



User manual Nano Relay Output



Soft >= v1.xx

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Dear Customer!

Thank you very much for choosing our product. Please carefully read this user manual as it contains most appropriate ways of dealing with this device, taking into account the basic principles of safety and maintenance. Please also keep the user guide that you can use it during subsequent use.

Manufacturer Liability!

The manufacturer is not liable for any damage caused by improper or incompatible use of this device, as well for any faults to the device resulting from improper use.

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1 Preliminary information

Before using the module please read the user manual carefully and follow the instructions contained within!

Description of visual symbols used in this user manual:



This symbol is responsible for reviewing the appropriate place in the user instructions, warnings and important information. Failure to follow warnings could cause injury or damage to the module.



Important information and guidelines.



Following this guidelines makes the use of the module easier.

Attention: The appearance of the screen shots shown in this manual may differ slightly from the actual work with the module. The differences may relate to the size and font type and size of symbols. There are no differences in the content of the information.

2 Device description

The NANO OUT device is used to control one electrical circuit using relay. The relay can be controlled using www website, network protocols (HTTP get, Modbus TCP, SNMP, MQTT) or dedicated software.

3 Warranty and liability of the manufacturer



The manufacturer provides a 2-year warranty on the module. The manufacturer also provides post-warranty service for 10 years from the date of the introducing the module on the market. The warranty covers all defects in material and workmanship.

The manufacturer undertakes to comply with the contract of guarantee, if the following conditions are met:

- All repairs, alterations, extensions and device calibrations are performed by the manufacturer or authorized service,
- supply network installation meets applicable standards in this regard,
- device is operated in accordance with the recommendations outlined in this manual,
- device is used as intended.

The manufacturer assumes no responsibility for consequences resulting from improper installation, improper use of the module, not following this manual and the repairs of the module by individuals without permission.



This device doesn't contain serviceable parts. The repairs can be done only by manufacturers approved repair service.

4 Safety guidelines

The module has been constructed using modern electronic components, according to the latest trends in the global electronics.

In particular, much emphasis was placed on ensuring optimum safety and reliability of control.

The device has a housing with high quality plastic.

4.1 Power supply



The device is designed to supply 10-24V DC and PoE IEEE 802.3af.

4.2 Storage, working environment and transportation

The module has to be used in closed environments free from fumes and corrosive atmosphere.

Environmental conditions for storage:

- Temperature: -30°C to +60°C,
- Relative humidity: <90% (unacceptable condensation)
- Atmospheric pressure: 700 – 1060hPa.

Environmental conditions for use:

- Temperature: +10°C to +55°C,
- Relative humidity: 30% to 75%,
- Atmospheric pressure: 700 to 1060hPa.

4.3 Installation and use of the module



The module should be used following the guidelines shown in next part of the user manual.

4.4 Utilisation of the module

When it becomes necessary to liquidate the device (e.g., after the time of use), please contact the manufacturer or its representative, who are obliged to respond appropriately, i.e., collecting the module from the user. You can also ask the companies involved in utilization and / or liquidation of electrical or computer equipment. Under no circumstances should you place the device along with other garbage.

5 Module description

5.1 General features

Overall view of the module Nano Relay Output is shown on the picture below.



Nano Relay Output

There are several ways to communicate with the module:

- using built in WWW server via any web browser,
- windows / linux command line programs.
- MODBUS TCP protocol,
- SNMP protocol,
- HTTP protocol,
- MQTT Inveo protocol,
- User application – communication protocol available for user

The module is equipped with a LED display which displays current state of the output: **on** or **oFF**.

5.2 Technical specification:

Power supply voltage: 10-24VDC or PoE according to PoE IEEE 802.3af

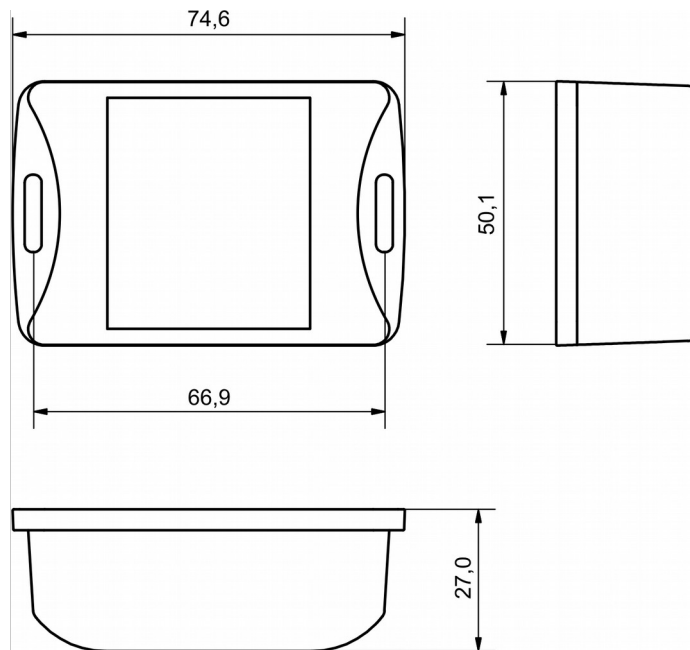
Power consumption: 1.5 W

Ethernet 10Mbit

7-segment LED display red

Weight: 60g

Distensions: height: 27 mm; width: 74.6 mm; length: 50.1 mm



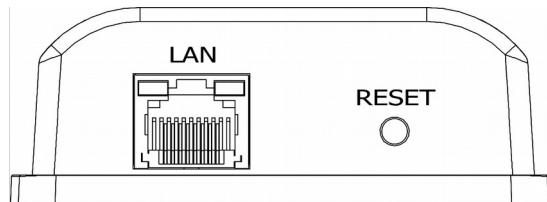
Output

Maximum working voltage: 250V AC, 30V DC,
Maximum load current: 2A,
NO output (normally open),
Switch-on time: 10ms,
Off time: 5ms,

