

User manual

Analog input converter LAN/RS485 Nano Analog PoE



Soft \geq 0.9

Dear Customer!

Thank you very much for choosing our product. Before its use, please read these instructions carefully. Here you find the most appropriate ways of dealing with this device, the basic principles of safety and maintenance. Please, also keep the user manual so that you can read it during later use.

Attention!

The manufacturer is not liable for any damage caused by improper use of the device which differ from its intended purpose, or improper handling, as well as a fault of driver resulting from improper use.

Contents

- 1 PRELIMINARY INFORMATION.....4**
- 2 APPLICATION OF THE DEVICE.....5**
- 3 WARRANTY AND LIABILITY OF THE MANUFACTURER.....5**
- 4 SAFETY GUIDELINES.....6**
 - 4.1 STORAGE, WORK AND TRANSPORT CONDITIONS.....6
 - 4.2 INSTALLATION AND USE OF THE DEVICE.....6
 - 4.3 DECOMMISSIONING OF THE DEVICE.....6
- 5 CONSTRUCTION OF THE DEVICE.....7**
 - 5.1 TECHNICAL DATA.....7
 - 5.2 GENERAL FEATURES.....8
 - 5.3 DESCRIPTION OF THE MODULE CONNECTORS.....9
 - 5.4 SENSOR CONNECTING SCHEMATICS.....10
- 6 CONFIGURATION OF THE DEVICE.....11**
 - 6.1 CHANGING THE DEVICE'S IP ADDRESS BY DISCOVERER APPLICATION.....11
 - 6.2 CHANGING THE PC'S SUBNET ADDRESS, FOR THE DEVICE CONFIGURATION.....12
 - 6.3 SECURITY SETTINGS AND ADMINISTRATION.....14
- 7 SENSOR SIGNAL CONVERSION FLOW.....15**
- 8 THE DEVICE FUNCTIONS.....17**
 - 8.1 THE DEVICE STATUS.....17
 - 8.2 CONFIGURATION OF THE ANALOG INPUT.....17
 - 8.3 SETTING THE ALARMS.....18
 - 8.4 SERVICES CONFIGURATION.....19
 - 8.5 DESTINATION CLIENT (M2M).....20
 - 8.6 TCP FRAMES FORMATS (DESTINATION CLIENT).....21
 - 8.7 SNMP CONFIGURATION.....23
 - 8.8 WINDOWS COMMAND LINE SOFTWARE.....24
 - 8.9 LINUX CONTROL PROGRAM.....24
 - 8.10 COMMUNICATION VIA THE MODBUS PROTOCOL.....25
 - 8.11 COMMUNICATION VIA THE MQTT INVEO PROTOCOL.....28
 - 8.12 COMMUNICATION WITH MODULE USING HTTP.....29
 - 8.13 DESCRIPTION OF THE COMMUNICATION PROTOCOL.....30
- 9 COMMUNICATION WITH THE MODULE FROM THE EXTERNAL NETWORK.....31**
- 10 CHECKING THE IP ADDRESS.....31**
- 11 DHCP.....31**
- 12 RESTORING FACTORY DEFAULTS.....32**
- 13 FIRMWARE UPDATE.....32**

1 Preliminary information

Before starting work with the device, read The User manual and follow the instructions contained therein!

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 device



Important information and guidelines



Following this guidelines makes the use of the device easier

Attention: The screenshots in this manual can be dissimilar from actual images at the time of the device purchase. Due to continuous development of the devices software, some of the functions may differ from these in the manual. The manufacturer claims no responsibility for any undesirable effects (misunderstanding) caused by changes of the software.

2 Application of the device

The Nano Analog PoE device is used to transmit the measured current or voltage across the LAN. The measured value is available through the embedded website and via HTTP GET, Modbus TCP, SNMP and MQTT protocols. An additional RS485 port enables communication via the Modbus RTU protocol. The device can send an exceeded value to other Inveo modules, causing eg remote activation of the relay.

3 Warranty and liability of the manufacturer



The manufacturer provides a 2-year warranty on the device. The manufacturer also provides post-warranty service for 10 years from the date of the introducing the device 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,
- the device is operated in accordance with the recommendations outlined in this manual,
- the device is used as intended.

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



This device doesn't contain serviceable parts.

4 Safety guidelines

The device has been designed and built 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 a high-quality plastic.

4.1 Storage, work and transport conditions

The device has to be stored in enclosed rooms which are free of caustic vapors and substances and also meet the requirements:

- surrounding temperature from -30°C to $+60^{\circ}\text{C}$,
- humidity from 25 to 90%,
- atmospheric pressure from 700 to 1060hPa.

The device working conditions:

- surrounding temperature from -10°C to $+55^{\circ}\text{C}$,
- relative humidity from 30% to 75%,
- atmospheric pressure from 700 to 1060hPa.

Recommended transport conditions:

- surrounding temperature from -40°C to $+85^{\circ}\text{C}$,
- relative humidity from 5% to 95%,
- atmospheric pressure from 700 to 1060hPa.

4.2 Installation and use of the device

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

4.3 Decommissioning of the device

When it becomes necessary to recycle the device (for instance, to decommission the device from service), please contact the manufacturer or its representative, who are obliged to respond, appropriately, i.e. collecting the device from the user. You can also ask the companies involved in recycling of electrical or computer equipment. Under no circumstances should you place the device along with other waste material.

