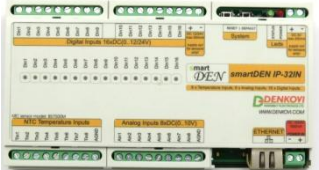
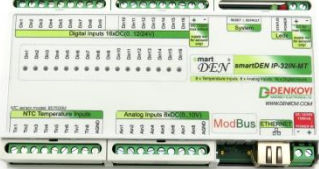



smartDEN IP-32IN-XX

Web enabled 32 Input Module

User Manual
 Date: 07 Nov 2024

Device	Short Name	Integration Protocol	Firmware version
	smartDEN IP-32IN	SNMPv2	v1.30 / Feb 2024
	smartDEN IP-32IN-MT	Modbus TCP	v1.30 / Nov 2024
	smartDEN Notifier	MQTT V3.1.1	v1.30 / Aug 2024

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1. Features

smartDEN IP-32IN-XX is an Ethernet input module designed especially for remote monitoring and logging. It provides 16 digital inputs (for motion detector sensors, dry contacts, switches, buttons), 8 analog inputs (for temperature, humidity, light, pressure sensors) and 8 NTC inputs especially designed for thermistors type B57500M. The integrated web server for set-up, the various communication protocols allow easy embedding in other systems. Additionally, the **smartDEN IP-32IN** module variant is able to control other remote relays based on input event or work in "Data Logging Mode" in order to post data in xml/json format on a remote server.

A list of **smartDEN IP-32IN-XX** features includes:

Inputs:

- 16 digital inputs (counters) with ON/OFF LED;
- 8 analog inputs 0-10V DC;
- 8 temperature inputs for NTC thermistors type B57500M;
- Linearization (scaling) for the analog inputs;

Communication:

- Fully Compatible with 10/100/1000 Base-T networks, Auto-MDIX;
- Protocols: TCP/IP, HTTP, DHCP, DNS, ICMP (ping);

Web Interface:

- Configuration of system parameters;
- Access current measurements;
- Secure login authorization;
- Access protection (by IP and MAC address);

TCP/IP Services:

- HTTP server: Access (GET) current measurements in XML/JSON format;
- Encrypted login process for reading inputs status and analog/temperature values;

Integration Protocol:

- SNMPv2 - for **smartDEN IP-32IN**;
- Modbus TCP – for **smartDEN IP-32IN-MT**;
- MQTT V3.1.1 - for **smartDEN Notifier**;

Notifications:

- SNMP Traps (**smartDEN IP-32IN only**);
- MQTT notifications triggered by threshold events and/or periodically (**smartDEN Notifier only**);
- Notifications via e-Mail using SMTP triggered by threshold events (**smartDEN Notifier only**);

Web Services (smartDEN IP-32IN only):

- Data Logging mode (push) mode: XML data is sent via HTTP post method to remote server periodically;
- Remote relay control mode: remote control of [smartDEN](#) Relay Modules, [DAenetIP3](#), [DAenetIP4](#) and [Wi-Fi Relay Modules](#) through Ethernet/Internet;

Power Supply:

- Supply voltage 10..28V DC;

- Additional source voltage 5V DC is provided to facilitate the sensors power supply;

Physical and Environment:

- Working temperature range: 0 to 70°C;
- DIN rail standard housing.

2. Application examples

smartDEN IP-32IN-XX could be used for home and industrial automation applications, datacenters monitoring, environmental monitoring and so on. Several application examples how smartDEN IP-32IN-XX could be used are shown below. The examples are only conceptual and additional equipment/connections can be required in actual implementations.

2.1. Remote sensors monitoring

smartDEN IP-32IN-XX allows monitoring up to 32 different sensors in real time. Various kinds of sensors for temperature, humidity, distance, light and others can be connected to the device. In this mode smartDEN IP-32IN-XX acts as a server. A custom client application can retrieve (poll) the current measurements using the supported integration protocol or HTTP/XML/JSON GET requests. Examples of client applications include iOS/Android mobile apps, desktop software, home automation server or just web browser.

