Inveo Sp. z o.o.

Nano Digital In

Instruction Manual

Overview

Warning

This manual applies only to the firmware version v1.42 onwards. Inveo does not guarantee that the information contained in this document applies to previous firmware revisions.



Purpose of the device

Nano Digital Input is designed to monitor the status of inputs in various automation systems.

Its main function is to enable remote readout of input state via various communication methods such as LAN, built-in webpage, HTTP GET protocol, Modbus TCP, SNMP, MQTT, TCP/UDP or appropriate software. This provides the user with various tools for interacting with the device and readout of the input state, making it a universal solution for monitoring and control in various environments.

Changelog

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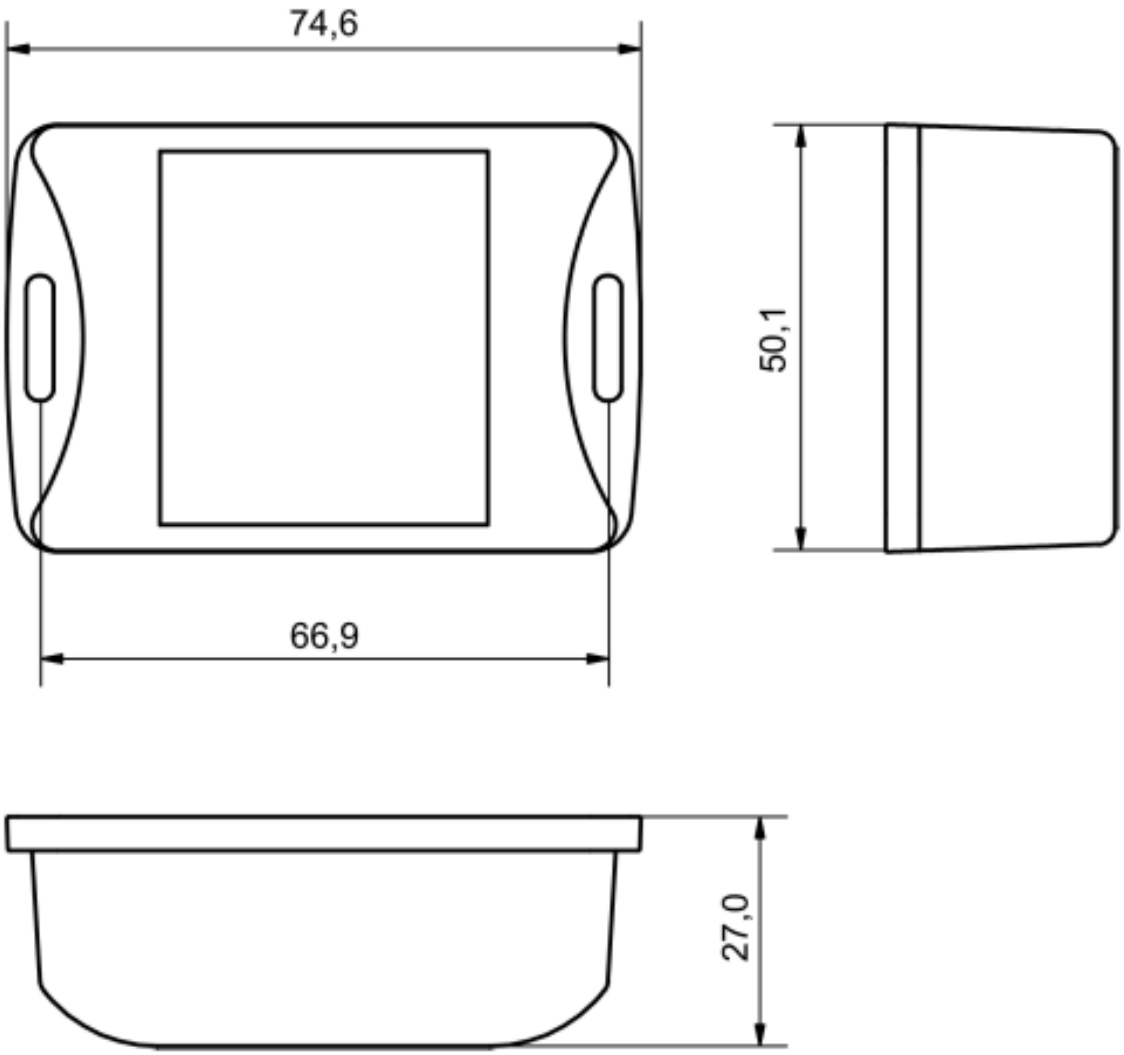
Device construction

Nano Digital Input PoE

Technical characteristics

Parameter	Description
Power supply	Two power supply methods are available: **10-24V DC:** with a 3,5mm pluggable terminal block **PoE:** 33-57V PoE IEEE 802.3af
Power consumption	1,5W
Input	1 input **Input type:** NO, **Maximum counter value:** 4 294 967 296, **Maximum input frequency:** 1000 Hz
Communication	Ethernet 10Mbps Half Duplex, RJ45
Enclosure ingress protection	IP30
Weight	ca. 65g (2,3oz)

Dimensions



Information

All dimensions are in millimeters.

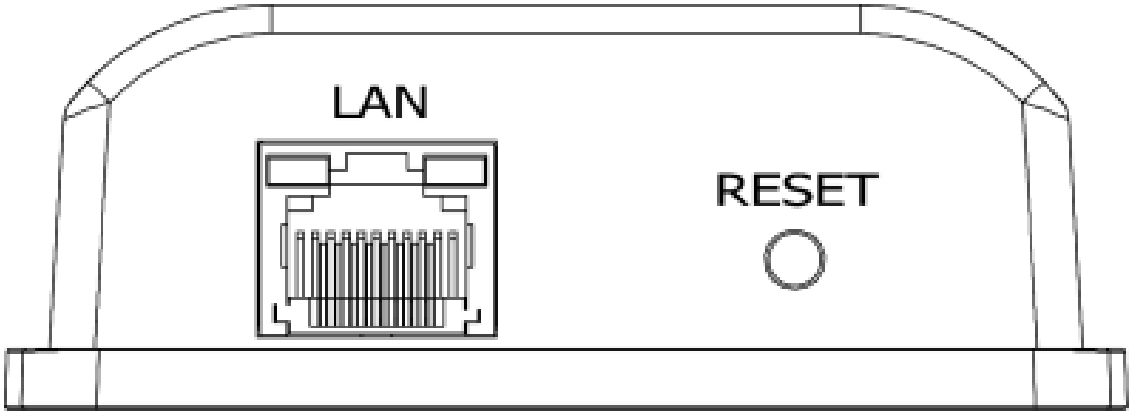
General characteristics



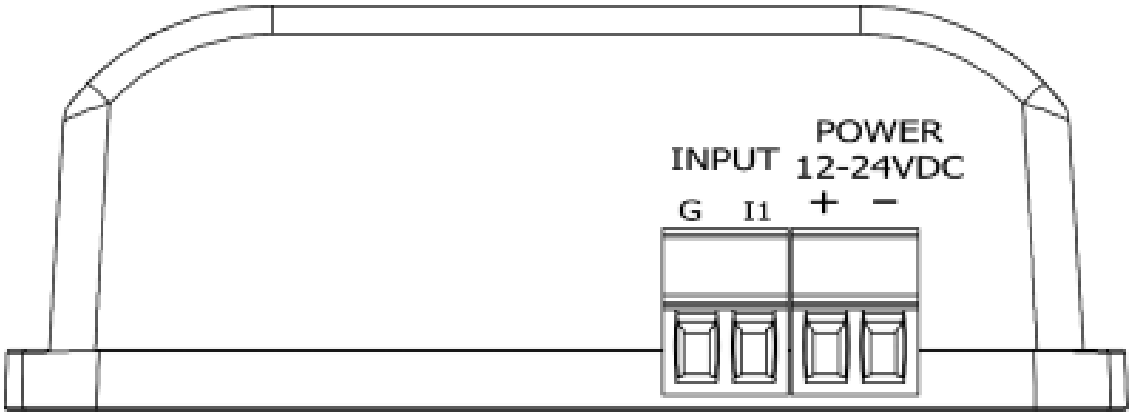
The device is equipped with a 7-segment LED display, on which the current input state can be shown (ON or OFF). The following communication options are available:

- Built-in WWW server, available from a standard web browser (Mozilla Firefox, Opera, Google Chrome are preferred),
- Windows/Linux command line programs,
- HTTP GET,
- Modbus TCP,
- SNMP,
- Own application via TCP (shared protocol),
- Inveo MQTT protocol.

Module connectors description



- **LAN** – LAN and PoE IEEE 802.3af,
- **RESET** – Button used to enable DHCP, check the current IP address and restore the module to factory settings.