5 Construction of the device

5.1 Technical data

Power supply:

PoE: 33-57V POE IEEE 802.3af
DC: 12-24VDC (screw terminals 3,5mm)
Power consumption: max 1,5W

Input

2 analog inputs
Readout from chosen analog input (voltage or current)
Software configuration
Frequency of measurement: 4Hz
Transducer resolution: 17 bit

Input parameters in current mode:

Measurement range: 0-20mA or 4-20mA
Maximum input current: 25mA
Input impedance: 1R
Measurement error: <0,8%

Input parameters in voltage mode:

Measurement range: 0-5V lub 0-10V
Maximum input voltage: 12V
Input impedance: 60k
Measurement error: <0,5%

Communication:

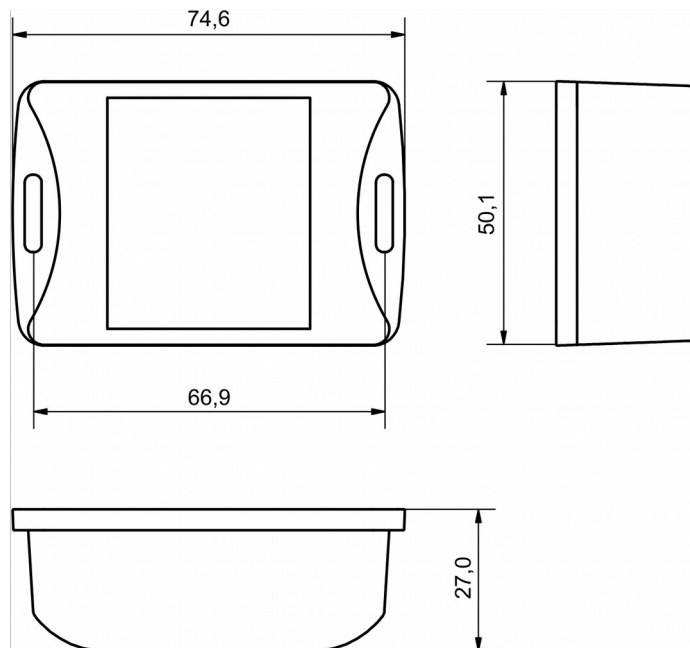
1 port Ethernet, 10Mbps,

1 port RS485, modbus RTU,
Transmission speed: 1200,2400,4800,9600,19200,38400,57600 bps,
Parity: None, Odd, Even, Mark, Space, 2 Stops.

Housing:

IP Code: 30

Dimensions:



5.2 General features

The general view of the Nano Analog PoE module is shown below.



The module supports the following types of sensors:

- sensors with voltage output 0-5V
- sensors with voltage output 0-10V
- sensors with current output 4-20mA
- sensors with current output 0-20mA.

The user can configure the method of transformation the measured value by using the function of conversion of the measured value (mathematical function), setting the range of the sensor and unit selection.

Communication with the module is done via LAN and RS485 (Modbus RTU)

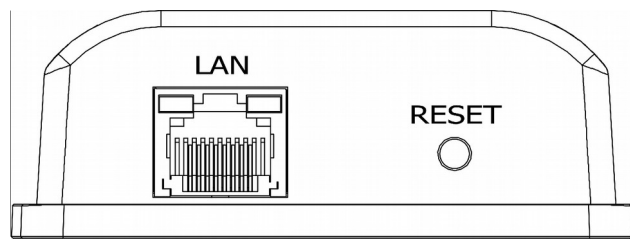
The following communication options are available:

- embedded web server, using a standard internet browser (preferred browsers are MOZILLA FIREFOX, OPERA, CHROME),
- windows / linux command line programs
- HTTP protocol
- Modbus TCP protocol
- Modbus RTU protocol
- SNMP protocol
- own application via TCP protocol (shared protocol)
- MQTT to Inveo server protocol

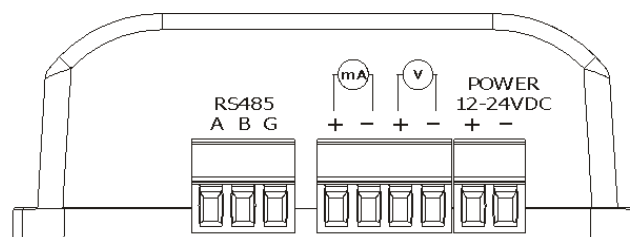
The module is equipped with an LED display on which the currently measured value is displayed.

5.3 Description of the module connectors

The module is equipped with the following connectors:



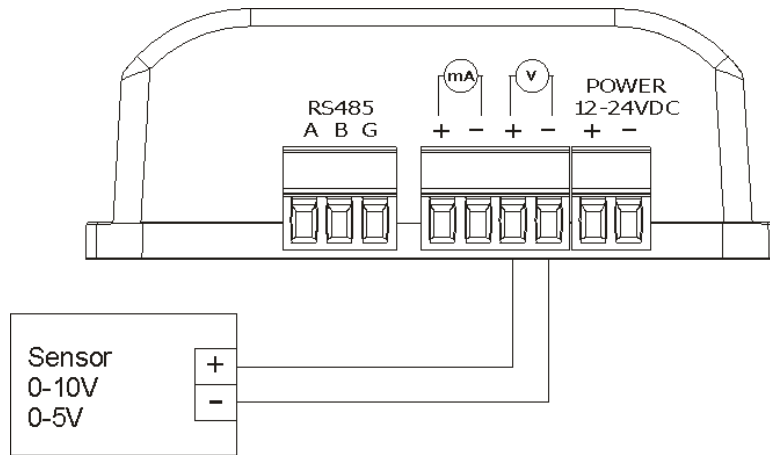
- **LAN** – connection of LAN and power PoE IEEE 802.3af,
- **RESET** – a button to enabling the DHCP, checking the current IP address and restoring the module to the factory settings,



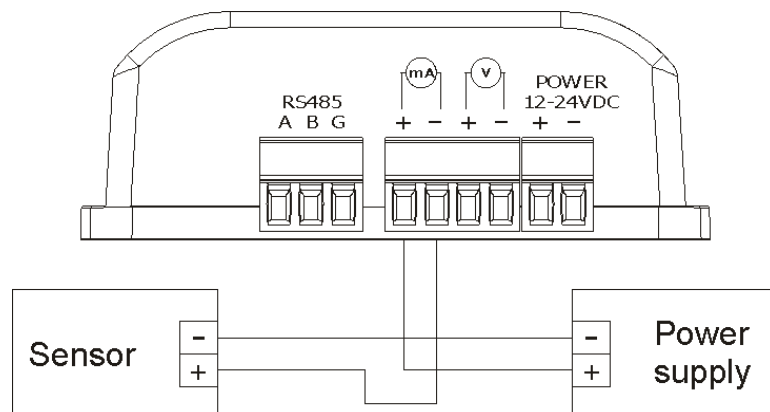
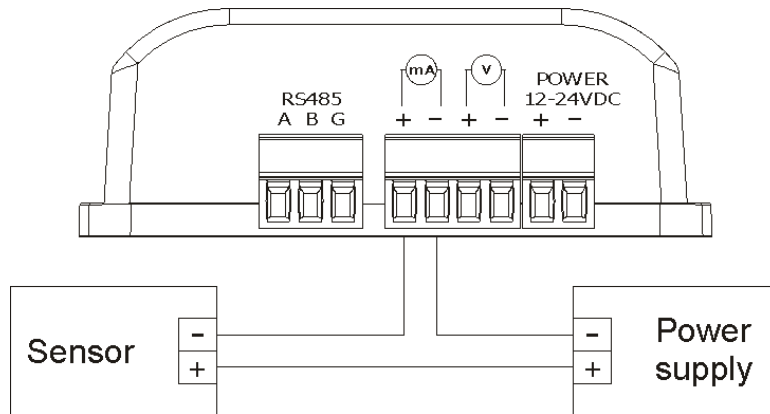
- **mA / V** – screw connection for sensor connection (voltage/current),
- **RS485** – MODBUS RTU communication connection,
- **POWER** – power connection. An additional power connection used in the event of a PoE power failure. Power supply voltage 12-24VDC.