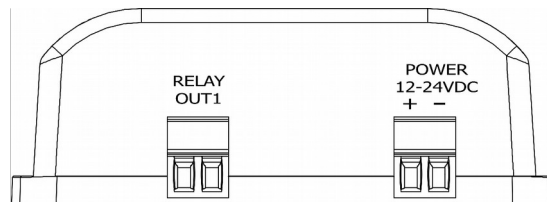
5.3 Module input/output terminal description

Nano Relay Output has connection terminals:

- **LAN** - LAN connection and PoE IEEE 802.3af power supply
- **RESET** – switch used to enabling DHCP service, checking the current IP address and restoring the module to the factory settings.



- **RELAY OUT1** -NO relay connector
- **POWER** power connector. An additional power connector used in the event of a PoE power failure. Supply voltage 12-24VDC.



6 Module configuration

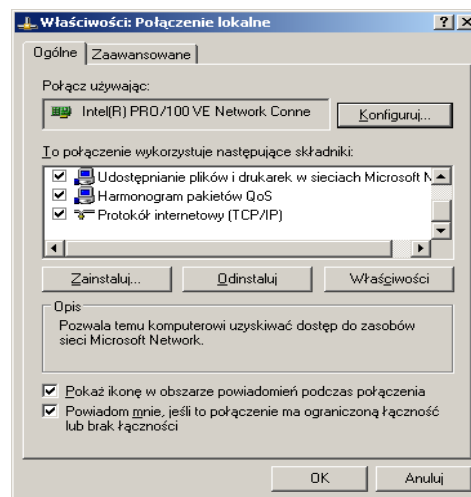
If using the module for the first time it is needed to configure it as shown below

6.1 Changing the PC setting for module configuration.

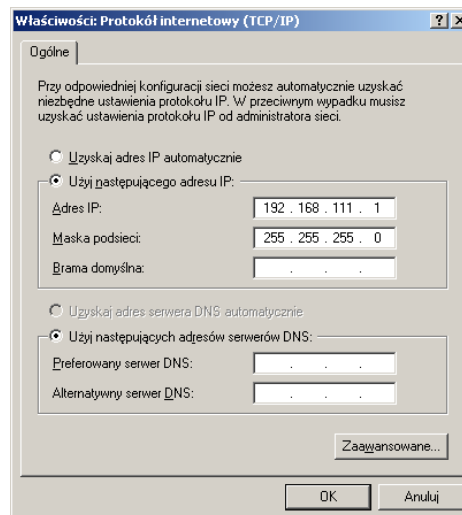
After connecting the module to the network there is a need to change the PC setting. In order to do that navigate to: Start->Control Panel->Network connections.

Then right click on the current network connection and click „Properties”.

The configuration screen as shown below should be visible on the screen:



Choose the „Internet Protocol (TCP/IP)” and press „Properties”:



TCP/IP example settings

Tick the box „Use the following IP address” and enter:

IP address: **192.168.111.1**

Subnet mask: **255.255.255.0**

The rest of the setting can be left blank.

Press OK to accept the changes.

Start the web browser and enter the following address into address bar:
192.168.111.15.
The default user name is „admin“ with password „admin00“

The screenshot shows the 'Network Configuration' page of the Inveo Nano Out SV:1.11 device. The page has a navigation menu with 'Home', 'Channel', 'Network', 'SNMP', and 'Administration'. The 'Network' tab is selected. The main content area is titled 'Network Configuration' and includes a sub-header: 'This page allows the configuration of the device's network settings.' Below this is a form with the following fields and values:

MAC Address:	54:10:EC:65:9B:CD
Host Name:	NANO
<input type="checkbox"/> Enable DHCP	
IP Address:	192.168.111.15
Gateway:	0.0.0.0
Subnet Mask:	255.255.255.0
Primary DNS:	0.0.0.0
Secondary DNS:	0.0.0.0
Destination IP:	0.0.0.0
Destination Port:	0
<input type="button" value="Save Config"/>	

At the bottom of the page, there is a copyright notice: 'Copyright © 2015 Inveo s.c.'

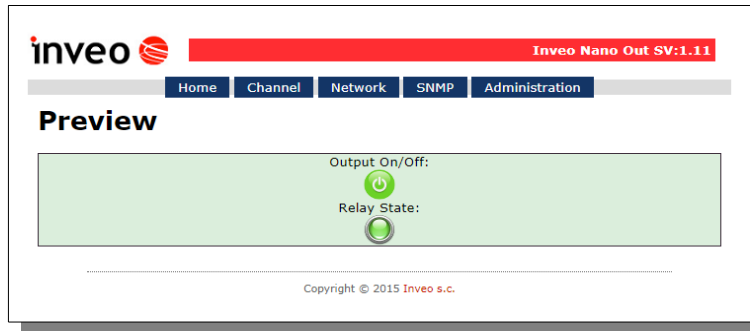
There are several fields used to configure the module network settings:



- MAC Address – MAC address of the module,
- Host Name – NETBIOS host name of the module,
- Enable DHCP – When this box is ticked the module will get its address from DHCP server,
- IP Address – IP address of the module – when configured manually,
- Gateway – Network gateway,
- Subnet Mask – Subnet mask of the module,
- Primary DNS, Secondary DNS – DNS servers addresses,
- Destination IP – Network address of the server that the module will connect to - optional,
- Destination Port – Network port of the server that the module can connect to.