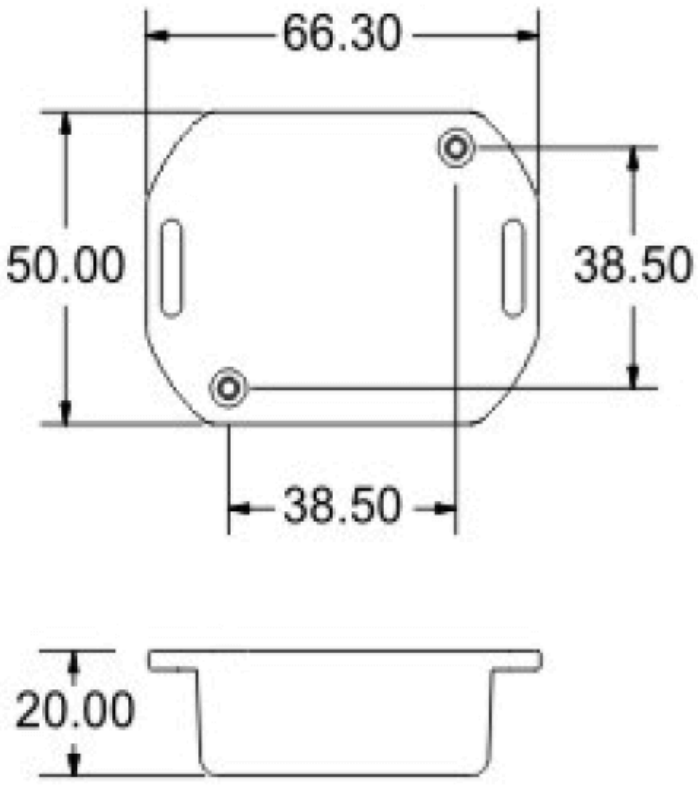
- **INPUT** – NO input,
- **POWER** – Additional power connector when PoE is unavailable. Power supply voltage: 12-24V DC.

Nano Digital Input

Technical data

Parameter	Description
Power supply	**Passive PoE:** 10-24V DC with a PoE adapter
Power consumption	1,5W
Input	1 input **Input type:** NO, **Maximum counter value:** 4 294 967 296, **Maximum input frequency:** 1000 Hz
Communication	Ethernet 10Mbps Half Duplex, RJ45
Enclosure ingress protection	IP30
Weight	ca. 40g (1,4oz)

Dimensions



General characteristics



The module is equipped with LED indicators that indicate power supply and input state.

The following communication options are available:

- Built-in WWW server, available from a standard web browser (MOZILLA FIREFOX, OPERA, CHROME are the preferred browsers),
- Windows/Linux command line programs,
- HTTP GET,
- Modbus TCP,
- SNMP,
- Own application via TCP (shared protocol),
- Inveo MQTT protocol.

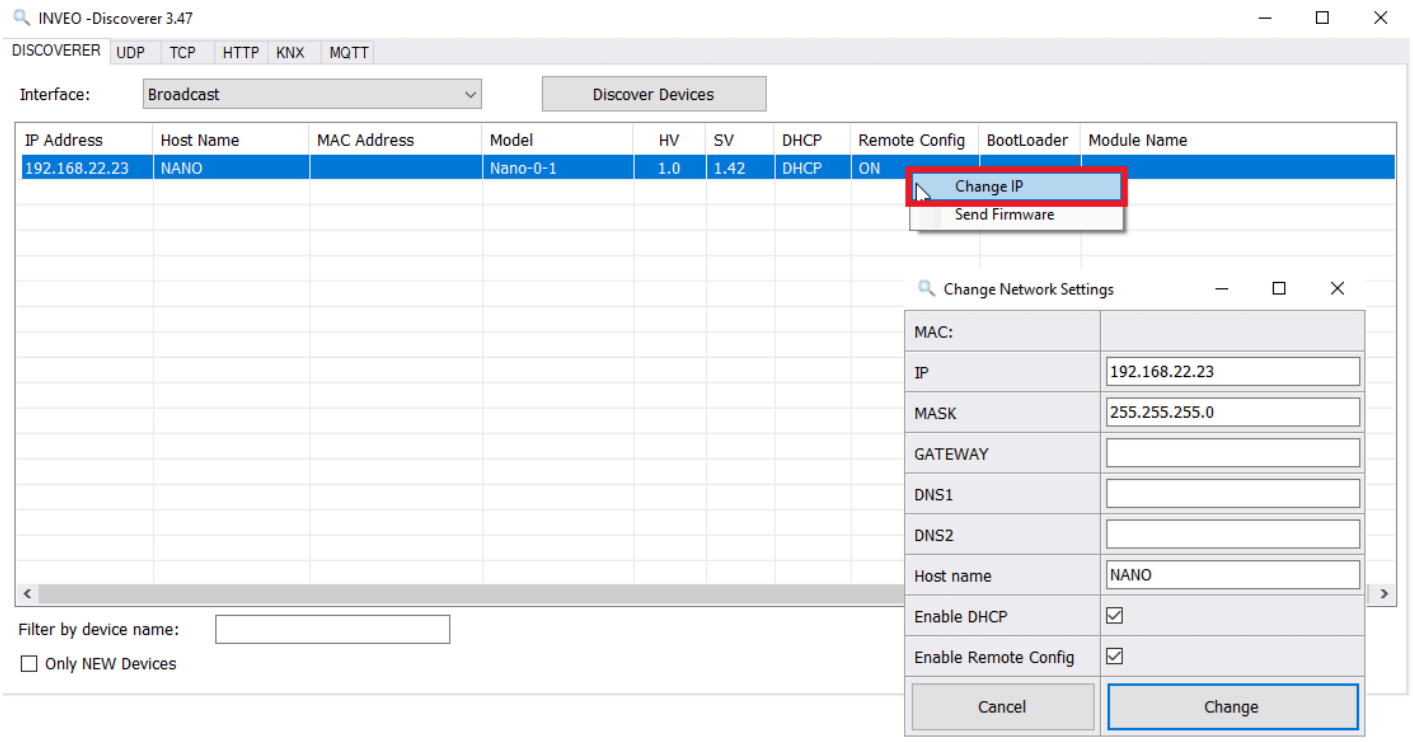
Module connectors description

- **LAN** – LAN and Passive PoE,
- **RESET** – Button used to enable DHCP and restore the module to factory settings,
- **INPUT** – NO input.

Network configuration

> **Warning**
>
> **After the initial power-up, it's needed to configure the device. It can be done in two ways, the simplest method is to use the Inveo Discoverer programme.**

Changing the device's IP address - Discoverer programme



After running the **Discoverer** programme and searching for the appropriate device:

1. Right-click the device,
2. Click the **Change** button.

After the dialogue window is opened you can:

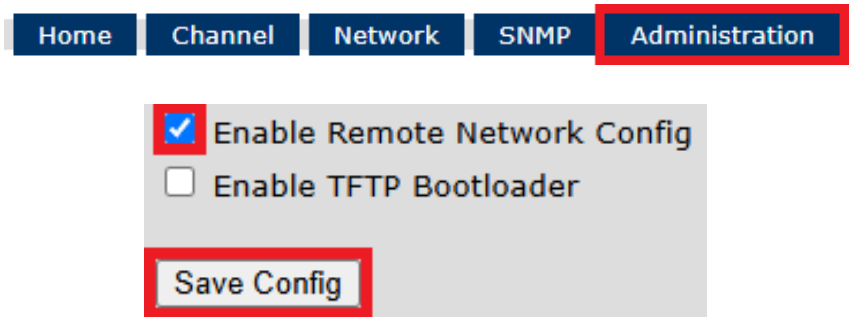
- Set the IP address, mask, gateway, DNS1/DNS2.
- Change the Host name.

> **Note**
>
> **The device will be configured after the Change button is pressed.**

If **Remote Config** is disabled (enabled by default), the device needs to be configured by changing the computer's subnet:

To enable remote configuration:

1. Go to the **Administration** tab,
2. Select **Enable Remote Config**.



> **Tip**
>
> **After making changes, apply them using the Save button**

Changing the computer's subnet address for configuration

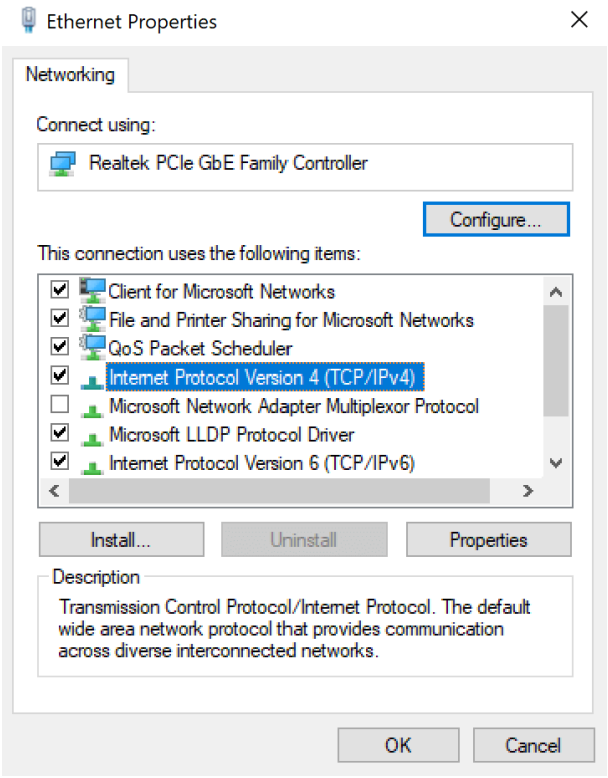
During configuration without **Discoverer** programme, it's needed to change the subnet address of the computer on the same network.