5.4 Sensor connecting schematics

Voltage output sensors (0-10V or 0-5V)



Current output sensor (0-20mA or 4-20mA)



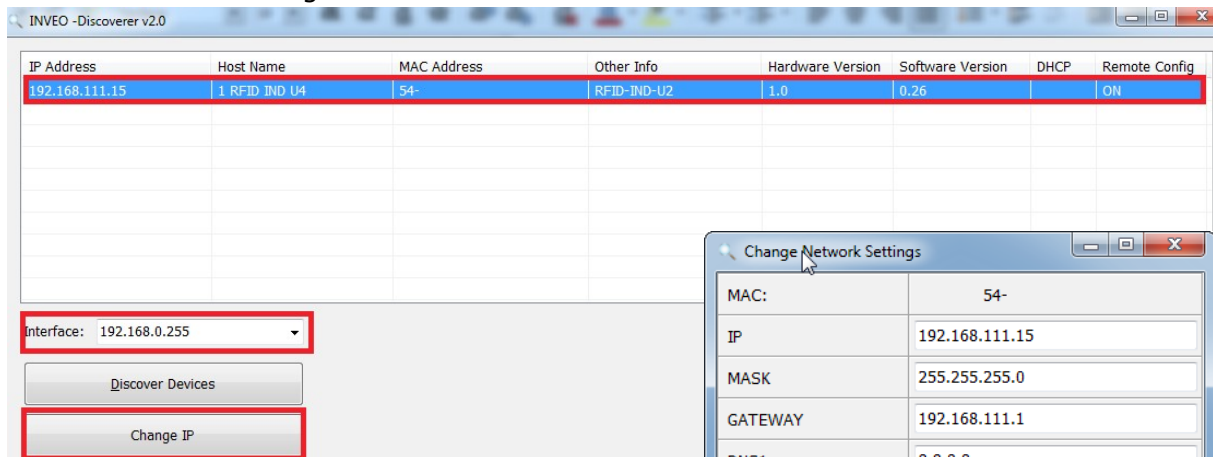
6 Configuration of the device

The device when used for first time needs to be configured.

There are two methods to do so. The network configuration can be easily changed by Inveo "Discoverer" (<https://inveo.com.pl/software/>) software:

6.1 Changing the device's IP address by Discoverer application.

When the "Discoverer" is opened and the relevant device is found, choose Interface list box and click on Change IP button.



In a new opened dialog box, settings such as IP address, MASK, GATEWAY, DNS1/DNS2 and the Host name can be changed.

Please save correct settings by choosing **Change** button.

If **Remote Config** is disabled (enabled by default), it is necessary to configure the device by changing the computer's subnet (chapter 6.2).

To enable the remote configuration it is necessary to enter **Administration** tab and mark **Enable Remote Network Config**.



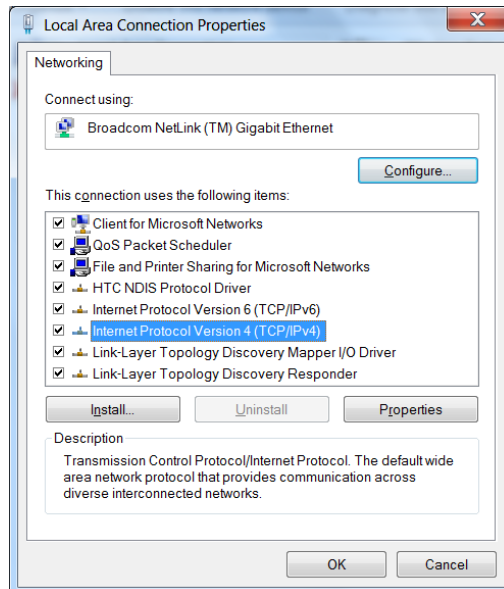
Save the setup by selecting **Save Config** button.

6.2 Changing the PC's subnet address, for the device configuration

After the device is connected to a network, a subnet address of a PC which is connected to the same network has to be changed.

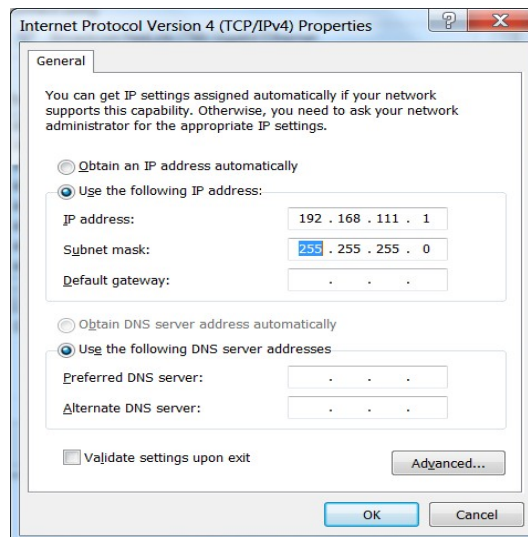
To do so, go to the PC's MS Windows network configuration: Start->Control panel ->Network and Sharing Center->Network and Internet->Network Connections, choose the related controller and right click on „Properties“.