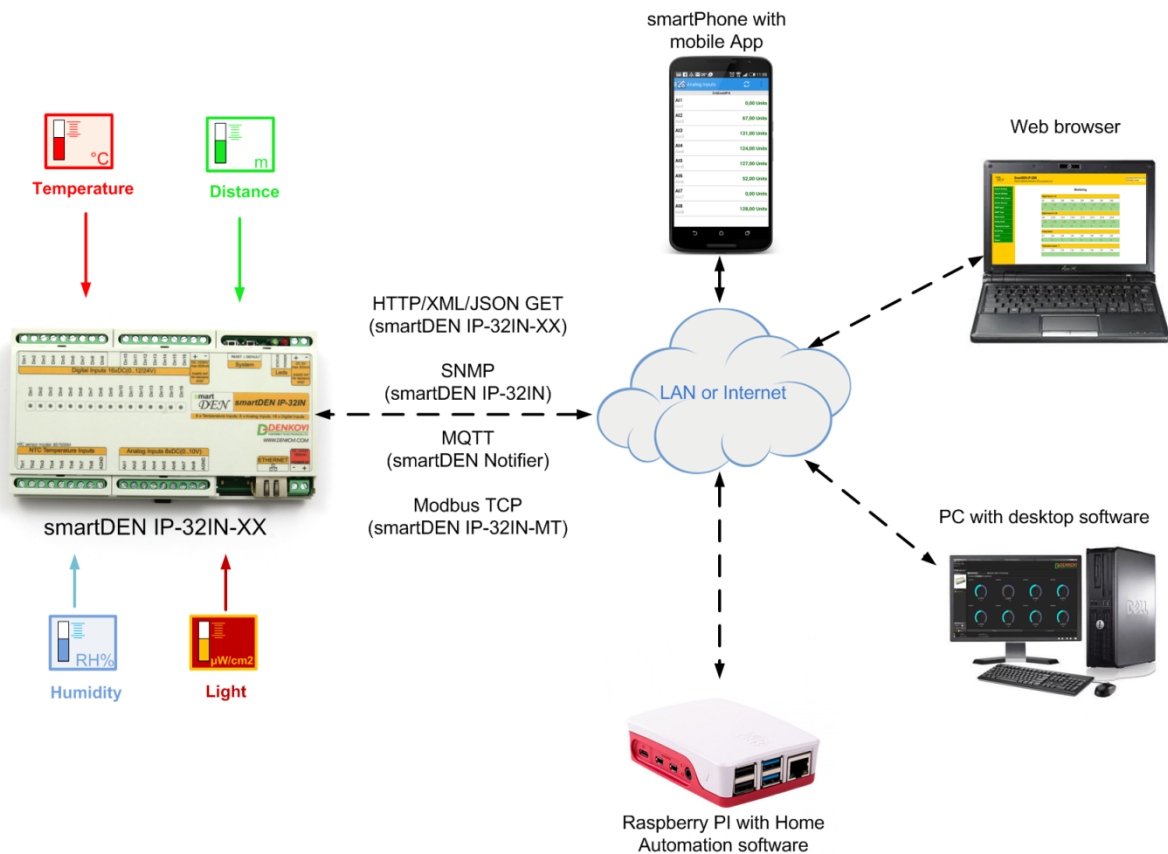


Figure 2.1. Remote sensors monitoring

2.2. Events counter

smartDEN IP-32IN-XX provides 16 x 16-bit counters (from 0 up to 65535) attached to the digital inputs that can be used to count various not fast events - for example detect when a person enters in a shop through the door (Figure. 2.2). Upon detecting the specified edge/level condition smartDEN IP-32IN-XX increments the

corresponding counter. With suitable software and database one could easily organize a simple monitoring and statistic system.

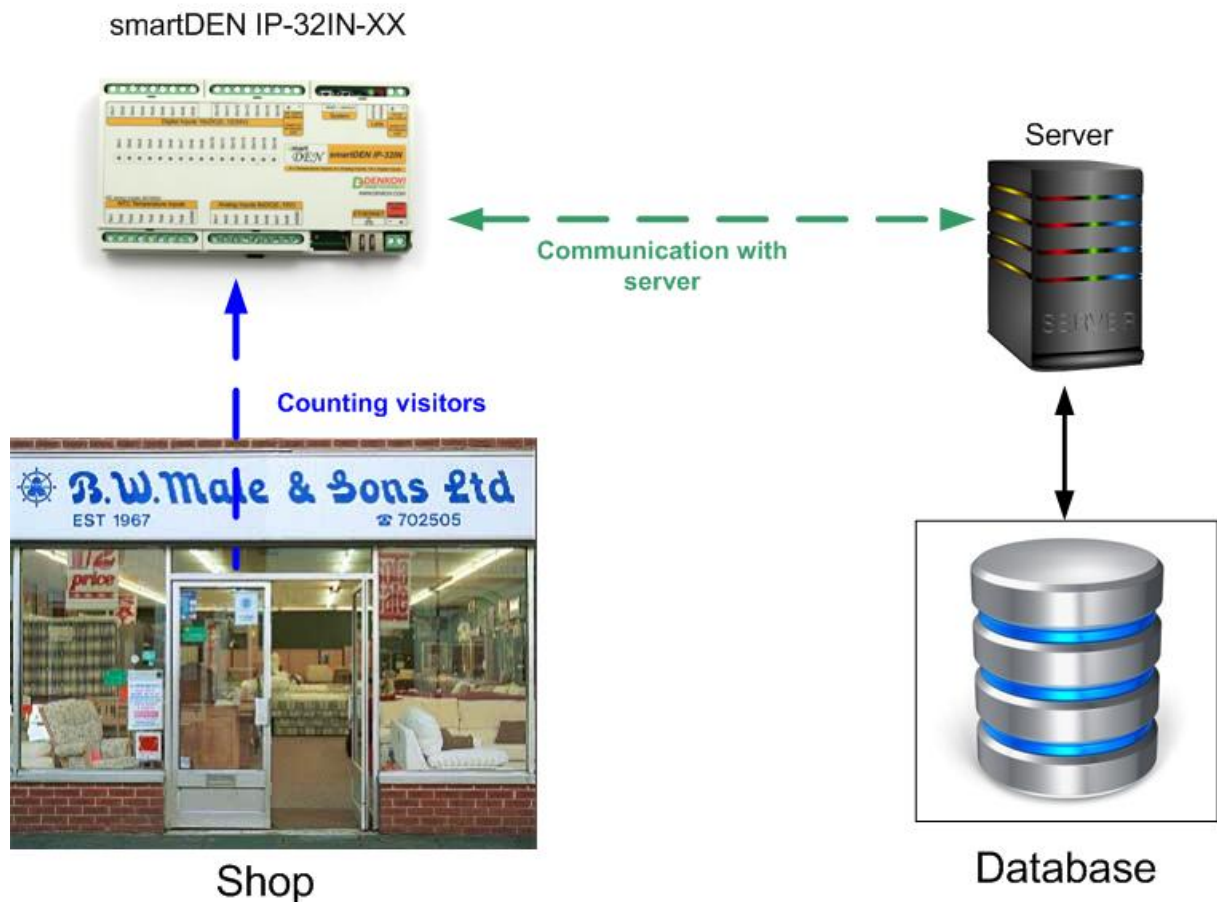


Figure 2.2. Counting visitors in shop

2.3. Push messages and data logging (smartDEN IP-32IN)

Another very useful mode of **smartDEN IP-32IN** is sending "push" messages (notifications) to remote server without the need to be polled continuously. This is very suitable for organizing alert and logging systems. The module is able to send HTTP POST messages in XML/JSON format periodically. The SNMP traps also can be triggered by events (for example when temperature is getting high) or sent periodically. It is also possible to control remote relay board over the LAN/WAN network again basing on input event via HTTP GET request.