To access the computer's network configuration, do one of the following:

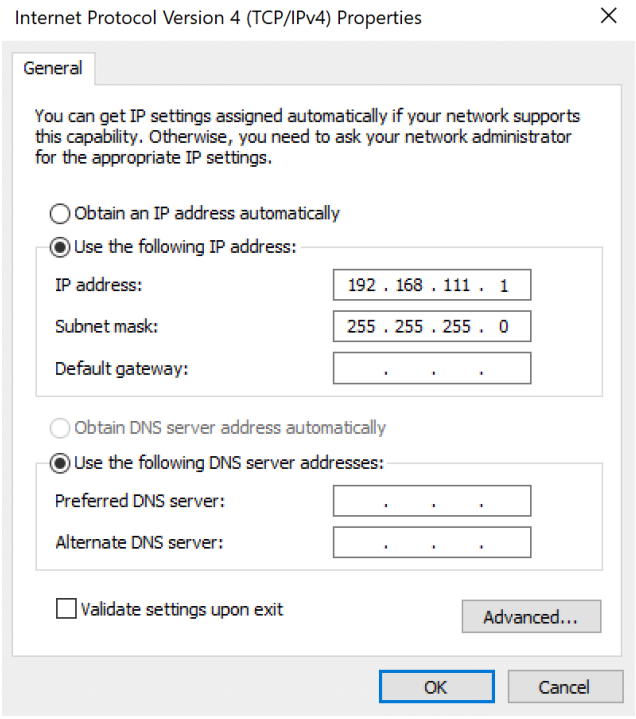
- Press **Win + R**, type in `ncpa.cpl`, and then press **Enter**.
- Alternatively, go to: **Start** → **Control Panel** → **Network and Internet** → **Network and sharing center** → **Change adapter settings**.

Then:

1. Select the network connection.
2. Right-click it and select **Properties**.
3. After selecting this option, network connection configuration screen will appear.



Select **Internet protocol version 4 (TCP/IPv4)** and type in the following parameters:

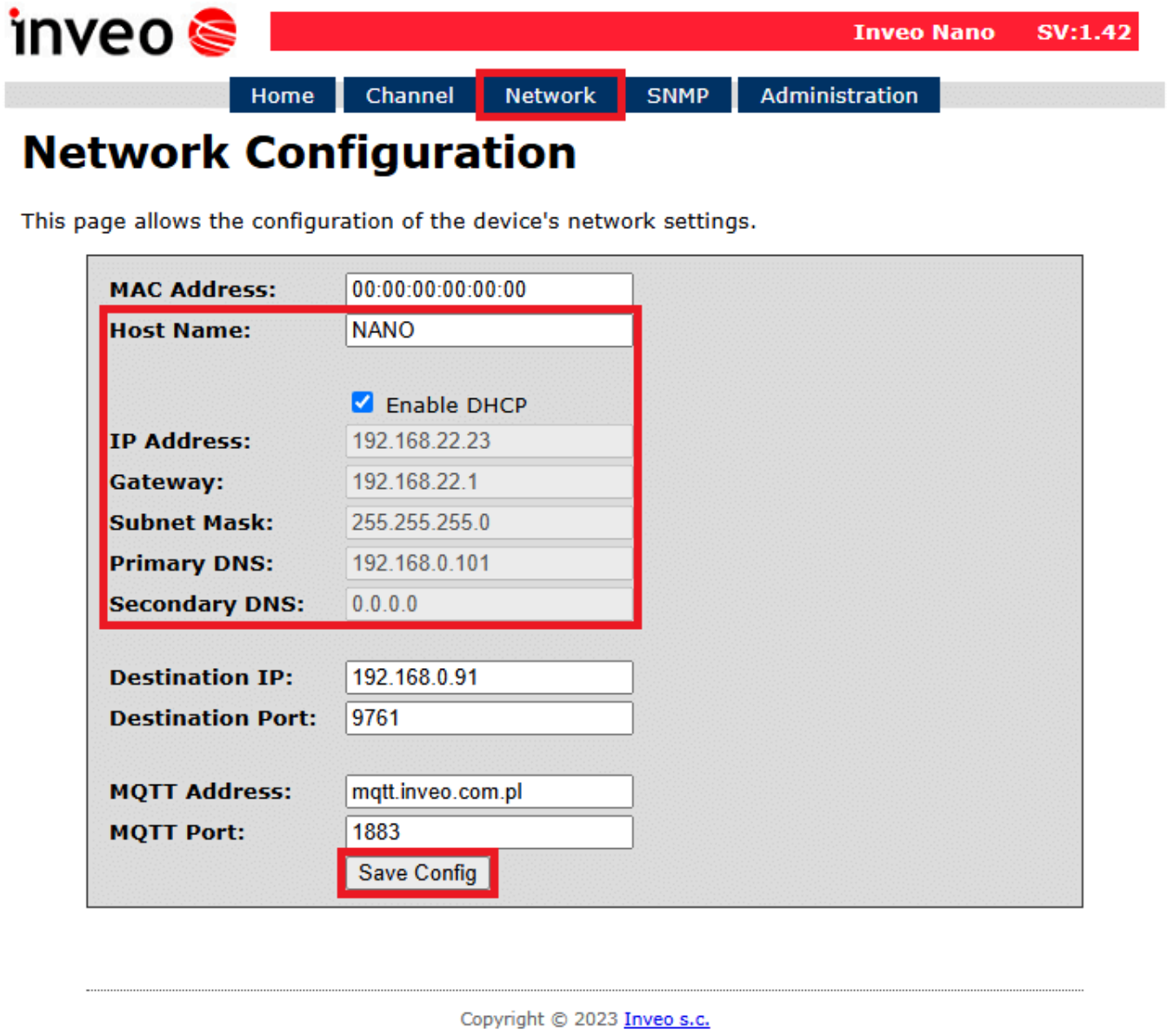


Note

After applying the configuration with OK, start a web browser and type in the following address: 192.168.111.15. (Default user and password: admin/admin00)

Network settings configuration

The **Network** tab allows the user to change LAN settings.



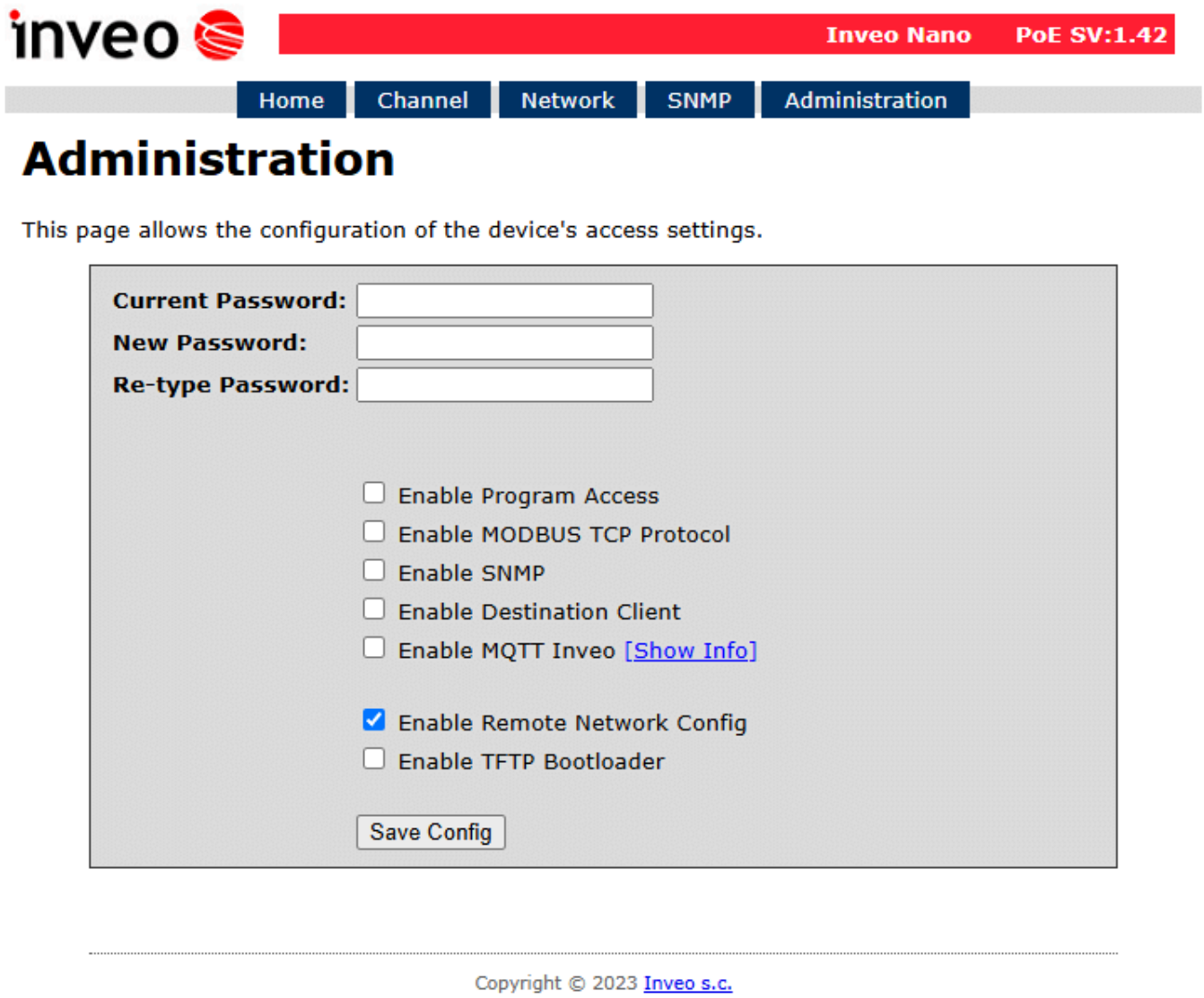
- **Host Name** – NetBios name,
- **DHCP** – Enable the DHCP client; selecting this option forces the use of DHCP assigned IP address,
- **IP Address** – Module IP address,
- **Gateway** – Network gateway,
- **Subnet Mask** – IP subnet mask,
- **DNS1, DNS2** – DNS addresses,
- **Destination IP** – IP address of the module, the input state should be routed to when using M2M communication,
- **Destination Port** – Port, on which the remote device is listening.