After changing the configuration press the „Save Config“ button.

6.2 Changing the state of the output.

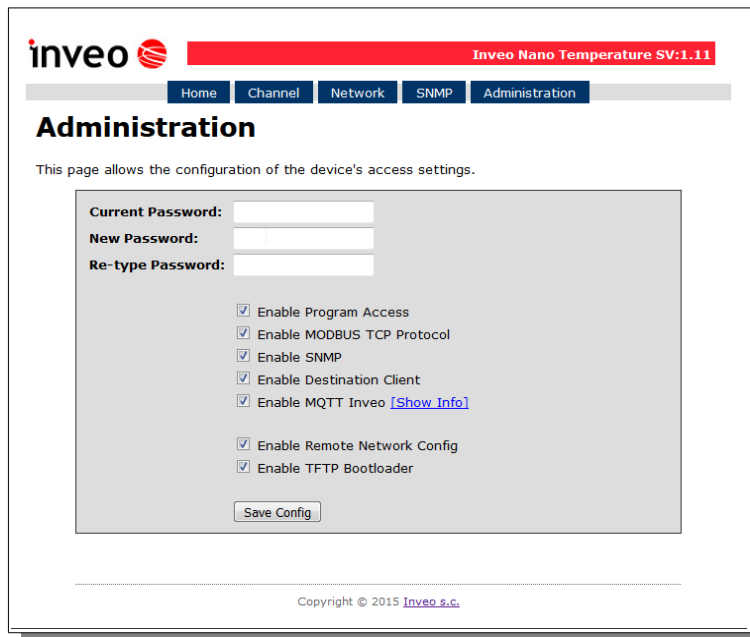
The Home tab shows the current state of the output channel and the current status of the relay.



Output On/Off: 	Current status of the output channel. The output is switched on or off by clicking on the icon.
Relay State: 	Current state of the relay output.

6.3 Access configuration

The Administration menu allows the User to configure which services are to be active in the device and to change the access password.



Changing the password

Enter old password into *Current Password* field.

Enter new password into *New Password* field and into *Re-type Password* field then press „Save Config” to save new passwords.

Enabling/disabling particular service

This function enables/disables different services. By enabling the tick box next to a service user can turn it on or off.

Module Access configuration

- **Enable Program Access** – access service by a computer program (Windows, Linux) and TCP / IP protocol operating on port 9761
- **Enable MODBUS TCP Protocol** – enables/disables access using MODBUS TCP protocol.
- **Enable SNMP** – enables/disables access using SNMP protocol.
- **Enable Destination client** – enables/disables connection service with a remote host
- **Enable MQTT Inveo** -enables/disables service sending data to the INVEO MQTT cloud
- **Enable Remote Network Config** – enables/disables service of remote change of network settings by the INVEO DISCOVERER program
- **Enable TFTP bootloader** – enables/disables bootloader mode

Warning:

TFTP Bootloader should be disabled during normal operation. Enabling should take place only before the software update.

6.4 Configuration of the output channel.

The configuration of the module output is carried out in the Channel tab.

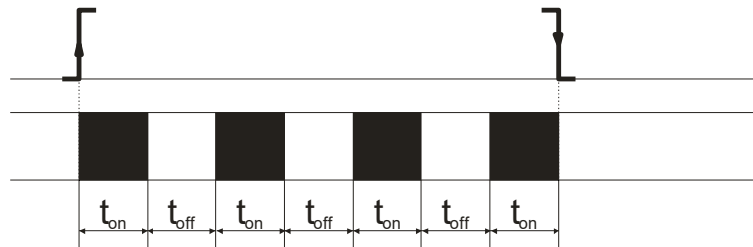
Configuration of relay output

The relay built into the module, it can work in 3 modes:

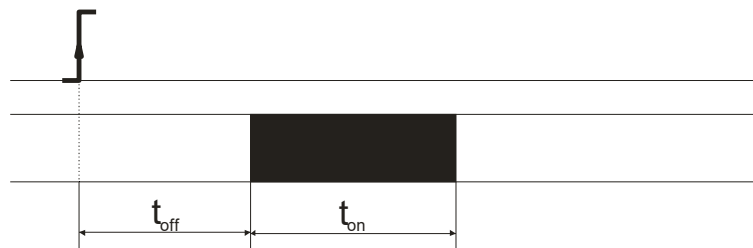
- **Bistable** – bistable mode. The relay has a fixed position (switched on or off).
- **Astable** –astable mode (intermittent). After switching on the channel, the relay cyclically short-cuts and opens the contacts. The time of shorting and opening the contact are determined by the times:

- **Time On**

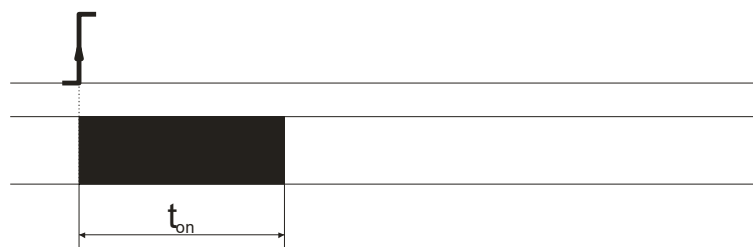
- **Time Off**



- **TimeBased** – single-trip mode
- If in mode **TimeBase** times $t_{on} > 0$ and $t_{off} > 0$ after relaying the output, the relay will turn on after time t_{off} on time t_{on} .