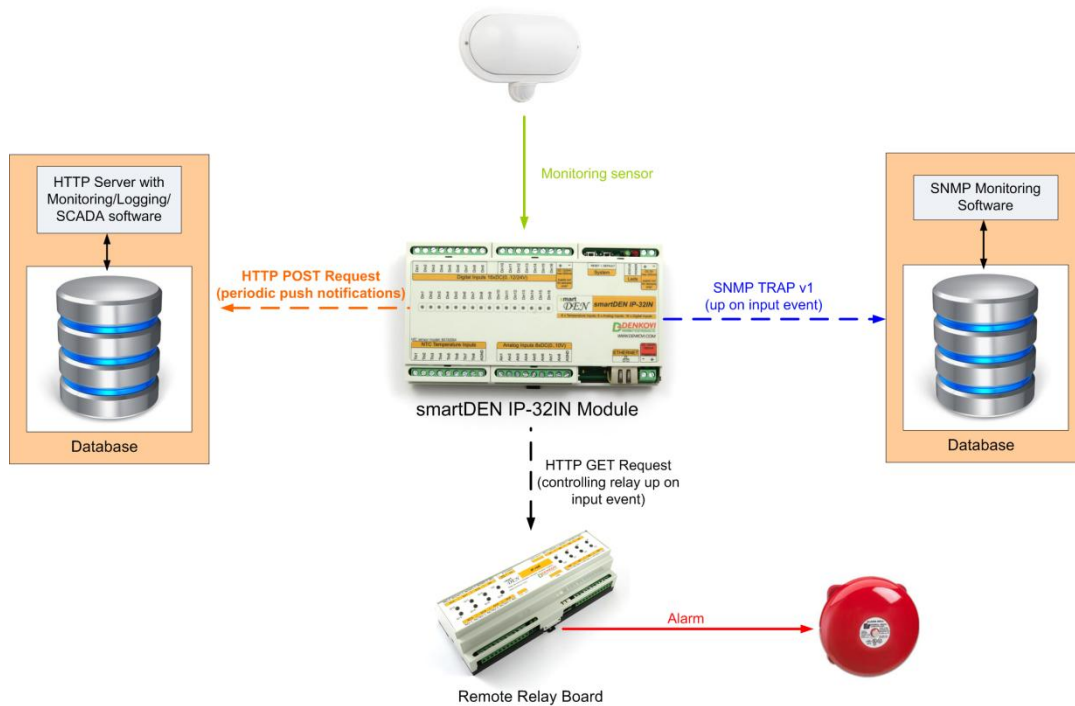


Figure 2.3. smartDEN IP-32IN alert and data log example system

2.4. Publish-subscribe based monitoring (smartDEN Notifier)

smartDEN Notifier supports the **MQTT (Message Queuing Telemetry Transport)** protocol version 3.1.1. With MQTT mode enabled, **smartDEN Notifier** “pushes” notifications to the remote data-collecting application rather than the application continuously polls the module for input data values. Notifications can be triggered by events or send periodically. Due to the MQTT publish/subscribe architecture and “one-to-many” message distribution, this mode allows **smartDEN Notifier** to be monitored simultaneously by a number of applications.

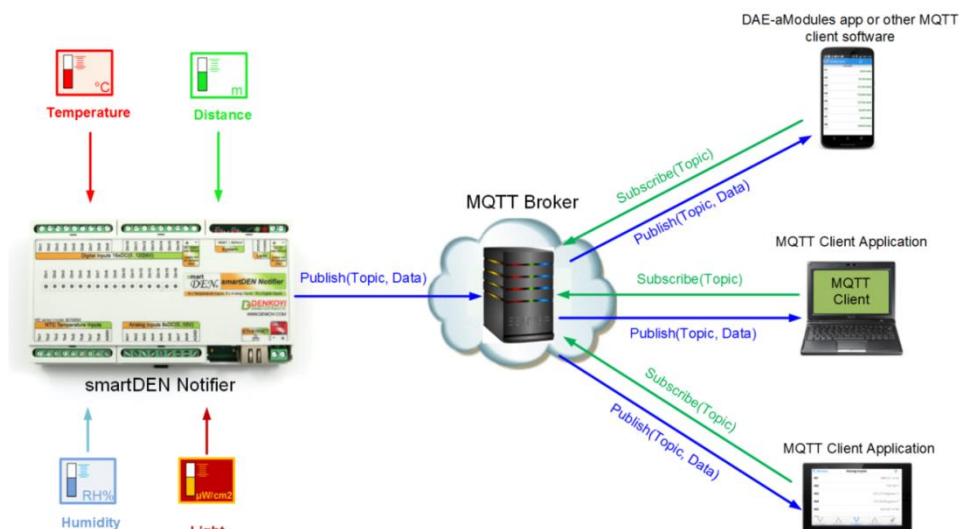


Figure 2.4. MQTT publish-subscribe monitoring

In a typical MQTT scenario (Figure. 2.4), the monitored data are published by **smartDEN Notifier** under designated topic. In turn, the MQTT broker distributes the messages to the MQTT client applications subscribed to the topic. Two topic types can be used – plain (non-encrypted) and encrypted. While the plain topics are supposed to be used with general MQTT clients, the encrypted ones are designed for communication with the Android [DAE-aModules](#) application or customized MQTT libraries.

2.5. e-Mail notifications (smartDEN Notifier)

smartDEN Notifier can be configured to send e-Mail messages using **SMTP** (Simple Mail Transfer Protocol) when specified events are triggered (Figure. 2.5). The event can be a change of digital inputs state or crossing of analog value/temperature over or below the predefined threshold values.