Tip

After making changes, apply them using the Save button

Security and services configuration

In **Administration**, active device services and access password can be selected and/or changed.



Changing the password:

To change the password, enter the **Current Password**. Next, type in the new password into the **New Password** and **Re-type Password** fields. Apply the changes with **Save Config**. If you want to remove the password altogether, leave **New Password** empty.

> **Information**
>
> **The maximum password length is 15 characters.**

Services settings:

The device allows selection of services that should be available. To activate the service, select the field next to its name.

- **Enable Program Access** – Enable access by external programs (Windows, Linux) and TCP/IP on port 9761,
- **Enable Modbus TCP Protocol**
- **Enable SNMP**
- **Enable Destination Client** – Forwarding of the input/output states to other modules,
- **Enable MQTT Inveo** – Activate MQTT protocol,
- **Enable Remote Network Config** – (Discoverer programme),
- **Enable TFTP Bootloader**.

> ⚠ **Warning**
>
> **TFTP Bootloader and Remote Network Config should be disabled during normal operation. The settings should only be enabled before firmware update.**

Communication with a module from an external network

If the module is located in a different LAN, port forwarding is required. Depending on the communication method utilized, contact with the network administrator and forwarding of certain ports is needed.

WWW webpage and HTTP protocol:

- TCP port 80

Computer programme or own application:

- TCP port 9761

Modbus TCP:

- TCP port 502

SNMP protocol:

- UDP port 161

Checking the IP address

To check the current device IP address (Nano PoE only):

1. Press and hold the **RESET** button. The screen will display the four groups of an IP address in sequence: eg. 192 168 111 15..
2. After the full address is displayed, release the **RESET** button.

DHCP

To enable or disable DHCP support:

1. Press and hold the **RESET** button for a time between 5 and 10 seconds.

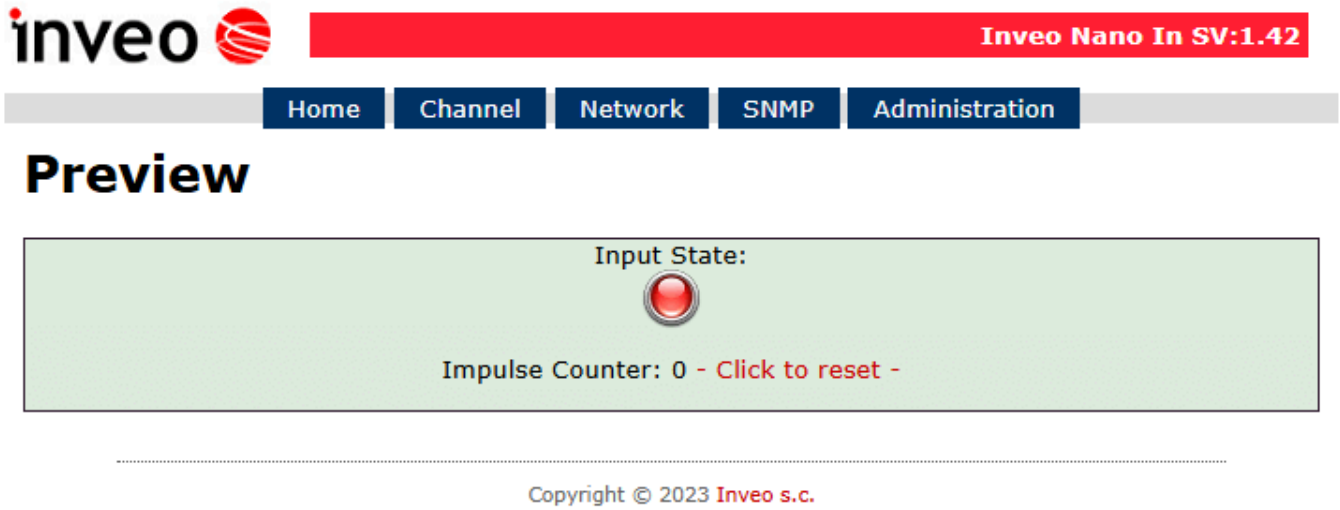
2. The LED will blink about 2 times per second (Nano), the display will show `dhcp` (Nano PoE).
3. Release the **RESET** button.
4. The current DHCP status will be displayed: **On** (enabled) or **Off** (disabled).

DHCP can also be enabled or disabled in the network settings. Access the **Network** tab or use the Discoverer programme.

Device functions

Input state preview

The primary function of Nano Digital Input is checking of the input channel state. The current state can be viewed in the **Home** tab.

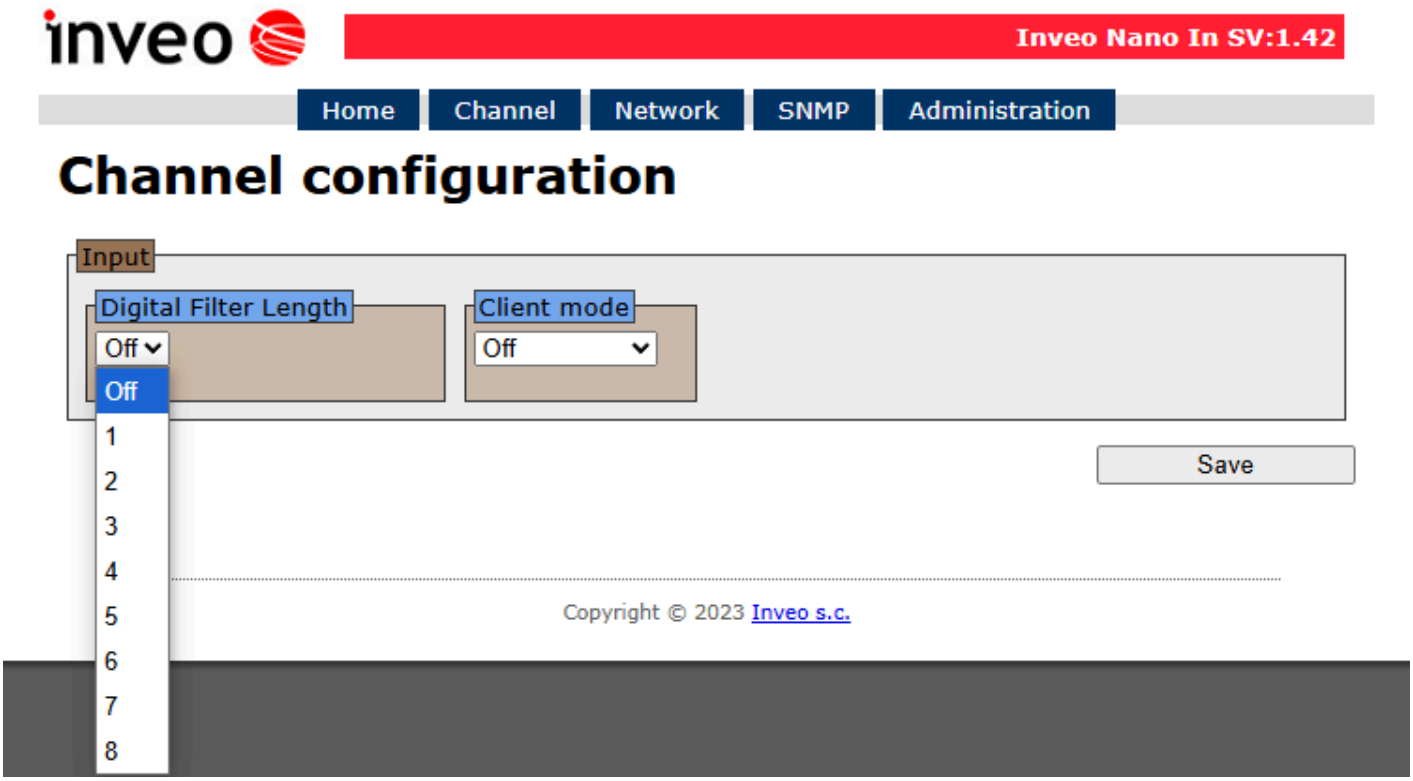


Additionally, the device counts the amount of time it has been activated. The counter can be reset if needed using **Click to reset**.

Input signal filter

Nano Digital Input is equipped with a built-in median filter that improves the readout accuracy. The filter operates in cycles with a 20ms sampling time. In each cycle, the module takes the current state of the input signal and then sorts the 0 and 1 values (low and high state respectively). The median value of the sorted samples determines the state of the module's input.

To enable filtering, go to the **Channel tab** and select the amount of samples the median should be calculated from. Each change of value by 1 increases the signal delay by 10ms.



Destination Client (M2M)

Inveo devices shuch as LanTick, Nano Temperature Sensor, Nano Digital Input, Nano Relay Output etc. can send the data to a server or other module equipped with outputs using TCP or UDP. Thanks to this, the remote module will react to channel activation and activate/deactivate relay outputs in real-time. The messages are sent after each change of state and every 5 seconds.