After selecting this option configuration window will show up:



Changing network settings in MS WINDOWS

Next choose "Internet Protocol (TCP/IP)", double click on it and enter following settings:




Illustrative TCP/IP protocol settings

After saving changes by clicking OK, open an Internet browser and enter in the browser's address line: **192.168.111.15**.

Default user name/password: admin/admin00

In the **Network** tab it is possible to change LAN parameters.


www.inveo.com.pl

- Model: Nano Thermo
- IP: 192.168.0.238
- Name:
- Firmware: 0.9
-

- Home
- Input
- Network
- SNMP
- Administration

Network Configuration

This page allows the configuration of the device's network settings.

IP Configuration		
Name	Value	Description
Host Name	<input type="text" value="NANO"/>	0..15 characters
DHCP	<input type="checkbox"/>	Enable DHCP Client
IP Address	<input type="text" value="192.168.0.238"/>	A.B.C.D
IP Mask	<input type="text" value="255.255.255.0"/>	A.B.C.D
Gateway	<input type="text" value="192.168.0.101"/>	A.B.C.D
DNS1	<input type="text" value="192.168.0.101"/>	A.B.C.D
DNS2	<input type="text" value="213.5.255.2"/>	A.B.C.D
Destination IP	<input type="text" value="0.0.0.0"/>	Address of other device to communicate (1 to 1 TCP connection)
Destination Port	<input type="text" value="0"/>	Port to communicate
Reset to default	<input type="text"/>	To reset the device type in this field 'reset'

To change the network settings, use the following fields:

- **Host Name** – NETBIOS name,
- **DHCP** – checking this box forces use of the address assigned by the DHCP server,
- **IP Address** – the IP address of the reader,
- **IP Mask** – IP subnet mask,
- **Gateway** – network gateway,
- **DNS1, DNS2** – DNS servers addresses,
- **Destination IP** – the IP address of the server or of the external device in the M2M connection (chapter 8.4),
- **Destination Port** – the listening port of the server or of the external device in the M2M connection,
- **Reset to default** – reset the device to the factory settings.

After all changes, select **Save**.

6.3 Security settings and administration

The Administration settings allow for changing access password and to enable/disable particular services in the device.

The device name

The device used in a system can be named and identified.

Module name		
Name	Value	Description
Module name	<input type="text"/>	0..15 characters

Admin password change

To change an administrator password, in **Current Password** value field write a current password. Next in appropriate value field **New Password** write your new password and confirm it at **Re-type Password** value field.

Admin Password		
Name	Value	Description
Current Password	<input type="text"/>	0..15 characters
New Password	<input type="text"/>	0..15 characters
Re-type password	<input type="text"/>	0..15 characters

Admin Password – an administrator password change (login: admin, has access to the device all configurations settings)

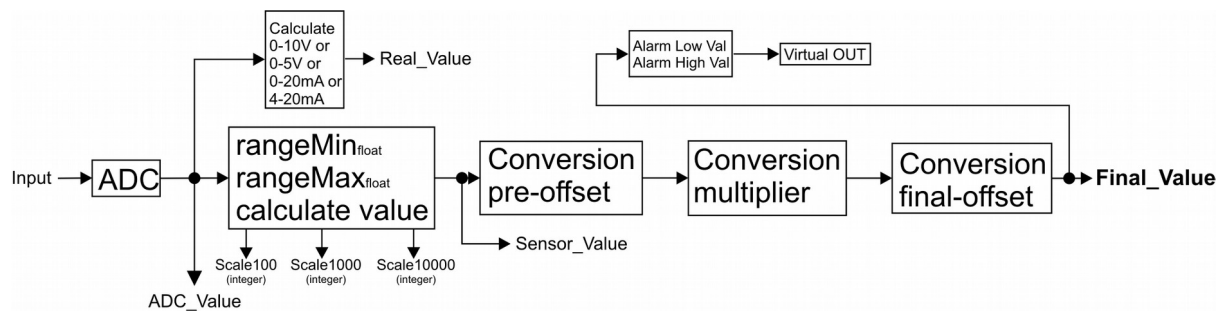
Current Password – current admin password

New Password – a new admin password

Re-type Password – a new admin password confirmation

7 Sensor signal conversion flow

Signal flow from Sensor is shown below.



Current or Voltage input signal (Input) is converted by Analog to Digital Converter (ADC). Value from ADC is available via **ADC_Value** variable.

Real_Value is measured value given in sensor unit (V or mA). Is the same value like measured by multimeter.

The **rangeMin** and **rangeMax** values are sensor measure range. The **rangeMin** is physical value of sensor for minimal measured range, i.e. -50°C for 4mA or 0V. The **rangeMax** is physical value of sensor for maximal measured range, i.e. 200°C for 20mA. This parameters are given for calculate real value from sensor and is accesible by **Sensor_Value** variable.

Example:

Application use the thermometer sensor with current output 4-20mA and measured range from -50°C to 100°C. The rangeMin is set to -50 and rangeMax is set to 100. The **Sensor_Value** variable show -50 for 4mA and 100 for 20mA. The remaining values in the range will be interpolated.

For better matching results for a given application, the user has a linear function:

$$\mathbf{Final_Value = a(Sensor_Value + c) * b}$$

It can be used for scale output or add/substract offset to measured value.

```
Final_Value = Conversion_multiplier * (Sensor_Value + Conversion_pre-offset)
+ Conversion_final-offset
```

The Conversion_* variables are real values (with sign and optional fraction part). The use of conversions, for example, allows subtraction from the measured value of -10, multiplication by 0.01 (i.e. dividing by 100) to obtain a usable quantity in the final application.

The **Final_Value** is presented on display LED.

Example:

The Sensor_Value value from the distance sensor is 2654 cm. This distance is overvalued by 10 cm, additionally in the application it is required that the value is given in inches. To obtain such a result, the coefficients must be set:

Conversion_pre-offset = -10

Conversion_multiplier = 0.394 (1 / 2.54 = 0.394)

Conversion_final-offset = 0

With such coefficients, the Final_Value value will be corrected for error and reported in inches.

The Scale10000, Scale1000 and Scale100 values are proportional to Real_Value in the given range. For example, at the current input for 4mA Scale10000 = 0, and for 20mA Scale10000 = 10000.