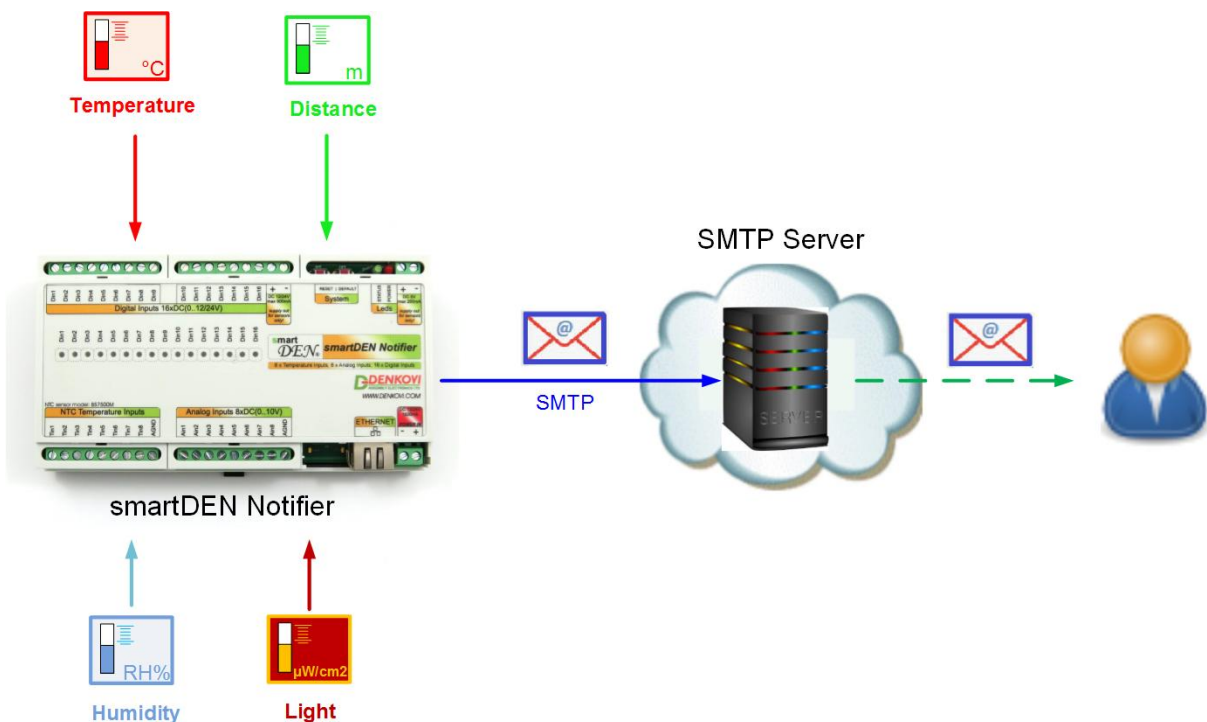


Figure 2.5. e-Mail notifications

3. Technical parameters

Table 3.1. Physical parameters

Parameter	Value
Size (L / W / H), mm	157 / 89 / 31
Weight, g	205
Operating temperature, °C	0 to 70

Table 3.2. System parameters

Parameter	Value
Power supply voltage, VDC	10... 28 ± 5%
Maximum current consumption, mA	1500
Protection against reverse polarity	Yes
Default settings button	Yes
Reset button	Yes

Table 3.3. Analog Inputs

Parameter	Value
Analog inputs number	8
Analog inputs full scale voltage range, VDC	0 up to 10
Analog inputs absolute maximum non-destructive voltage, VDC	24
Analog inputs resolution, bits	10
Value of LSB, mV	~10
Input impedance, KΩ	1330
Sample period, ms	Min: 25*
	Max: 300**
Protection against reverse polarity	Yes

*No communication (HTTP, SNMP) is taking place with the module

**Intensive communication (HTTP, SNMP) with the module

Table 3.4. Digital Inputs

Parameter	Value
Digital inputs number	16
Digital inputs voltage range, VDC	0 up to 30
Input switching threshold from 0 to 1, VDC	>7.6
Input switching threshold from 0 to 1, mA	>3.2
Input switching threshold from 1 to 0, VDC	<4.5
Input switching threshold from 1 to 0, mA	<1.8
Supported sensor output type	PNP
Input type	Resistive with Schmitt trigger
Sample period, ms	Min: 25*
	Max: 300**
Protection against reverse polarity	Yes

*No communication (HTTP, SNMP) is taking place with the module

**Intensive communication (HTTP, SNMP) with the module

Table 3.5. Counters

Parameter	Value
Counters number	16
Max. pulses frequency, Hz	1 ..10*

*See point 7.5

Table 3.6. Temperature Inputs

Parameter	Value
NTC inputs number	8
Sensor type	B57500M
Units	Celsius/Fahrenheit
Sensor working temperature range	-55°C/-67°F to +155°C/311°F
Accuracy	±0.5°C
Sample period, ms	Min: 25*
	Max: 300**

*No communication (HTTP, SNMP) is taking place with the module

**Intensive communication (HTTP, SNMP) with the module

Table 3.7. Network/protocols

Parameter	Value
Network parameters	IP/Mask/Default gateway
MAC lock (protection)	Yes
DHCP	Yes
DNS	Yes
ICMP	Yes
SNMPv2c	Yes (set, get, table, walk, getnext, bulk)
Read-Write Community String	Yes
Read-Only Community String	Yes
SNMP traps	Yes
SNMP I/O access commands	Yes
Web server for configuration/access	Yes
Secure HTTP/XML/JSON access	Yes

Table 3.8. Network/protocols

Parameter	Value
Network parameters	IP/Mask/Default gateway
MAC lock (protection)	Yes
DHCP	Yes
DNS	Yes
ICMP	Yes
Integration protocol	SNMPv2c - smartDEN IP-32IN Modbus TCP - smartDEN IP-32IN-MT MQTT V3.1.1 - smartDEN Notifier
Web server for configuration/access	Yes
Secure HTTP/XML/JSON access	Yes

4. Connectors, ports and led indicators

Bellow is shown a picture with the device connectors, ports and led indicators.