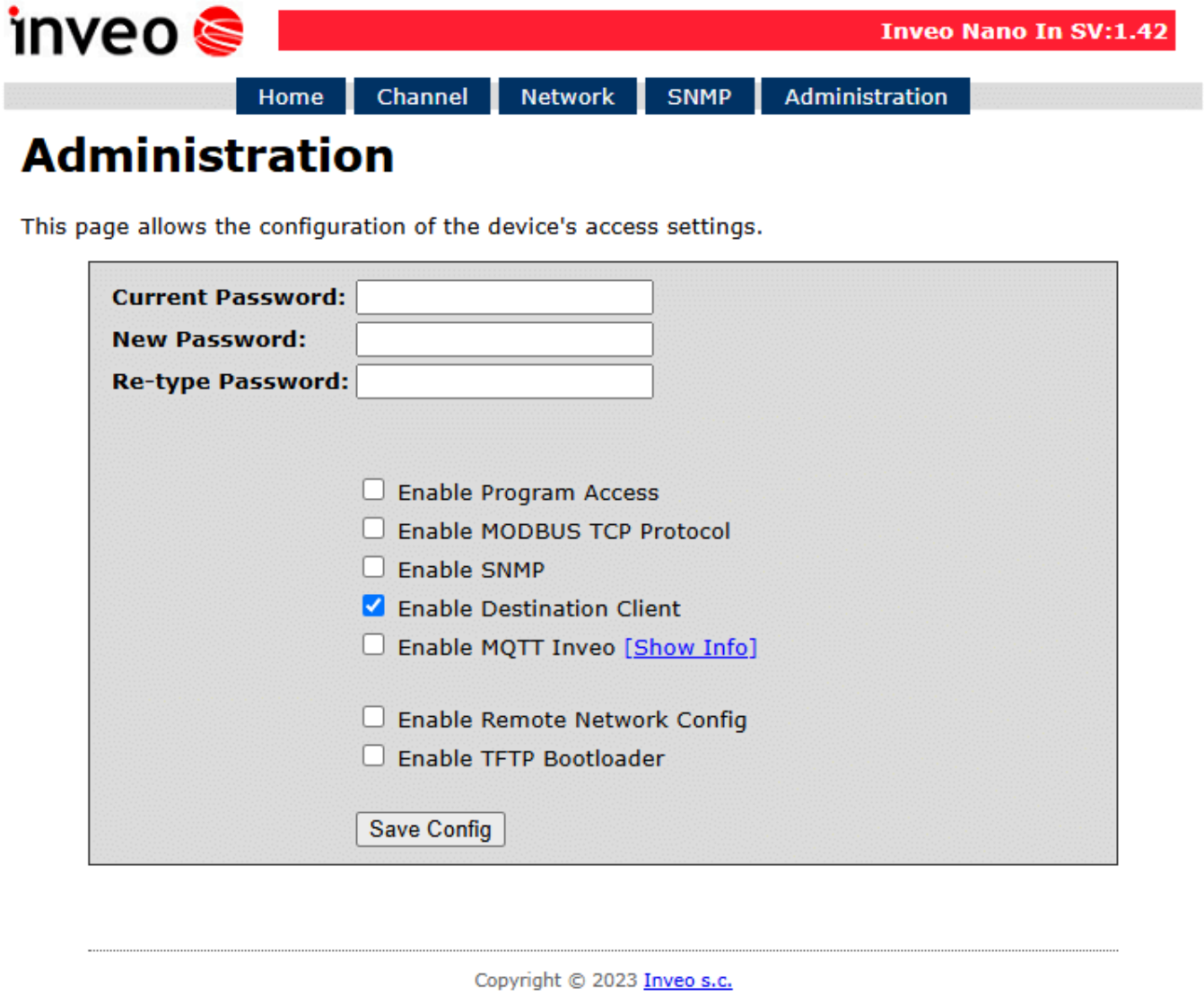
Configuration for receiving modules (target devices):

Step 1: Enable the service In **Administration**, select **Enable Program access** and **Save config**.

Configuration for messaging modules (output status):

Step 1: Enable Destination Client

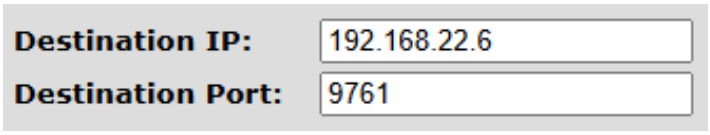
In **Administration**, select **Enable Destination Client** and **Save config** to activate the service.



Step 2: Network settings

In the **Network** tab, fill in the fields:

- **Destination IP** – Target device or server IP address,
- **Destination Port** – Port, on which the remote device is listening. 9761 by default.

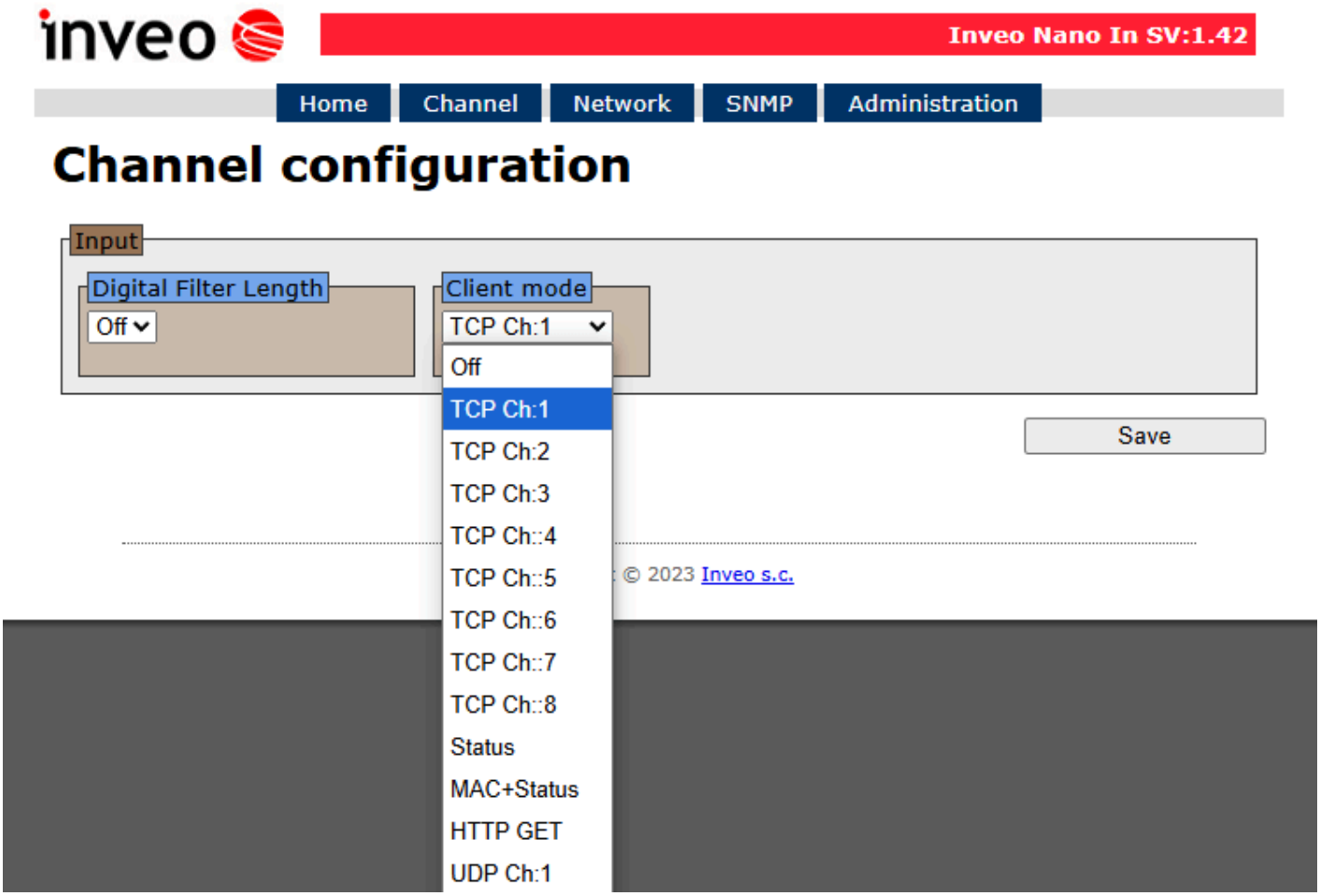


Step 3:

Go to the **Channel** tab and select the type of message to be sent. If using TCP and UDP, select the channel that will be controlled on the taget device.

The following options are available: - Off
- TCP Ch:x
- UDP Ch:x
- Status

- MAC+Status
- HTTP GET



TCP Ch:x and UDP CH:x

TCP Ch:x – This function uses the connection oriented protocol (TCP). Ch:x is the target output channel in the remote device (eg. LanTick) that will be controlled after the local device channel state changes. TCP frame format #1.

UDP Ch:x – Function uses the connectionless protocol (UDP). Ch:x is the target output channel in the remote device (eg. LanTick) that will be controlled after the local device channel state changes. UDP frame format #1.

The format #1 frame is sent in HEX form. Example TCP frame sent while Ch:1 is active:

SOF	CMD	CH	F_ID	IN_STATE	!IN_STATE	CNT0	CNT1	CNT2	CNT3	CRC
0x0F	0x01	**0x00**	0xFF	0x01	0xFE	0x00	0x00	0x00	0x00	0x23

Example TCP frame sent while Ch:1 is inactive.