All resulting values (variables) are available via Modbus TCP, Modbus RTU, HTTP XML and others.

8 The device functions

8.1 The device status

Current data from the sensor is displayed in the **Home** tab.

Name	Value	Description
Sensor Name	Sensor 1	
Final Value	60.18 cm	Final user value
Sensor Value	.60	Measured value
Real Value	4.954mA	Voltage/Current real value
Alarm State	OK	

The field **Sensor Name** is the name of the sensor edited in the **Input** tab. **Alarm State** informs about exceeding set thresholds.

8.2 Configuration of the analog input

The **Input** tab is to configure the input type and signal conversion method. Before configuring, it is recommended to read the chapter Sensor signal conversion flow.

Input Configuration		
Input Setup		
Name	Value	Description
Input Name	<input type="text" value="Sensor 1"/>	0..15 characters
Type	<input type="text" value="4-20mA"/>	See User Manual for additional external connections
Range Min	<input type="text" value="0.000"/>	Sensor value for min range
Range Max	<input type="text" value="10.000"/>	Sensor value for max range
Scaling Conversion [final = a(input+c) + b]		
Name	Value	Description
Conversion Pre-Offset (c)	<input type="text" value="0.0"/>	Value added to input value
Conversion Multiplier (a)	<input type="text" value="100.00"/>	Multiplier factor (after pre-Offset)
Conversion Final-Offset (b)	<input type="text" value="0.0"/>	Value added to multiplied value.
Unit	<input type="text" value="cm"/>	0..3 characters

Input Name is the name of the sensor (not the device) given by the user. The input type is set in the field **Type**. The options are:

- 4-20mA
- 0-20mA
- 0-5V
- 0-10V

Range Min and **Range Max** determine the range of the sensor for the input measuring range.

The **Conversion...** fields set the conversion parameters of the measured value (Sensor_Value) to final value (Final_Value).

The **Unit** field allows adding a unit to the final value of the measured signal.

8.3 Setting the alarms

The device can compare the measured value with the thresholds set by the user. Detection of value violation is treated as an alarm. The alarm status is available as virtual input and for most protocols.

Alarm		
Name	Value	Description
Alarm Low Value	<input type="text" value="0.0"/>	0.0 format
Alarm High Value	<input type="text" value="0.0"/>	0.0 format
Alarm mode	<input type="text" value="Disabled"/>	

Client Setup		
Name	Value	Description
Client Mode	<input type="text" value="Off"/>	Select destination channel in 1 to 1 TCP connection

The alarm can be configured for the following cases (Alarm mode):

- **Disabled** – the alarm disabled
- **Low** – the alarm is active if the measured value is smaller than the value set in the field **Alarm Low Value**.
- **High** – the alarm is active if the measured value is higher than the value set in the field **Alarm High Value**.
- **Low + High** – the alarm is active if the measured value is higher than the value in the field **Alarm High Value** or lower than the value **Alarm Low Value**.

The occurrence of an alarm condition is signaled by a flashing LED display on the device. During the alarm, the virtual output 1 is activated in the status.xml resource <http://192.168.111.15/status.xml> (`<on>00000001</on>`)

```
<response>
<prod_name>Nano-AN</prod_name>
<sv>0.9</sv>
<mac>D0:00:00:00:00:00</mac>
<on>00000001</on>
<valFinal>2.49</valFinal>
<unitFinal>m</unitFinal>
<valSensor>2.49</valSensor>
<unitSensor>mA</unitSensor>
<inputType>0</inputType>
<valScale10000>2338</valScale10000>
<valScale1000>233</valScale1000>
<valScale100>23</valScale100>
<iu>7.735</iu>
</response>
```

If the SNMP service has been configured, the device can send **TRAP** to the IP address.

8.4 Services configuration

Administration tab allows to choose which services are to be available. Selecting the check box next to the service name activates the selected service.

Services		
Name	Value	Description
Enable Program Access	<input type="checkbox"/>	Is needed by TCPrel and 1 to 1 TCP connection.
Enable MODBUS TCP	<input type="checkbox"/>	
Enable MODBUS RTU	<input type="checkbox"/>	
Enable SNMP	<input type="checkbox"/>	
Enable Destination Client	<input type="checkbox"/>	Allow module to send data to other device (1 to 1 TCP connection)
EnableMQTT Client	<input type="checkbox"/>	[Show Info]
Enable Remote Network Config	<input checked="" type="checkbox"/>	
Enable TFTP Bootloader	<input type="checkbox"/>	Allow remote upgrade firmware by TFTP. For safety reasons, the option should be disabled.

Enable Program Access – a service of access by a computer program (Windows, Linux) and TCP / IP protocol operating on port 9761,

Enable Modbus TCP – enables Modbus TCP server,

Enable Modbus RTU – enables Modbus RTU (RS485) server,

Enable SNMP – enables SNMP protocol supporting,

Enable Destination Client – connecting to a remote host service (chapter 8.5),

Enable MQTT Inveo – a service that sends data to the INVEO MQTT cloud,

Enable Remote Network Config – a service of remote change of network settings by the INVEO DISCOVERER program,

Enable TFTP Bootloader – enables a bootloader.



Attention:

TFTP Bootloader and **Remote Network Config** ought to be disabled during normal work operation. It should be enabled for a firmware update only.

8.5 Destination Client (M2M)

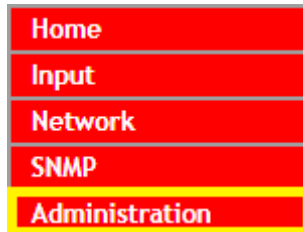
Inveo devices as LanTick, Nano Temperature Sensor, Nano Digital Input, Nano Relay Output or others **are able to send information data to the server or to another module with outputs** using the TCP or UDP protocol. It means that this another module can react to activation of channel or when alarm occurs (Nano Sensors). The message is sent each time state is changed and additionally every 5 seconds.

Configuration of devices receiving messages (external devices)

To enable the service, enter the **Administration** tab and select **Enable Program Access** and confirm with the **Save Config** button.