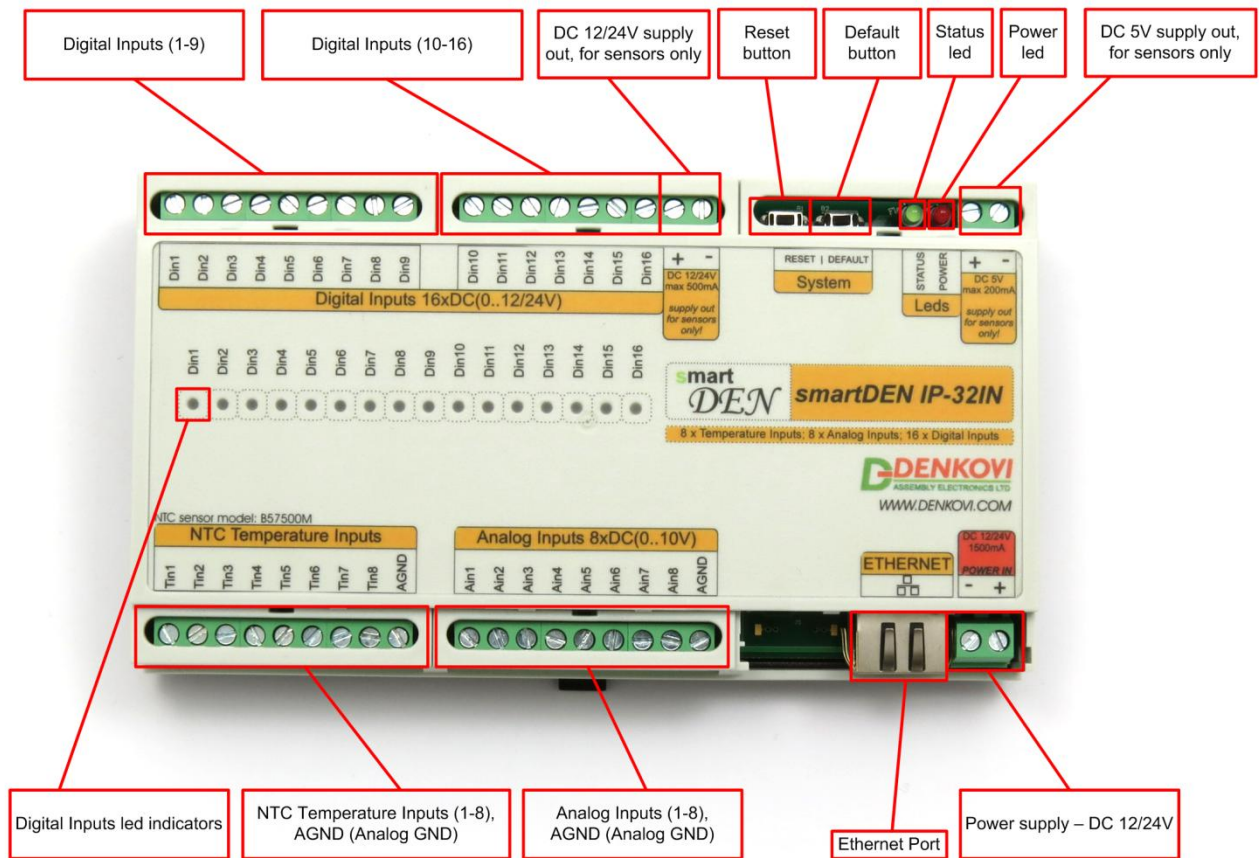


Figure 4.1. Device overview

5. Installation

- This device must be installed by qualified personnel;
- This device must not be installed directly outdoors;
- Installation consists of mounting the device, connecting to an IP network, connecting sensors, providing power and configuring via a web browser.

5.1. Box mounting



Figure 5.1. Mounting the device to DIN rail

smartDEN IP-32IN-XX can be mounted to a standard (35mm by 7.55mm) DIN rail. Attach the module to the DIN rail by hooking the hook on the back of the enclosure to the DIN rail and then snap the bottom hook into place.