- If in mode **TimeBased** times $t_{on} > 0$ and $t_{off} = 0$ to after releasing the output, the relay will switch on for the time t_{on} and then it will be turned off.



- If in mode **TimeBased** times $t_{on} = 0$ and $t_{off} > 0$ after the output is triggered, the relay will turn on after the t_{off}



Power on state determines the output status after switching on the power supply.

- **ON** -after powering on, the output channel is active
- **OFF** -after turning on the power supply, the output channel is inactive
- **LAST** -when the power is turned on, the output channel assumes the state before the power was turned off.

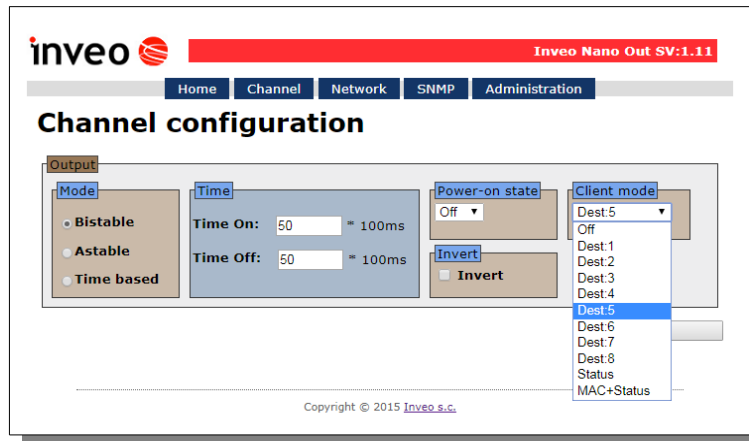
Invert out –activates the inversion of the relay contact.

Client Mode field allows to select the format of the TCP frame which will be sent to the address set in the **Network** Destination IP, Destination Port. The TCP frame is sent every 5 seconds and at each change of the output state.

After making changes, click the **Save** button.

6.5 Komunikacija TCP/IP

The NANO Relay Output module is able to send an output status to another module or to the server using the TCP protocol. This means that when a state of the output will change a message will be sent to another device that can react, for example, by activating a relay. The IP address of the device to which information is to be sent should be set in the tab **Network** Destination IP, Destination Port. The message is sent whenever an output status changes, and additional every 5 seconds.



In the **Client mode** field, you can select the frame format:

- **Off** -sending frames disabled
- **Dest: 1..8** -sending TCP frames in the **format #1** (compatible with INVEO devices)
- **Status** -sending TCP frames in the **format #2**
- **MAC + Status** -sending TCP frames in the **format #3**

6.6 TCP frames format

Format #1

The frame in the format #1 is sent in binary form.

An example of a TCP frame sent with active output and **Dest:5** set

SOF	CMD	CH	F_ID	OUT	!OUT	R1	R2	R3	R4	CRC
0x0F	0x01	0x04	0xFF	0x01	0xFE	0x00	0x00	0x00	0x00	0x7F

An example of a TCP frame sent with inactive output and **Dest:5** set

SOF	CMD	CH	F_ID	OUT	!OUT	R1	R2	R3	R4	CRC
0x0F	0x01	0x04	0xFF	0x00	0xFF	0x00	0x00	0x00	0x00	0x7F

Calculation CRC:

$$\text{CRC} = (\text{BYTE}) \text{ SUM} (\text{SOF} + \text{CMD} + \text{CH} + \text{F_ID} + \text{OUT} + \text{!OUT} + \text{R1} + \text{R2} + \text{R3} + \text{R4})$$

Format #2

The frame #2 is sent as a string (STRING).

<OUTPUT STATE>

- **OUTPUT STATE** -value 1 means active output, 0 means inactive output

HEX value	STRING
30	0

Format #3

The frame #3 is sent as a string (STRING).

<MAC>[SPACE]<OUTPUT STATE>

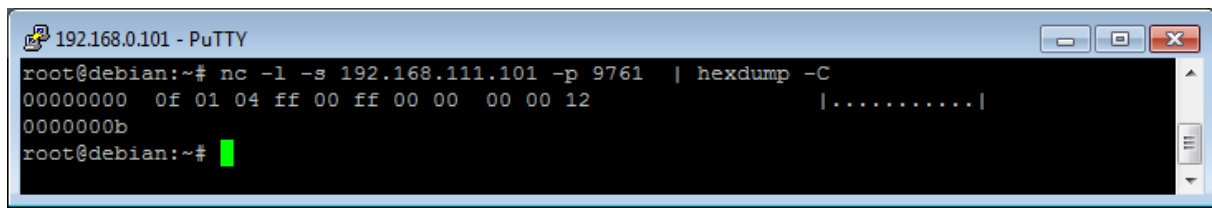
- **MAC** -network address of the module
- **STAN WYJŚCIA** value 1 means active output, 0 means inactive output