Configuration of devices sending alarm status messages

To enable the service, enter the **Administration** tab and select **Enable Destination Client** and confirm with the **Save Config** button.



Enable Destination Client	<input checked="" type="checkbox"/>	Allow module to send data to other device (1 to 1 TCP connection)
---------------------------	-------------------------------------	---

In the **Administration** tab, fill in the **Destination IP** and **Destination Port** fields. The **Destination IP** field is an IP address of the external device. The **Destination Port** field is a port number of the external device (9731 by default).

Destination IP	<input type="text" value="192.168.111.16"/>	Address of other device to communicate (1 to 1 TCP connection)
Destination Port	<input type="text" value="9761"/>	Port to communicate

Then, in the **Input** tab select the appropriate output which will be enabled in the external device or – select type of the message.

Client Setup		
Name	Value	Description
Client Mode	<input type="text" value="Dest:1"/>	Select destination channel in 1 to 1 TCP connection

In the **Client mode** field in the **Administration** tab, user can choose the format of the frame:

- **Off** – sending frames disabled,
- **Dest: 1..8** – sending TCP frames in **format #1** (compatible with INVEO devices)

This format allows to enable output in the other Inveo device with the relay output (e.g. LanTick). The output will be turned on when the alarm state occurred and will be turned off when the device is in its normal state.

- **Status** – sending TCP frames in **format #2**,
- **MAC + Status** – sending TCP frames in **format #3**.

8.6 TCP frames formats (Destination Client)

Format #1

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

An example TCP frame sent with active alarm and **Dest:5** set

SOF	CMD	CH	F_ID	ALARM	!ALARM	Val0 (LSB)	Val1	Val2	Val3 (MSB)	CRC
0x0F	0x01	0x04	0xFF	0x01	0xFE	0x0F	0x00	0x01	0x57	0x79

An example TCP frame sent with inactive alarm and **Dest:5** set

SOF	CMD	CH	F_ID	ALARM	!ALARM	Val0 (LSB)	Val1	Val2	Val3 (MSB)	CRC
0x0F	0x01	0x04	0xFF	0x00	0xFF	0x0F	0x00	0x01	0x57	0x79

Values **Val0-Val3** is a 32-byte Final_Val value multiplied with * 1000.

Calculation CRC:

CRC = (BYTE) SUM (SOF+CMD+CH+F_ID+ALARM+!ALARM+Val0 (LSB)+Val1+Val2+Val3 (MSB))

Format #2

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

<ALARM>[SPACE]<Final_Val>

- **ALARM** – value 1 means an alarm is active, 0 means an alarm is inactive
- **Final_Val** – Final_Val value

Value in HEX						STRING
30	20	33	39	2E	35	0 39.5

Format #3

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

<MAC>[SPACE]<ALARM>[SPACE]<Final_Val>

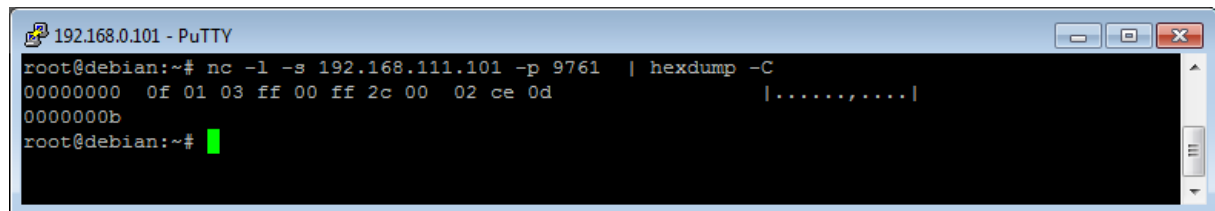
- **MAC** – network address of the module
- **ALARM** – value 1 means an alarm is active, 0 means an alarm is inactive
- **Final_Val** – Final_Val value

Value in HEX	STRING
35 34 31 30 45 43 36 35 35 30 32 31 20 30 20 34 36 2E 39	5410EC655021 0 46.9

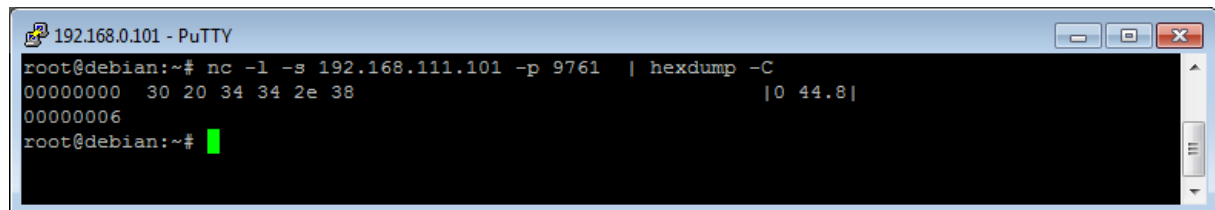
The TCP frame can be supported with your own software.

An example of using the netcat command for Linux:

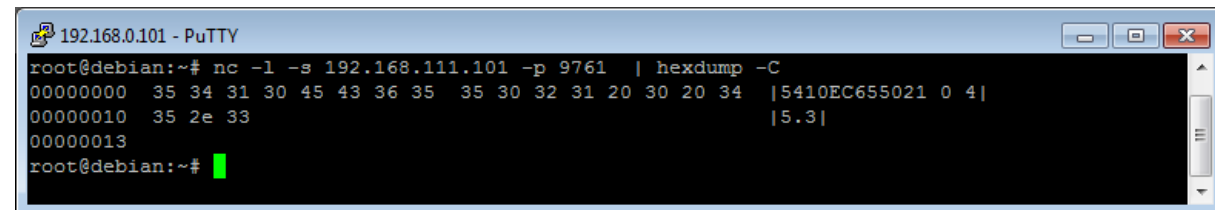
Format #1



Format #2



Format #3



8.7 SNMP configuration

The module is equipped with an SNMP v2c server.

To enable this feature go to **Administration** tab and check **Enable SNMP** option.

The SNMP protocol allows to read the current value.