5.2. Power supply

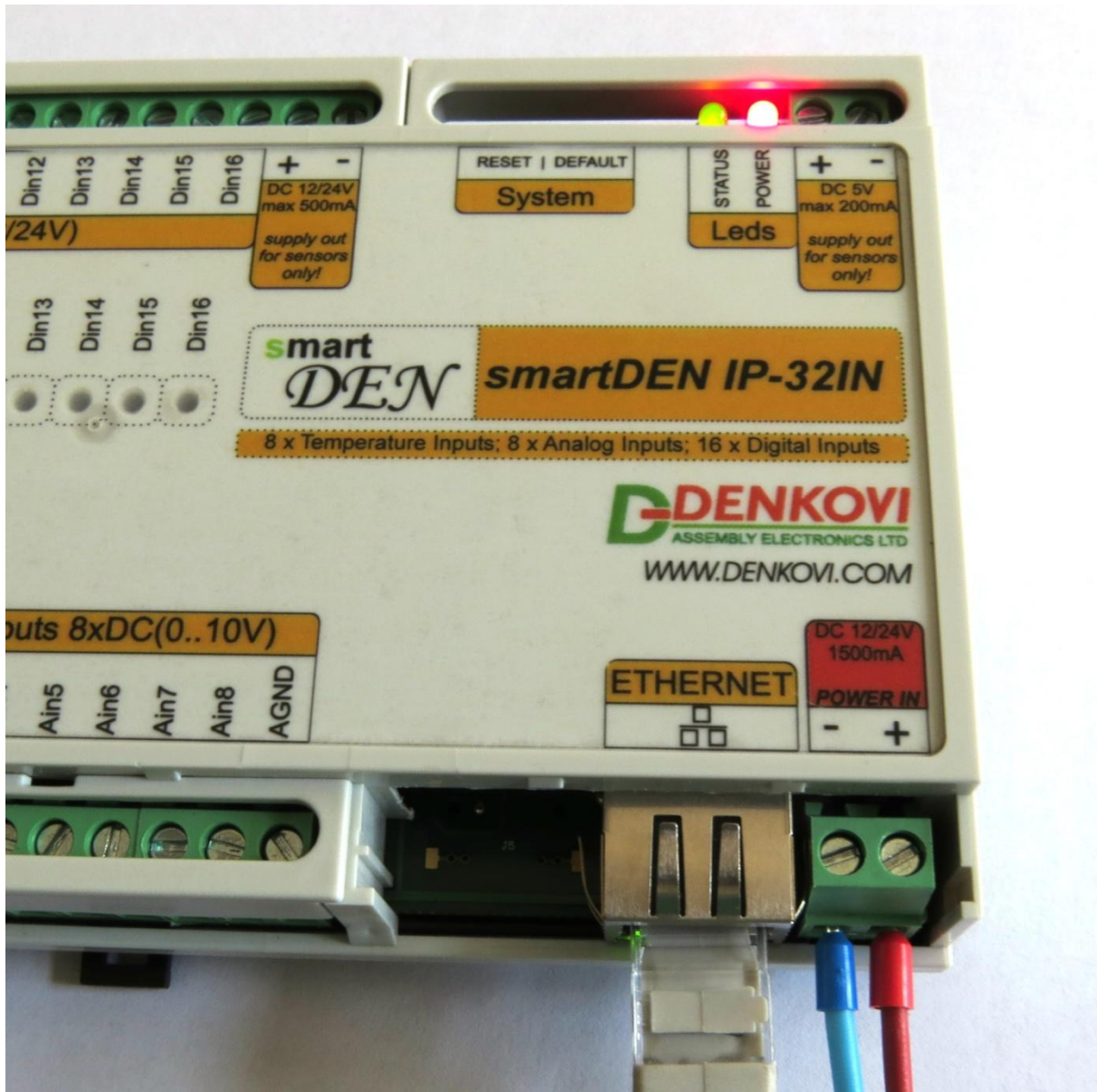


Figure 5.2. smartDEN IP-32IN-XX power supply

smartDEN IP-32IN-XX must be with voltage either **12VDC** or **24VDC** stabilized and filtered. After power on, the power led must be on and **STATUS indicator** must start blinking in 5 seconds which means the module is running normally.

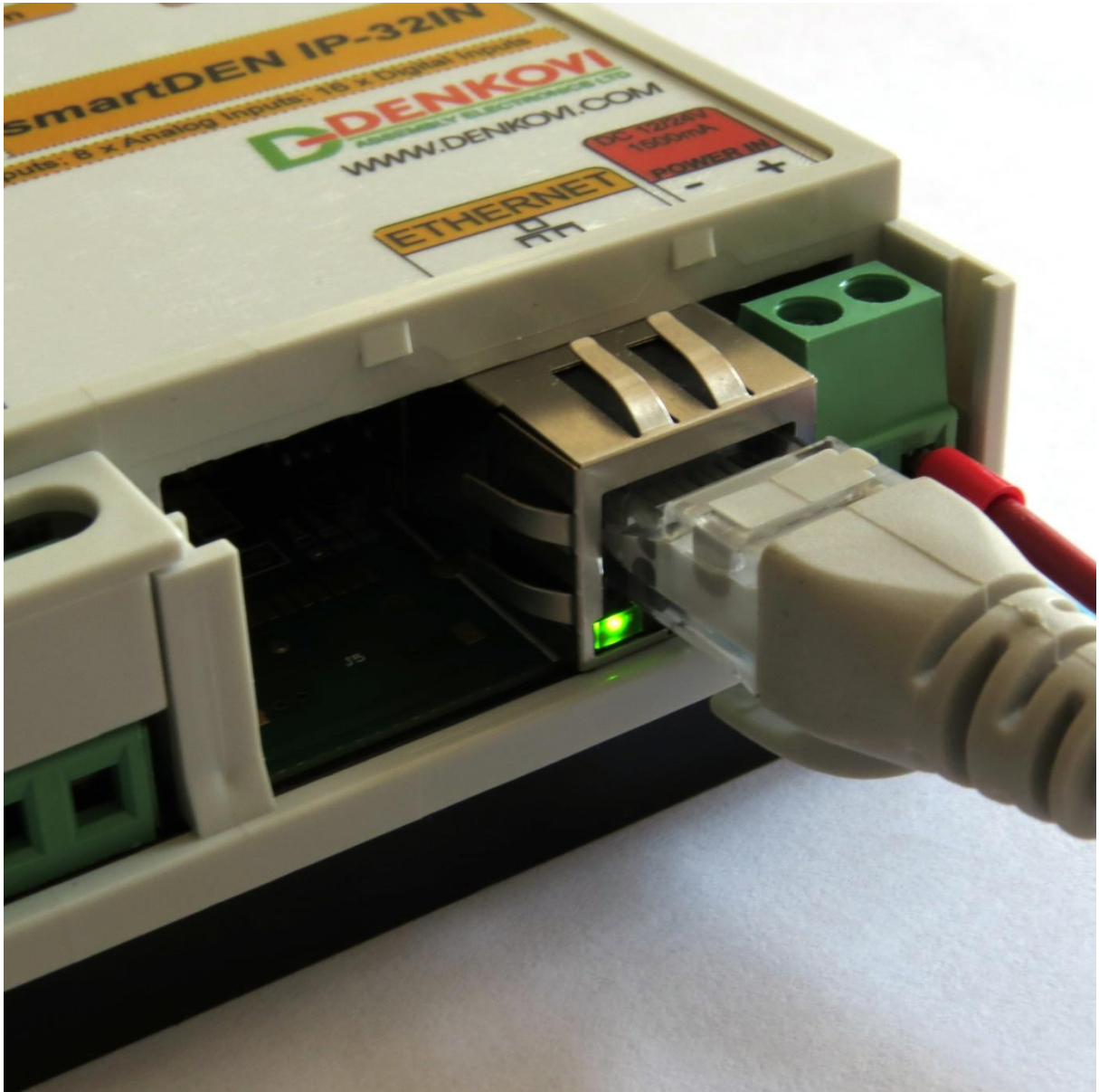


Figure 5.3. Connecting a LAN cable

- ❗ Please keep the polarity and supply voltage range!
- ❗ **smartDEN IP-32IN-XX** does not accept AC supply voltage. It is highly recommended to check the power supply source parameters before supply the module.
- ❗ The power supply equipment shall be resistant to short circuit and overload in secondary circuit.
- ❗ When in use, do not place the equipment so that it is difficult to disconnect the device from the power supply.