SOF	CMD	CH	F_ID	IN_STATE	!IN_STATE	CNT0	CNT1	CNT2	CNT3	CRC
0x0F	0x01	**0x00**	0xFF	0x00	0xFF	0x00	0x00	0x00	0x00	0x23

CH determines the output channel in the target device that will be controlled when the channel state changes.

IN_STATE – 01 - channel active, 00 - channel inactive.

Bytes **CNT0** - **CNT3** represent the counter value.

Calculating CRC:

`CRC = (SOF+CMD+CH+F_ID+IN_STATE+!IN_STATE+CNT0+CNT1+CNT2+CNT3) MOD 256`

Format 1:

11:16:23 data from 192.168.22.23: 0f 01 00 ff 00 ff 04 57 34 12 af

Status

Selection of this message type will cause the device to send its channel state and counter value. TCP frame format #2.

The format #2 frame is sent in the form of a character string.

`<IN_STATE>[SPACE]<CNT>`

- **IN_STATE** – 01 - channel active, 00 - channel inactive,
- **CNT** – Read counter value.

HEX value	STRING
30 20 34	0 4
31 20 35	1 5

Format 2:

11:27:21 data from 192.168.22.23: 0 5

MAC + Status

Selection of this message type will cause the module to send its MAC address and current channel state with the counter value. TCP frame format #3.

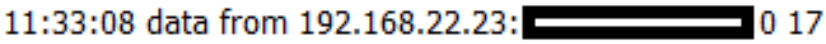
The format #3 frame is sent in the form of a character string.

`<MAC>[SPACE]<IN_STATE>[SPACE]<CNT>`

- **MAC** – Module MAC address,
- **IN_STATE** – 01 - channel active, 00 - channel inactive,
- **CNT** – Read counter value.

HEX Value	STRING
00 00 00 00 00 00 00 00 00 00 00 20 30 20 37	000000000000 0 7
00 00 00 00 00 00 00 00 00 00 00 20 31 20 38	000000000000 1 8

Format 3:



HTTP GET

The module sends its MAC address, channel state and counter value. Frame format #4.

Setting **Client Mode** to **HTTP GET** makes the device send data to the server in the following form:

`nano.php?mac=<MAC>&io=<IN_STATE>&cnt=<CNT>`

- **MAC** – Module MAC address,
- **IN_STATE** – 01 - channel active, 00 - channel inactive,
- **CNT** – Read counter value.

Example

Example frame received by the server:
GET /nano.php?mac=000000000000&io=1&cnt=26
MAC address = 000000000000,
io=1, (channel active)
cnt=26, (counter value is 26)

The TCP frame can be handled by own software.

Tip

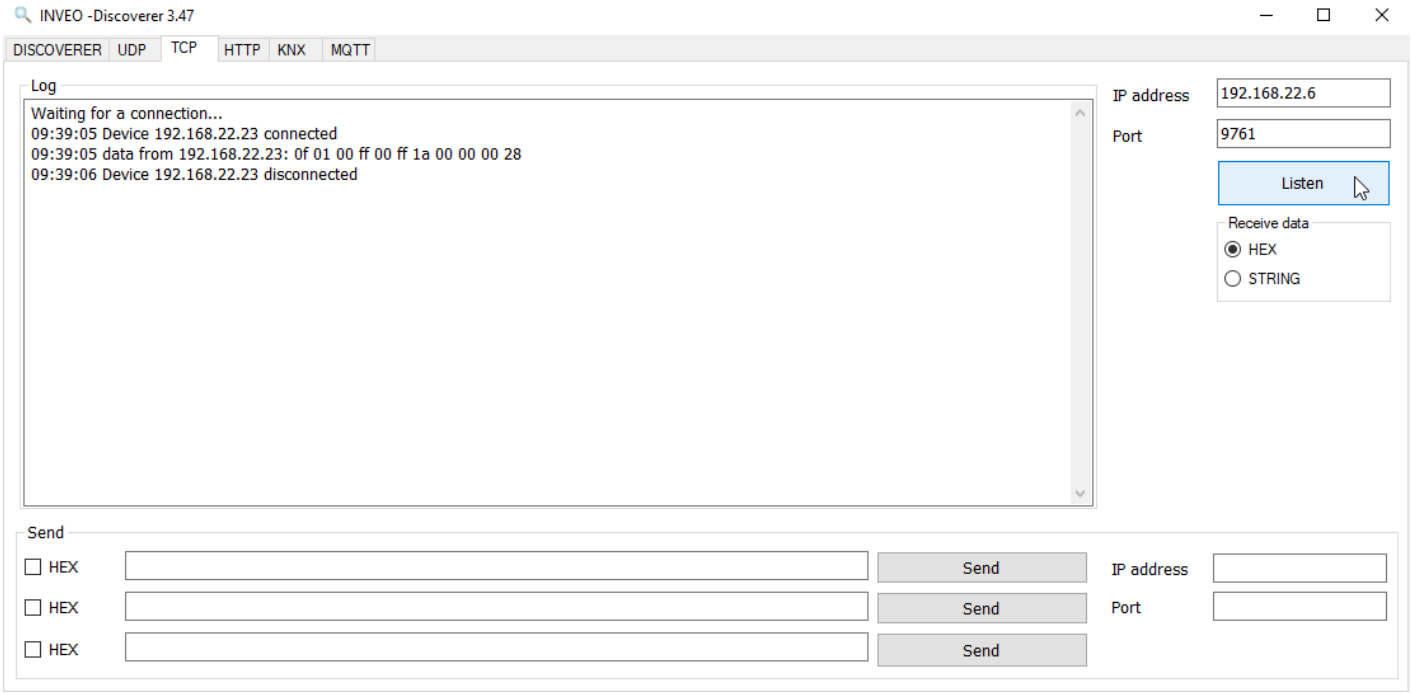
Data transfer can be tested using the Inveo Discoverer programme.

To test the data transfer, go to **Administration**, select **Enable Destination Client**, and click **Save Config**.

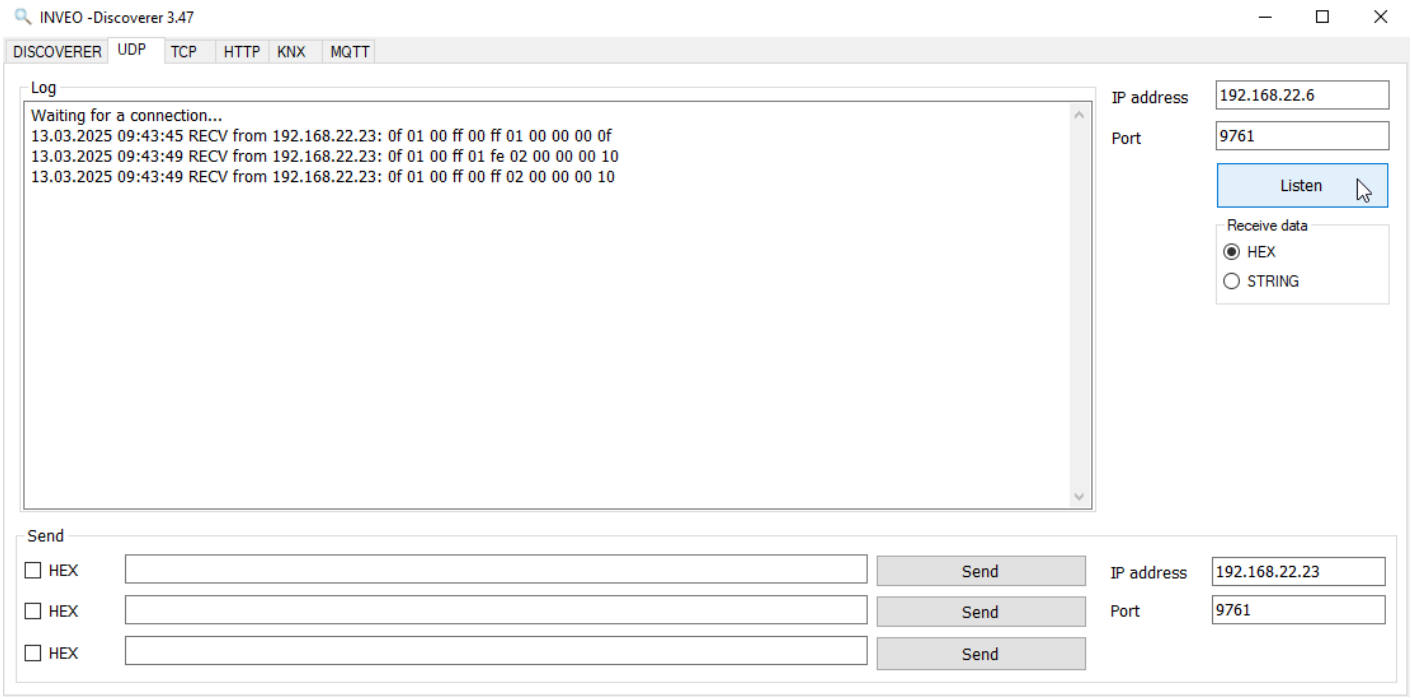
In the **Network** tab, fill in the following fields:

- **Destination IP** – Computer's IP address,
- **Destination Port** – Port, on which the remote device is listening on (default 9761).