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

Name	Value	Description
Read Community	public	0..15 characters
Write Community	private	0..15 characters
Enable Trap 1	<input type="checkbox"/>	
Trap IP Address 1	0.0.0.0	
Enable Trap 2	<input type="checkbox"/>	
Trap IP Address 2	0.0.0.0	

To use the SNMP protocol, save the MIB file by right-clicking on the **Download MIB file** link. Then select the **Save** link as option. Download the file to the MIB Browser program.

The basic parameters that can be read from the Nano Analog PoE module can be found in the table:

Name	Format	OID
Final_Val	STRING	.1.3.6.1.4.1.42814.14.3.5.1.0
Final_Val (część całkowita)	INTEGER	.1.3.6.1.4.1.42814.14.3.5.2.0
Final_Val x10	INTEGER	.1.3.6.1.4.1.42814.14.3.5.3.0
Alarm aktywny	INTEGER	.1.3.6.1.4.1.42814.14.3.1.1.0

Module can send TRAP messages after alarm activation. Destination address should be entered in **Trap IP Address 1** and **Trap IP Address 2** fields.

8.8 Windows command line software

The module's input status can be read from the Windows command line. To use the Windows command line, enable the **Program Access** service in the **Administration** tab.

Windows syntax:

TCPRel.exe [Parameters]

Parameter	Description
-in=1	The number of the input being read
-host=[HOST]	The IP address of the module
-port=[PORT]	Module port
-analog	Reading values from the sensor

Example:

Reading the current value, the module has an address: 192.168.111.15 and listens on port 9761:

```
TCPRel -in=1 -host=192.168.111.15 -port=9761 -analog
```

8.9 Linux control program

The module's input status can be read from the command line of the Linux system. To use the Linux control program, enable the **Program Access** service in the **Administration** tab.

Syntax:

./TcpRel.exe [Parameters]

Parameter	Description
-i 1	The number of the input being read
-h [HOST]	The IP address of the module
-p [PORT]	Module port
-a	Reading the current value

Example:

Reading the current value, the module has an address: 192.168.111.15 and listens on port 9761:

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


8.10 Communication via the MODBUS protocol

The device supports Modbus RTU and Modbus TCP protocols.
The Modbus TCP server is available over LAN and listens on port 502.
Modbus RTU is available via the RS485 port.

The Modbus configuration is available via the **Administration** tab:

Services		
Name	Value	Description
Enable Program Access	<input type="checkbox"/>	Is needed by TCPrel and 1 to 1 TCP connection.
Enable MODBUS TCP	<input checked="" type="checkbox"/>	
Enable MODBUS RTU	<input checked="" type="checkbox"/>	
Enable SNMP	<input checked="" type="checkbox"/>	
Enable Destination Client	<input type="checkbox"/>	Allow module to send data to other device (1 to 1 TCP connection)
EnableMQTT Client	<input type="checkbox"/>	[Show Info]
Enable Remote Network Config	<input type="checkbox"/>	
Enable TFTP Bootloader	<input checked="" type="checkbox"/>	Allow remote upgrade firmware by TFTP. For safety reasons, the option should be disabled.

RS485 Parameters (Modbus RTU)		
Name	Value	Description
PDU	<input type="text" value="1"/>	
Baudrate	<input type="text" value="9600"/>	bps
Parity	<input type="text" value="None"/>	

Modbus data mode		
Name	Value	Description
Long (32bit) byte order	<input type="text" value="CD AB"/>	
Float byte order	<input type="text" value="CD AB"/>	

To enable the Modbus protocol, check the **Enable Modbus TCP** or **Enable Modbus RTU** field.

Configuration of RS485 port:

The options are:

PDU – the device address

Baudrate – transmission speed setting: 1200, 2400, 4800, 9600, 19200, 38400, 57600 bps

Parity: None, Odd, Even, Mark, Space, 2 Stops

Order of bytes for the Long and Float types

To enable working with less standard Modbus master devices, the module has been configured with a 32-bit value representation method.

32-bit values are read as 2 consecutive registers (HoldingRegisters) which are 16 bit. Each 16-bit register consists of 2 bytes.

Devices existing on the market interpret such 4-byte numbers in different ways. Sometimes it is necessary to convert the order of bytes to a 32-bit value.

The device allows 4 conversion modes (that is all possible) separately for Long (integer) and Float (floating point) values.

For example, for Long, a decimal number 512002 has a hexadecimal value 00 07 D0 02

Representation of the number in different formats will look as follows

Order	A	B	C	D	HoldingRegister	HoldingRegister + 1
AB CD	00	07	D2	02	0007	D202
CD AB	D2	02	07	00	D202	0700
DC BA	02	D2	00	07	02D2	0007
BA DC	07	00	02	D2	0700	02D2

The most common modes are AB CD and CD AB.

Supported Modbus functions

The device supports the following MODBUS functions:

- 0x01 Read Coils,
- 0x03 Read Holding Register,
- 0x06 Write Single Register,
- 0x0F Write Multiple Coils,
- 0x10 Write Multiple Registers.

Coils Register

Reg. no.	Name	R/W	Description
1	Alarm	R	Alarm flag (1-alarm, 0-no alarm)

Holding Registers

Reg. no.	Name	R/W	Description
Integer value 16 bit			
1	Final_value	R	Wartość finalna, część dziesiętna
2	Final_value x 10	R	Wartość finalna *10
3	Real_Value x1000	R	Zmierzona wielkość z wejścia (0-20mA, 0-10V) x1000
4	Scale10000	R	Sygnal wejściowy skalowany do wartości 0-10000
5	Scale1000	R	Sygnal wejściowy skalowany do wartości 0-1000
6	Scale100	R	Sygnal wejściowy skalowany do wartości 0-100
Long values (32 bit)			
10	ADC_Value	R	Wartość z przetwornika
11			
12	Final_Value x1000	R	Wartość finalna * 1000
13			
14	Sensor_Value x1000	R	Wartość z sensora * 1000
15			
16	Real_Value x1000	R	Zmierzona wielkość z wejścia (0-20mA, 0-10V) x1000
17			
Float value (32 bit)			
10	ADC_Value	R	Wartość z przetwornika
11			
12	Final_Value *1000	R	Wartość finalna * 1000
13			
14	Sensor_Value *1000	R	Wartość z sensora * 1000
15			
16	Real_Value x1000	R	Zmierzona wielkość z wejścia (0-20mA, 0-10V) x1000
17			