5.3. Connecting inputs

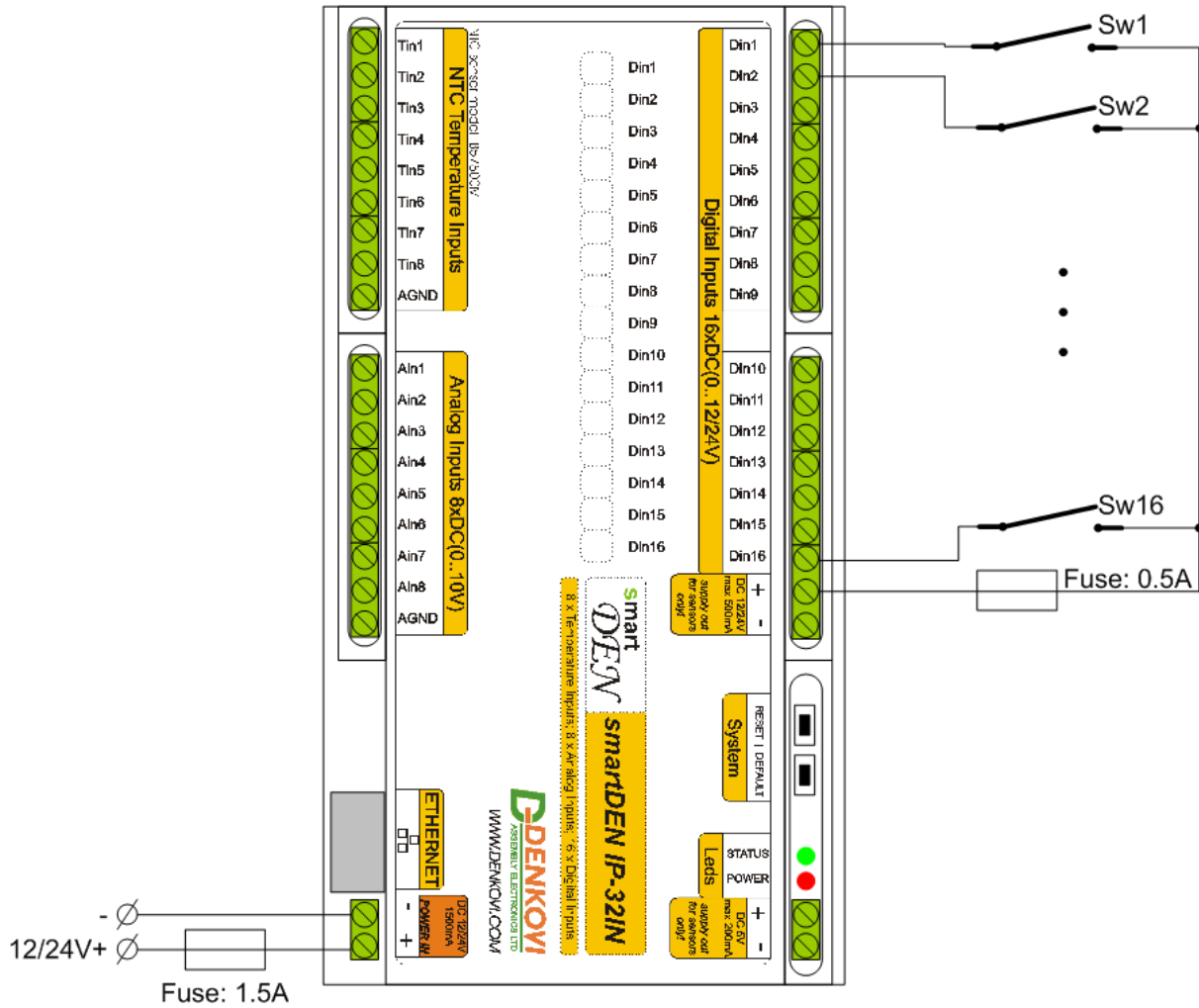


Figure 5.4. Connecting SPST NO output (dry contact) sensors, switches, buttons, door sensors and so on to the digital inputs.