HEX value	STRING
35 34 31 30 45 43 36 35 35 30 32 31 20 30	5410EC655021 0

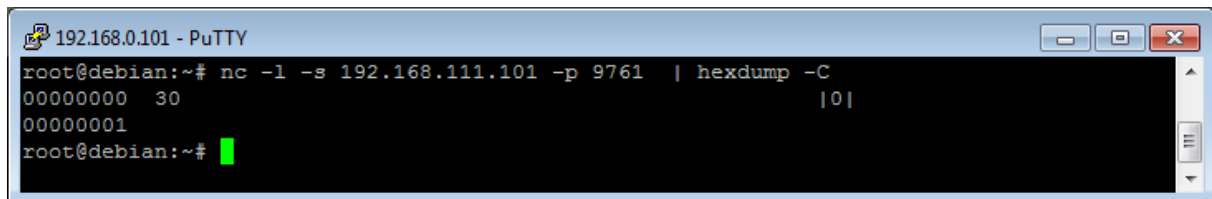
The TCP frame can be supported with your own software.

An example of using the netcat command for Linux:

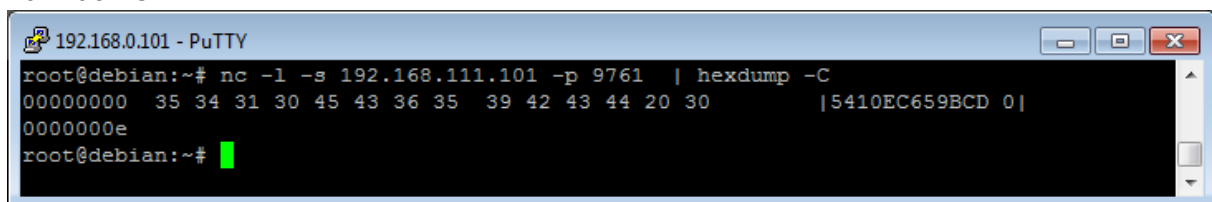
Format #1



Format #2



Format #3



6.7 SNMP configuration

The module is equipped with an SNMP v2c server.

To enable this feature go to Administration tab-> Enable SNMP.

SNMP protocol enables user to retrieve and set the output status

The MIB file describing the structure can be downloaded the SNMP tab.

The screenshot shows the 'SNMP Configuration' page for 'Inveo Nano Out SV:1.11'. The navigation menu includes Home, Channel, Network, SNMP, and Administration. The configuration area is titled 'Configuration for SNMP v2c Agent' and contains the following fields and options:

- Read Community: public
- Write Community: private
- Trap IP Address 1: 192.168.111.143
- Enable Trap 1:
- Trap IP Address 2: 0.0.0.0
- Enable Trap 2:
- Save Config button

Below the configuration area, there is a link for 'Download MIB file' and a copyright notice for '© 2015 Inveo s.c.'.

The basic parameters that can be read from the NANO Relay Output module can be found in the table:

Name	Format	OID
Status of the output channel	INTEGER	.1.3.6.1.4.1.42814.14.3.1.1.0
State of the relay contact	INTEGER	.1.3.6.1.4.1.42814.14.3.2.1.0

The module allows to send TRAP messages in the event of a change in the status of the output channel. The destination address is entered in the **Trap IP Address 1** and **Trap IP Address 2** fields.

6.8 Managing the module using windows command line software

The module can be operated using windows command line

Syntax is as follows:

: TCPRel.exe [Parameters]

Parameter	Description
-out=1	Output number, for NANO always 1
-host=[HOST]	Module IP address
-port=[PORT]	Module Port number
-on -off	Enables or disables output
-verb	Enabled display of additional info
-stat	Displays current state of output

Examples:

Enables relay - module address 192.168.111.15 listening on port 9761:

```
TCPRel -out=1 -host=192.168.111.15 -port=9761 -on
```

6.9 Managing the module using Linux command line software

The module can be configured using Linux command line

Syntax is as follows:

./TcpRel.exe [Parameters]

Parameter	Description
-o 1	Output number, for NANO always 1
-h [HOST]	Module IP address
-p [PORT]	Module Port number
-s [0,1]	Enables or disables output
-l	Displays current state of output

Examples:

Enables relay - module address 192.168.111.15 listening on port 9761:

Załączenie przekaźnika, moduł ma adres 192.168.111.15 i nasłuchuje na porcie 9761:

```
./tcprel -i 1 -h 192.168.111.15 -p 9761 -t
```

Checking output state:

```
./tcprel -h
```

6.10 Managing the module using MODBUS TCP

MODBUS TCP protocol is listening on port 502.

The module supports following functions of MODBUS protocol:

- 0x01 Read Coils,
- 0x05 Write Single Coil,

The registers description is shown in tables below

MODBUS TCP - Coils

Register	Name	Mode: R-read W-write	Description
1000	On1	R/W	Enable relay

MODBUS TCP - Holding Registers

Register	Name	Mode: R-read W-write	Description
4000	T1On	R/W	Relay engage time (*100ms)
4001	T1Off	R/W	Relay disengage time (*100ms)
4002	Rel1Mode	R/W	Mode of operation: 1 - Static 2 - Toggle 3 - 1-Pulse

6.11 Communication via the MQTT Inveo protocol.

If the MQTT Inveo service has been enabled in the **Administration** menu, the module sends to mqtt.inveo.com.pl server the state of the input every 1 minute and additionally at each change.