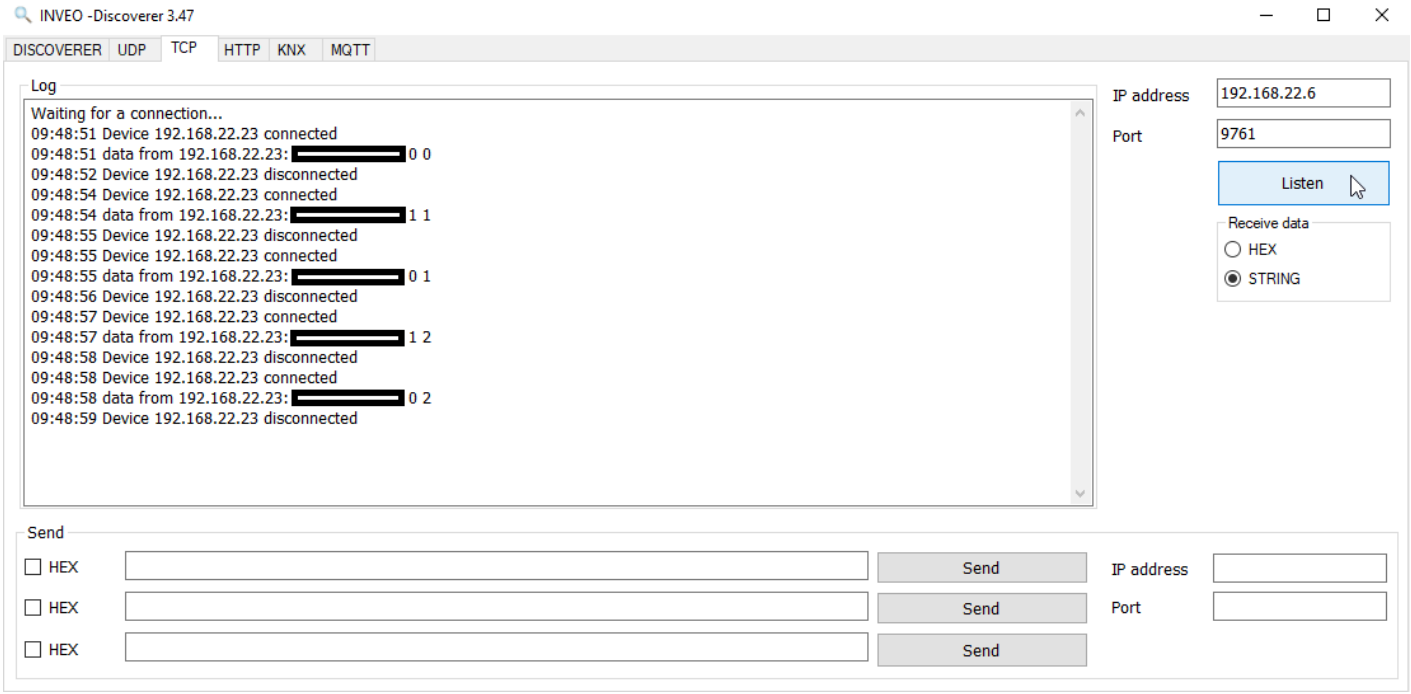
To test the TCP message type, select **TCP Ch:x** in the **Channel** tab. The next step is to run Inveo Discoverer and click **TCP**. Input the values from **Network** into the **IP address** and **Port** fields. Select **HEX** in **Receive Data**, then click **Listen**.



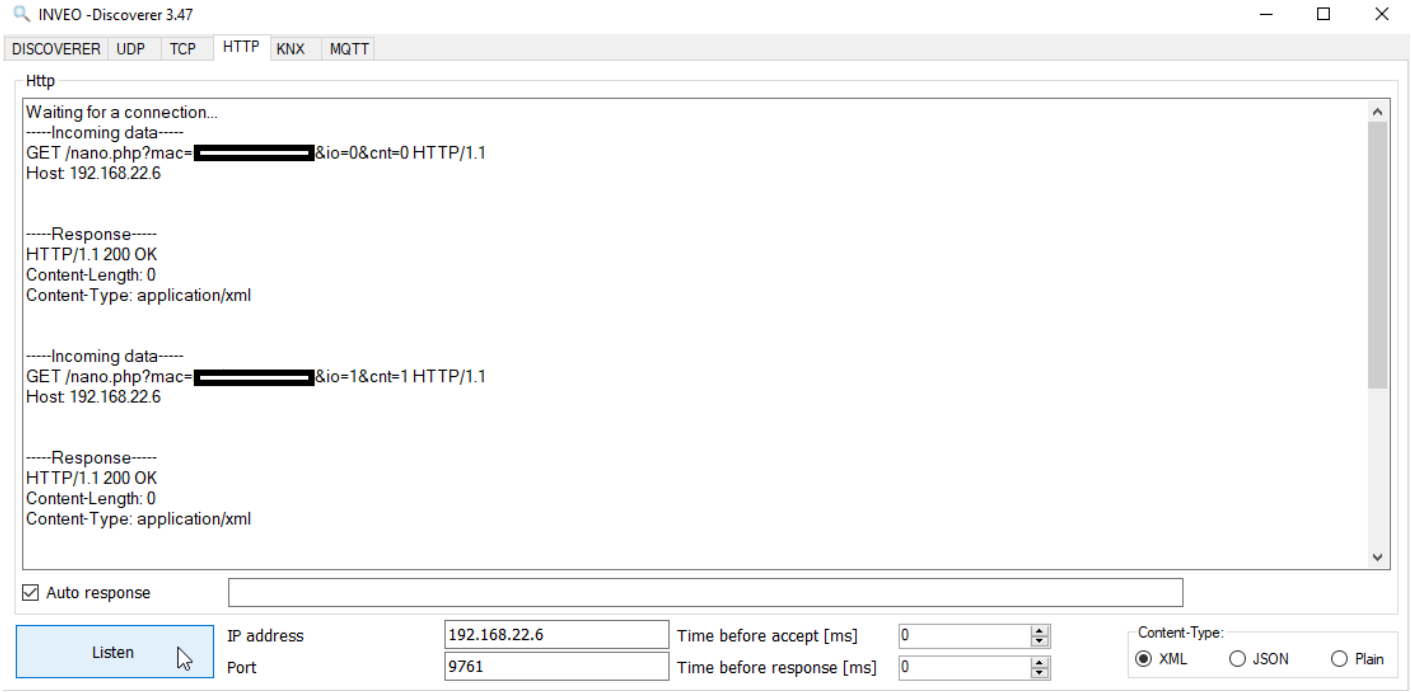
To test the UDP message type, select **UDP Ch:x** in the **Channel** tab. The next step is to run Inveo Discoverer and click **UDP**. Input the values from **Network** into the **IP address** and **Port** fields. Select **HEX** in **Receive Data**, then click **Listen**.



To test the Status and Mac+status message types, select **Status** or **Mac+status** in the **Channel** tab accordingly. The next step is to run Inveo Discoverer and click **TCP**. Input the values from **Network** into the **IP address** and **Port** fields. Select **STRING** in **Receive Data**, then click **Listen**.



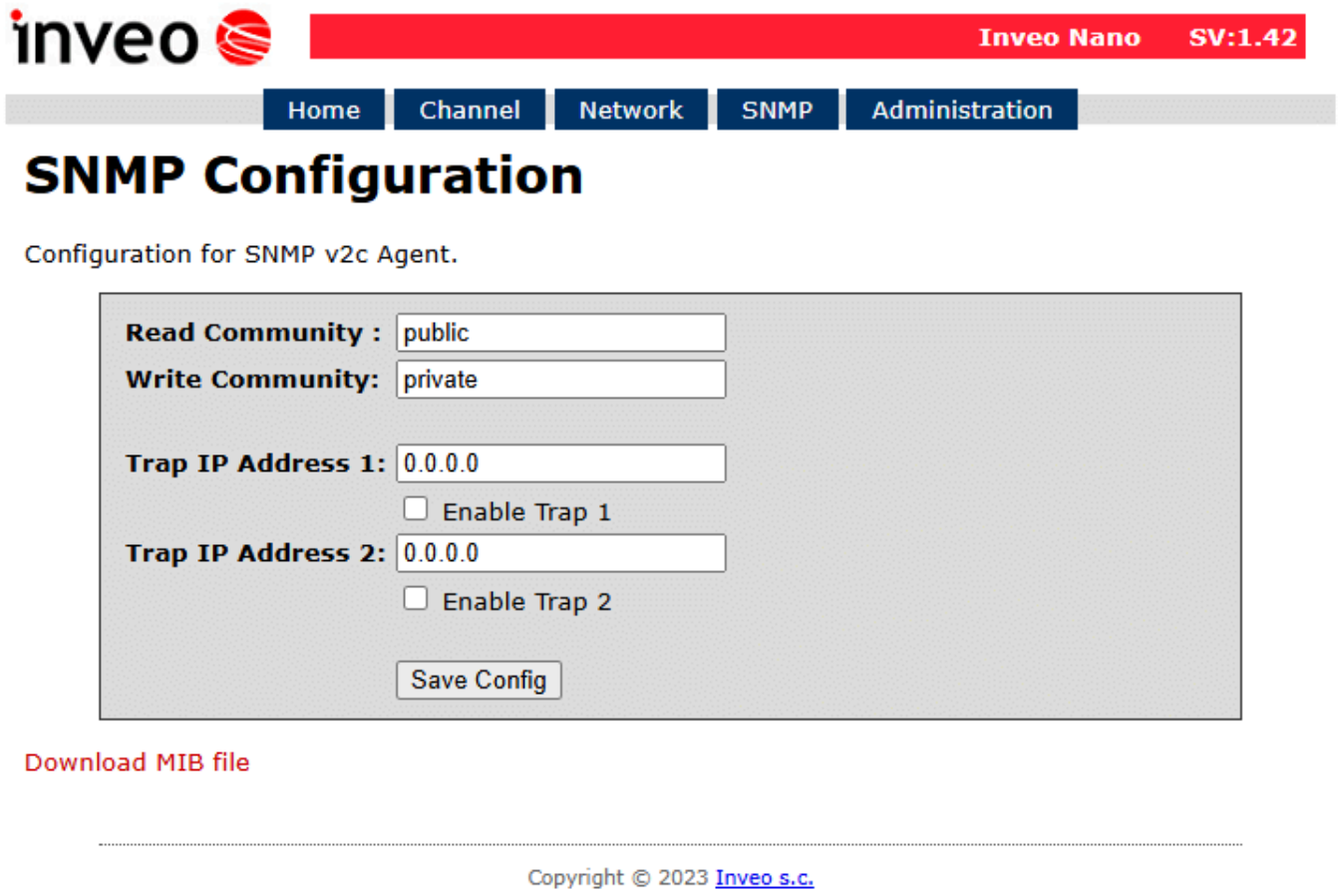
To test the HTTP message type, select **HTTP** in the **Channel** tab. The next step is to run Inveo Discoverer and click **HTTP**. Input the values from **Network** into the **IP address** and **Port** fields, then click **Listen**.



