevent using metal bare wires! Risk of short circuit and fire hazard!
- DO NOT use the system before, during or shortly after a thunderstorm (risk of lightning and high energy over-voltage). An advanced range of application under certain conditions is allowed with therefore designed products only. For details please refer to the specifications.
- Make sure that your hands, shoes, clothes, the floor, the system or measuring leads, integrated circuits and so on, are dry.
- DO NOT use the system in rooms with flammable gases, fumes or dust or in adverse environmental conditions.
- Avoid operation in the immediate vicinity of high magnetic or electromagnetic fields, transmitting antennas or high-frequency generators, for exact values please refer to enclosed specifications.
- Use measurement leads or measurement accessories aligned with the specification of the system only. Fire hazard in case of overload!

- Lithium ion batteries are classified as not hazardous when used according to the recommendations of the manufacturer described in Battery Safety Data Sheet, which is available for download from [this link](#).
- Do not switch on the system after transporting it from a cold into a warm room and vice versa. The thereby created condensation may damage your system. Acclimatise the system unpowered to room temperature.
- Do not disassemble the system! There is a high risk of getting a perilous electric shock. Capacitors still might be charged, even if the system has been removed from the power supply.
- The electrical installations and equipment in industrial facilities must be observed by the security regulations and insurance institutions.
- The use of the measuring system in schools and other training facilities must be observed by skilled personnel.
- The measuring systems are not designed for use in humans and animals.
- Please contact a professional if you have doubts about the method of operation, safety or the connection of the system.
- Please be careful with the product. Shocks, hits and dropping it from already- lower level may damage your system.
- Please also consider the detailed technical reference manual as well as the security advice of the connected systems.
- This product has left the factory in safety-related flawlessness and in proper condition. In order to maintain this condition and guarantee safety use, the user has to consider the security advice and warnings in this manual.

#### EN 61326-3-1:2008

IEC 61326-1 applies to this part of IEC 61326 but is limited to systems and equipment for industrial applications intended to perform safety functions as defined in IEC 61508 with SIL 1-3.

The electromagnetic environments encompassed by this product family standard are industrial, both indoor and outdoor, as described for industrial locations in IEC 61000-6-2 or defined in 3.7 of IEC 61326-1.

Equipment and systems intended for use in other electromagnetic environments, for example, in the process industry or in environments with potentially explosive atmospheres, are excluded from the scope of this product family standard, IEC 61326-3-1.

Devices and systems according to IEC 61508 or IEC 61511 which are considered as “operationally well-tried”, are excluded from the scope of IEC 61326-3-1.

Fire-alarm and safety-alarm systems, intended for the protection of buildings, are excluded from the scope of IEC 61326-3-1.

## Documentation version history

Version	Date	Notes
V22-1	2022-06-07	Initial version
V22-2	2022-08-29	Functional description, LEDs
V23-1	2023-01-23	Quick start guide, diagrams
V23-2	2023-02-22	MQTT topics added
V23-3	2023-12-12	Links to config tool, manual updated