Application configuration - MQTT client:

Address: mqtt.inveo.com.pl

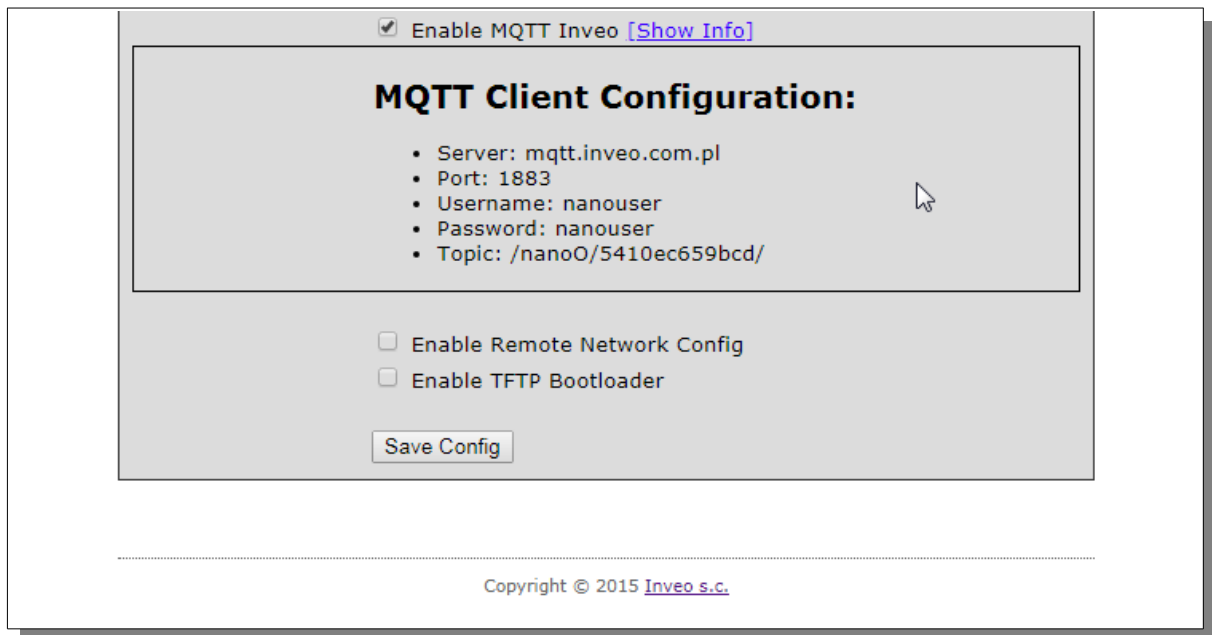
Port: 1883

User name: nanouser

User password: nanouser

Topic: /nanoT/<MAC>

After click [\[Show Info\]](#) the settings for the MQTT client will be displayed:



The screenshot shows a web interface for MQTT Client Configuration. At the top, there is a checked checkbox labeled "Enable MQTT Inveo" with a [\[Show Info\]](#) link. Below this is a box titled "MQTT Client Configuration:" containing a list of settings: Server: mqtt.inveo.com.pl, Port: 1883, Username: nanouser, Password: nanouser, and Topic: /nanoO/5410ec659bcd/. Below the list are two unchecked checkboxes: "Enable Remote Network Config" and "Enable TFTP Bootloader". A "Save Config" button is located at the bottom of the configuration box. At the very bottom of the page, there is a copyright notice: "Copyright © 2015 [Inveo s.c.](#)".

There are many applications on Android, IOS or PC that can display data sent by the module.

6.12 Communication with module using HTTP.

NANO OUT modules can be controlled using HTTP. To read current state of the module inputs/outputs access this address - <http://192.168.111.15/stat.php> - in web browser.

XML file consist all of the information:

```
<response>
<prod_name>Nano-1-0</prod_name>
<mac>54:10:EC:65:9B:CD</mac>
<out>00000000</out>
<on>00000000</on>
<in>00000000</in>
<counter1>0</counter1>
<temp1>0.0</temp1>
</response>
```

Section	Description
<prod_name>Nano-1-0</prod_name>	Type of module In this case Nano-1-0.
<mac>54:10:EC:65:9B:CD</mac>	MAC address of the module. Unique for each device.
<out>00000000</out>	Output state (enabled/disabled). In this case output inactive
<on>00000000</on>	Output state
<in>00000000</in>	In NANO-OUT always read as 0
<counter1>0</counter1>	In NANO-OUT always read as 0
<temp1>0.0</temp1>	In NANO-OUT always read as 0

Command	Description
<i>http://nr_ip/stat.php?on=1</i>	Enable output relay.
<i>http://nr_ip/stat.php?off=1</i>	Disable output relay.
<i>http://nr_ip/stat.php?inv=1</i>	Invert output state.
<i>http://nr_ip/stat.php?set=0000000x</i>	Set output. Options x=: 1-Enable 0-Disable n-Invert - -No changes

Example:

1.Enable relay output:

<http://192.168.111.15/stat.php?on=1>

2.Invert output relay state :

<http://192.168.111.15/stat.php?inv=1>

3. Disable relay output:

<http://192.168.111.15/stat.php?off=1>

Example of reading data with the command CURL.