SNMP configuration

Nano Digital Input is equipped with an SNMP v2c server, making remote readout of input state possible. To **Enable SNMP**, go to the **Administration** tab.

Configuration options are located in the **SNMP** tab:



SNMP allows readout of current module input state. To use this function, download the MIB file (describing the data structure) first. To do that, right-click **Download MIB file** and select **Save link as**. Import the downloaded MIB file into the MIB Browser programme.

The basic parameters that can be read from the module are displayed in the following table:

Name	Format	OID
Input channel state	INTEGER	.1.3.6.1.4.1.42814.14.3.3.1.0
Counter state	INTEGER	.1.3.6.1.4.1.42814.14.3.4.1.0

The module also has the ability to send TRAP notifications if the input channel state changes. To configure the destination addresses for those notifications, input them into **Trap IP Address 1** and **Trap IP Address 2**.

Windows command line control programme

When controlling the module from the command line, the cURL program can be used. First, enable **Program Access** in the **Administration** tab.

Example

Read input state, module IP address 192.168.0.231:
Access to `stat.php` requires authentication. In this case, we precede the command with `-u login:password`. `curl -u admin:admin00 http://192.168.0.231/stat.php`

In response, the device will send the following information:

```
<response>
    <prod_name>Nano In</prod_name>
    <sv>1.42</sv>
    <mac>00:00:00:00:00:00</mac>
    <out>00000000</out>
    <on>00000000</on>
    <in>00000000</in>
    <counter1>15</counter1>
    <temp1>0.0</temp1>
</response>
```

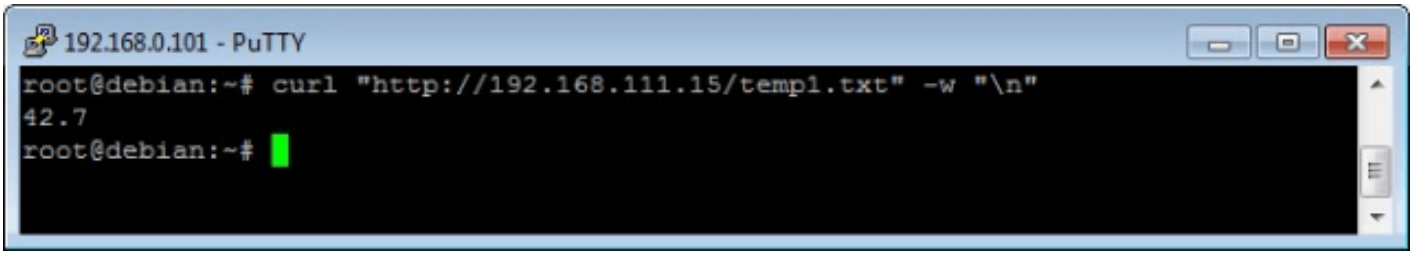
Section	Description
`<prod_name>`	Module type
`<sv>`	Firmware version
`<mac>`	Module MAC address
`<out>`	Output mode
`<on>`	Output state
`<in>`	Input state
`<counter1>`	Counter
`<temp1>`	Measured temperature - applies only to Nano Temp

Linux control programme

cURL can be used in Linux:

> **Tip**
>
> **Access to `stat.php` requires authentication.**
> **Access to `status.xml` does not require authentication.**

```
curl "http://192.168.111.15/temp1.txt" -w "\n"
```



Modbus TCP

To activate the function of sending data using Modbus TCP protocol, select **Enable Modbus TCP protocol** in the **Administration** tab.

Modbus is available via the LAN connector.

Modbus TCP listens on port 502.

The device supports the following Modbus functions:

- 0x01 Read Coils
- 0x03 Read Holding Register
- 0x05 Write Single Coil
- 0x06 Write Single Register
- 0x0F Write Multiple Coils
- 0x10 Write Multiple Registers

Coils addressing

Address	Name	R/W	Description
1000	On1	R	Input 1 state

Holding Registers addressing

Address	Name	R/W	Description
4003	Counter1H	R/W	Counter input No. 1 state (MSB)
4004	Counter1L	R/W	Counter input No. 1 state (LSB)

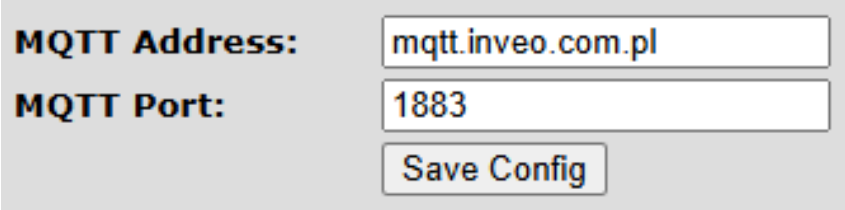
MQTT

The device supports MQTT protocol. Data from the device is sent to the server every minute and after each value change. The data is not encrypted. The user subscribes the device data after connecting with the broker. The amount of users that can receive the data from a single device is unlimited.

In addition to the default Inveo MQTT broker, the user can specify their own MQTT server for digital input state monitoring purposes.

Configuration:

Firstly, **Enable MQTT Inveo** in **Administration**. In the **Network** tab, MQTT broker address and port can be configured:



Tip

For the Inveo broker, the settings should be as follows: - MQTT Address: mqtt.inveo.com.pl - MQTT Port: 1883 A computer with the Inveo Monitoring application installed can be used as a broker. To do that, type the PC's IP address into the MQTT Address field.

In the **Administration** tab, after clicking **Show info** for **Enable MQTT Inveo**, MQTT client settings that will be needed for launching the application will be displayed:



Many Android/IOS applications support MQTT, enabling the user to receive the data on their telephone (eg. MQTT dash) and PC (MQTT explorer).

Factory settings

Restoring factory settings

To restore the factory settings:

- Power up the device,
- Press the **RESET** button for a time period between 10 and 15 seconds,
- The **TAG** LED will start flashing about 4 times a second (Nano, Nano RFID PoE), `rSt` will appear on the display (Nano In/Out/Temp PoE),
- Release the **RESET** button.

Once the above steps have been completed, the device will be set to the following parameters:

- **IP address:** 192.168.111.15
- **IP mask:** 255.255.255.0
- **User:** admin
- **Password:** admin00

Warranty and manufacturer's liability

Warning

The manufacturer provides a two-year warranty for the device and post-warranty service for a period of 10 years from the date of introduction of the device to the market. The warranty covers all material and production defects.

The manufacturer undertakes to respect the warranty agreement, if the following conditions are met:

- All repairs, changes, expansions and device calibrations are carried out by the manufacturer or an authorized service center,
- The power supply system meets the applicable standards,
- The device is operated in accordance with the suggestions presented in this manual,
- The device is operated in accordance with its intended purpose.

The manufacturer assumes no responsibility for consequences resulting from improper installation, improper use of the device, failure to comply with the instruction manual, and repairs made by unauthorized personnel.

Warning

The device contains no user serviceable parts inside.

Storage, operation and transport conditions

The device should be stored in enclosed rooms, where the atmosphere is free from vapours and corrosive substances:

- Environment temperature from -30°C to +60°C (-22°F - 140°F),
- Humidity from 25% to 90% (condensation unacceptable),
- Atmospheric pressure from 700 to 1060 hPa.

The device is intended to operate in the following conditions:

- Environment temperature from -10°C do +55°C (14°F - 131°F),
- Humidity from 30% to 75%,
- Atmospheric pressure from 700 to 1060 hPa.

Recommended transport conditions:

- Environment temperature from -40°C do +85°C (-40°F - 185°F),
- Humidity from 5% to 95%,
- Atmospheric pressure from 700 to 1060 hPa.

Installation and device operation:

- The module should be operated in accordance with recommendations provided later in this manual.

Disposal and decommissioning

In an event the device needs to be decommissioned (eg. after its intended life period is surpassed), it is recommended to contact the manufacturer or his representative, who are responsible to respond appropriately, i.e., to collect the device from the user. The user can alternatively contact companies specializing in electronic device or computer equipment disposal and/or decommissioning. Under no condition should the device be placed with other waste.