8.11 Communication via the MQTT Inveo protocol

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

Application configuration – MQTT client:

Address: mqtt.inveo.com.pl

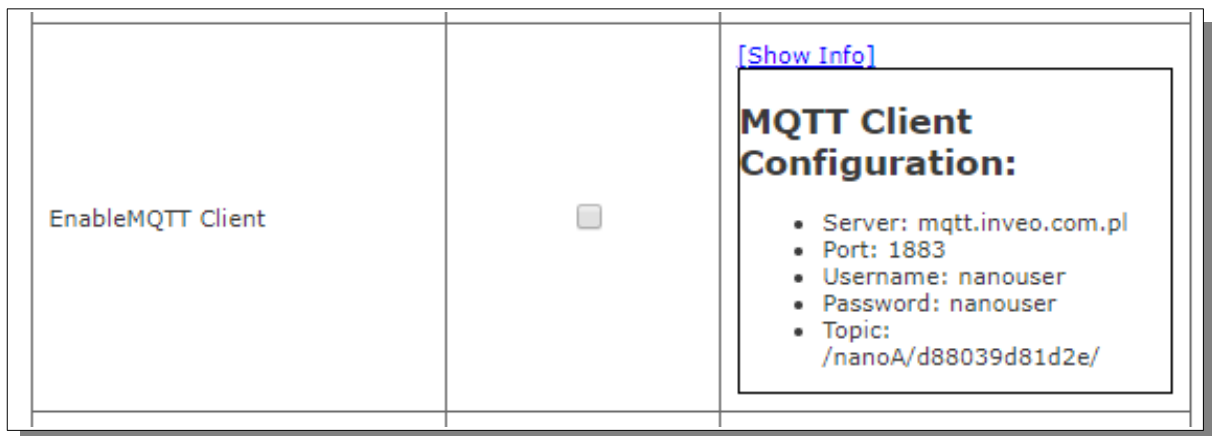
Port: 1883

User name: nanouser

User password: nanouser

Topic: /nanoA/<MAC>

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



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

8.12 Communication with module using HTTP.

Modules are able to download data using the HTTP GET protocol.

- **status.xml** – the resource containing basic information about the module
- **value.txt** – the final value (Final_Value) presented in text form

To read the current state of the module, refer to a resource in an Internet browser, e.g. <http://192.168.111.15/status.xml>

The module in the XML file will return all relevant information:

```
<response>
<prod_name>Nano-TC</prod_name>
<sv>0.9</sv>
<mac>00:00:00:00:00:00</mac>
<on>00000000</on>
<valFinal0>3.13</valFinal0>
<unitFinal0>C</unitFinal0>
<valFinal1>22.99</valFinal1>
<unitFinal1>C</unitFinal1>
</response>
```

Section	Description
<prod_name>Nano-TC</prod_name>	Type of the module
<sv>0.9</sv>	The firmware version
<mac>00:00:00:00:00:00</mac>	MAC address
<on>00000000</on>	Status of virtual outputs: 00000001 means alarm state
<valFinal0>3.3</valFinal0>	The final value of the thermocouple (Final_Value)
<unitFinal0>C</unitFinal0>	Unit
<valFinal1>22.99</valFinal1>	The final value of the RTD sensor (Final_Value)
<unitFinal1>C</unitFinal1>	Unit

Example of reading the measured value with the CURL command

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

Reading values from the **value.txt** resource:

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

Reading the Final_Value value from the status.xml file

```
curl "http://192.168.111.15/status.xml" -w "\n" 2>/dev/null | grep 'valFinal' | awk -F ">" '{print $3}'
```

8.13 Description of the communication protocol

Nano TC Sensor communication data frame.

Command	Byte number	1	2	3	4	5	6	7	8	9	10	11	
	Byte name	SOF	CMD	Channel	Data1	Data2	Data3	Data4	Data5	Data6	Data7	CRC	Returns
Temperature reading	dec	15	13	0	X	X	X	X	X	X	X	CRC	4bytes + CRC
	hex	0x0F	0x0D	0x00	X	X	X	X	X	X	X	CRC	4 bytes + CRC

As default modules are listening on TCP port 9761.

Reading the current value from the Nano TC Sensor.

SOF	CMD	CH	D1	D2	D3	D4	D5	D6	D7	CRC
0x0F	0x0D	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x1C

CRC = (BYTE) SUM (SOF+CMD+CH+D1..D7)

9 Communication with the module from the external network

If the module is in a different LAN network than the computer connecting to it, port forwarding is required.

Depending on the communication method used with the module, it is necessary to contact the Network Administrator and port forwarding:

Support via website and HTTP protocol:

- port TCP 80

Service by a computer program or by your own application:

- port TCP 9761

Support via MODBUS TCP:

- port TCP 502

Support via SNMP protocol:

- port UDP 161

10 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.

11 DHCP

To enable/disable DHCP service:

1. Press and hold RESET button (about 5 sec) 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**.

It is also possible to enable DHCP in the network configuration in the **Network** tab or through Discoverer application.

12 Restoring factory defaults

In order to restore the module to its factory defaults:

1. Press and hold reset button (about 10 sec) until the display shows: **rSt**.
2. Release the reset button.

With factory defaults restored the module settings are as follows:

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

13 Firmware update

The device has the ability to update the firmware. The software update program is provided as a *.bin file.

Warning! Incorrect use of the update feature may damage the reader. Make sure that undisturbed power is provided to the device for duration of programming.

To update the software:

- check the **Enable TFTP Bootloader** option, which is located in the Administration tab,
- run the Windows command line (Start-> Run enter 'cmd' and confirm with the Enter key),
- go to the directory where the .bin file is located
- enter the command:

```
tftp -i <address_ip_of the reader> PUT file.bin
```

where: <address_ip_of the reader> is the IP Address of the reader
file.bin – the file with the update program

Programming takes 1-2 minutes. End of programming confirms the message 'File Transferred'.

For correct functioning of the reader, after the update operation the „**Enable TFTP Bootloader**“ option has to be switched off.

Step-by-step instruction for firmware updates is available at www.inveo.com.pl.

The latest instructions and software are available on the site www.inveo.com.pl.