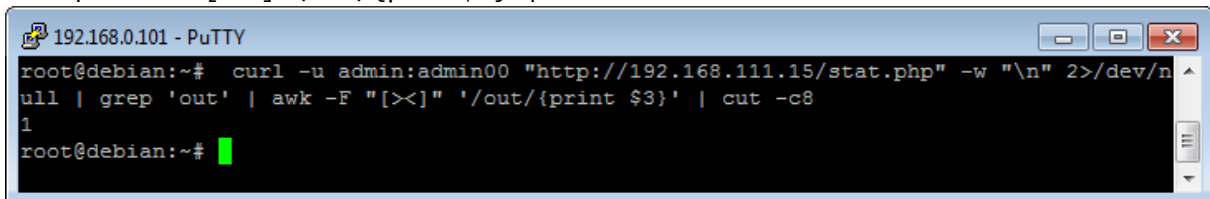
Warning:

Access to the **stat.php** resource requires authorization.

Access to the **status.xml** resources does not require authorization.

Reading the relay status:

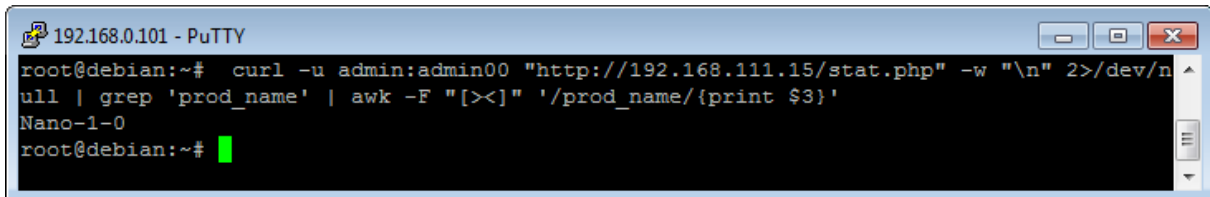
```
curl -u admin:admin00 "http://192.168.111.15/stat.php" -w "\n" 2>/dev/null | grep 'out' | awk -F "[><]" '/out/{print $3}' | cut -c8
```



```
192.168.0.101 - PuTTY
root@debian:~# curl -u admin:admin00 "http://192.168.111.15/stat.php" -w "\n" 2>/dev/null | grep 'out' | awk -F "[><]" '/out/{print $3}' | cut -c8
1
root@debian:~#
```

Reading the name of the module:

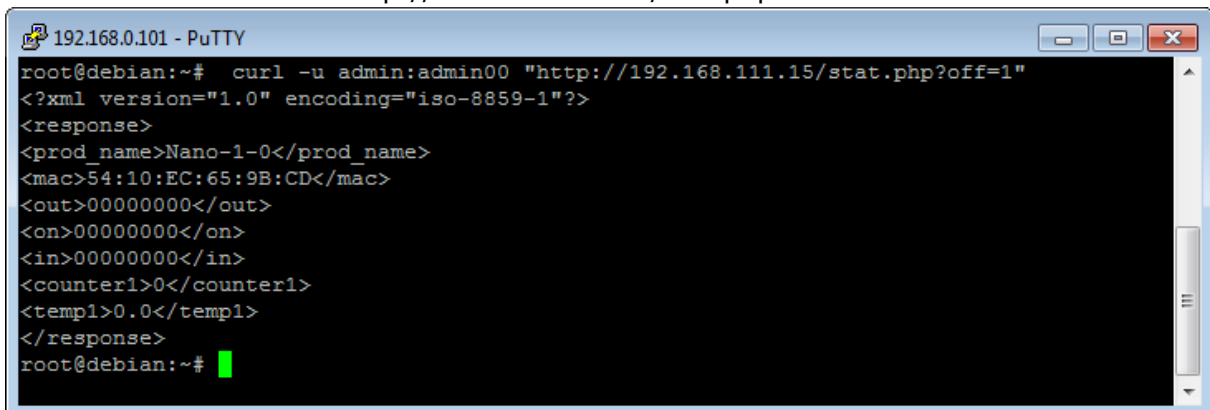
```
curl -u admin:admin00 "http://192.168.111.15/stat.php" -w "\n" 2>/dev/null | grep 'prod_name' | awk -F "[><]" '/prod_name/{print $3}'
```



```
192.168.0.101 - PuTTY
root@debian:~# curl -u admin:admin00 "http://192.168.111.15/stat.php" -w "\n" 2>/dev/null | grep 'prod_name' | awk -F "[><]" '/prod_name/{print $3}'
Nano-1-0
root@debian:~#
```

Turning off the output channel:

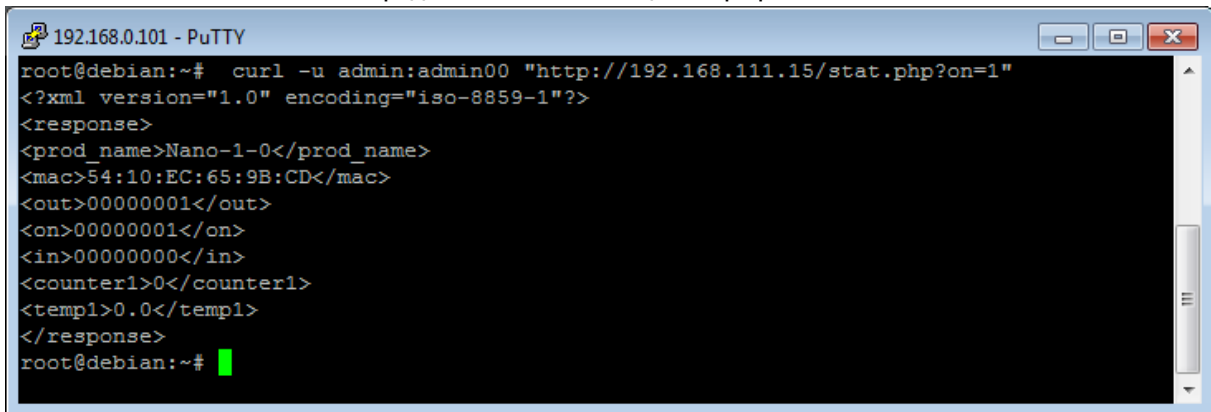
```
curl -u admin:admin00 "http://192.168.111.15/stat.php?off=1"
```



```
192.168.0.101 - PuTTY
root@debian:~# curl -u admin:admin00 "http://192.168.111.15/stat.php?off=1"
<?xml version="1.0" encoding="iso-8859-1"?>
<response>
<prod_name>Nano-1-0</prod_name>
<mac>54:10:EC:65:9B:CD</mac>
<out>00000000</out>
<on>00000000</on>
<in>00000000</in>
<counter1>0</counter1>
<temp1>0.0</temp1>
</response>
root@debian:~#
```

Switching on the output channel:

```
curl -u admin:admin00 "http://192.168.111.15/stat.php?on=1"
```



The screenshot shows a PuTTY terminal window titled "192.168.0.101 - PuTTY". The terminal displays the following text:

```
root@debian:~# curl -u admin:admin00 "http://192.168.111.15/stat.php?on=1"
<?xml version="1.0" encoding="iso-8859-1"?>
<response>
<prod_name>Nano-1-0</prod_name>
<mac>54:10:EC:65:9B:CD</mac>
<out>00000001</out>
<on>00000001</on>
<in>00000000</in>
<counter1>0</counter1>
<temp1>0.0</temp1>
</response>
root@debian:~# █
```


6.13 Communication protocol description

Byte	1	2	3	4	5	6	7	8	9	10	11		
Name	SOF	CMD	CH	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7	CRC	Return	
Command													
Set output	15	1	0-7	Mode [1-3]*	ON/OFF [0,1]	TON LSB*	TON MSB*	TOFF LSB*	TOFF MSB*	Restart state**	CRC	ON or NO	
Read channel parameters	15	2	0-7	x	x	x	x	x	x	x	CRC		
Set counter	15	10	0-7	[0:7]	[8:15]	[16:23]	[24:31]				CRC		
Read counter	15	11	0-7	[0:7]	[8:15]	[16:23]	[24:31]				CRC		
WWW control	15	99	x	1 - status 0x55 - off all other - on	x	x	x	x	x	x	CRC	ON or NO	
Read channels	15	100	x	x	x	x	x	x	x	x	CRC	CH7-CH0	Chx - 2 bytes; 1 output state 2 coil state
Read channel name	15	101	0-7	x	x	x	x	x	x	x	CRC	String	
Read device name	15	200	x	x	x	x	x	x	x	x	CRC	String	

*only Lantick and PE-2-1

** only Lantick

*** - Reading parameters returns:

SOF	CMD	Ch	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7	CRC
15	2	0-7	Mode[1-3], 100-input	ON/OFF[0,1]	TON LSB	TON MSB	TOFF LSB	TOFF MSB	Restart state	CRC

Description	Value	State
ON/OFF	0	off
	1	on
MODE	1	static
	2	toggle
	3	1-pulse
CRC	Byte sum	

As default modules are listening on port 9761

Frame examples:

Enabling output 1 in static mode

SOF	CMD	CH	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7	CRC
15	1	0	0	1	1	0	0	0	0	18

Set counter 2 to 100

SOF	CMD	CH	Data 1	Data 2	Data 3	Data 4	Data 5	Data 6	Data 7	CRC
15	10	1	100	0	0	0	0	0	0	132

6.14 Communication with module from outside network

If the module is in the LAN network different than PC that connects to it, the redirection of ports is necessary.

Depending on the form of communication different ports need to be redirected:

Using web interface:

- port TCP/IP 80

Computer software or customer application:

- 1 port TCP/IP 9761

Using MODBUS TCP protocol:

- port TCP/IP 502

Using SNMP protocol:

- port UDP 161

7 Checking the IP address

To check the current IP address of the device:

1. Press and hold the reset button until the display shows the four parts of the IP number, e.g.

192
168
111
15

2. Release the reset button.

8 DHCP

To enable/disable DHCP service:

1. Press and hold RESET button until the display shows: **dhcP**
2. Release the reset button.
3. Depending on the current DHCP setting, the message will be displayed **-on** or **-off**

9 Restoring factory defaults

In order to restore the module to its factory defaults:

1. Press and hold reset button until the display shows: **rSt**
2. Release the reset button.

With factory defaults restored the module settings are as follows:

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

10 Firmware update

The module has the ability to update the firmware. The firmware is supplied as a file with .bin extension.

Note! Improper use of the update feature may damage the module. Make sure that undisturbed power is connected to the module for duration of programming.

To perform the programming operation, go to the Windows command line (Start-> Run-> type 'cmd' and confirm with Enter).

Then navigate to the directory where the file resides and enter the command

```
tftp -i <module_ip_adress> PUT filename.bin
```

where: < module_ip_adress > is the IP address of the module
filename.bin – is the firmware supplied by Inveo s.c.

The programming takes about 1 minute and it's confirmed by "File Transferred" message.

.....
.....
.....