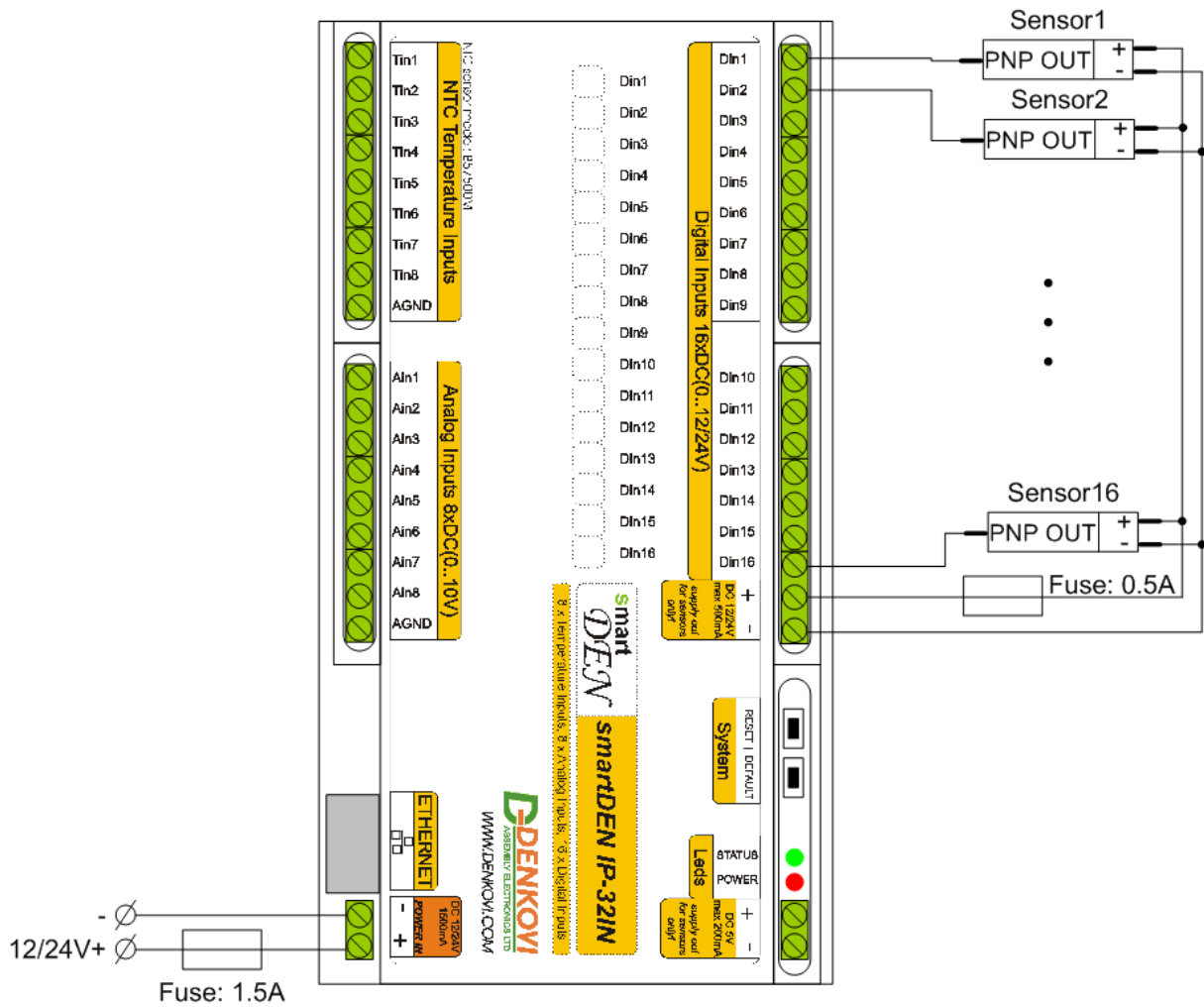


Figure 5.5. Connecting PNP output digital sensors requiring supply voltage 12/24V DC to the digital inputs.

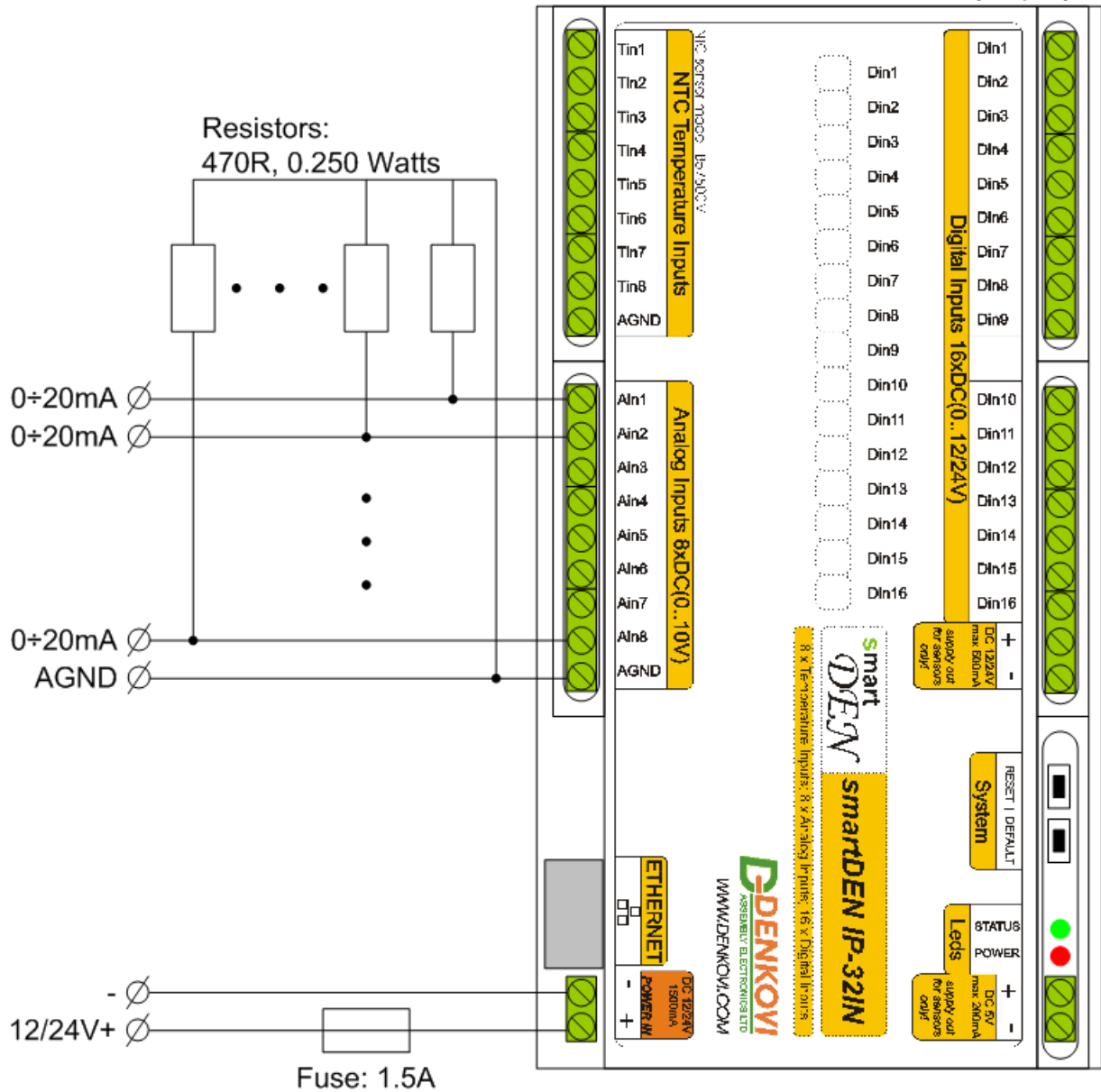


Figure 5.6. Connecting 0-20mA output analog sensors to the analog inputs.

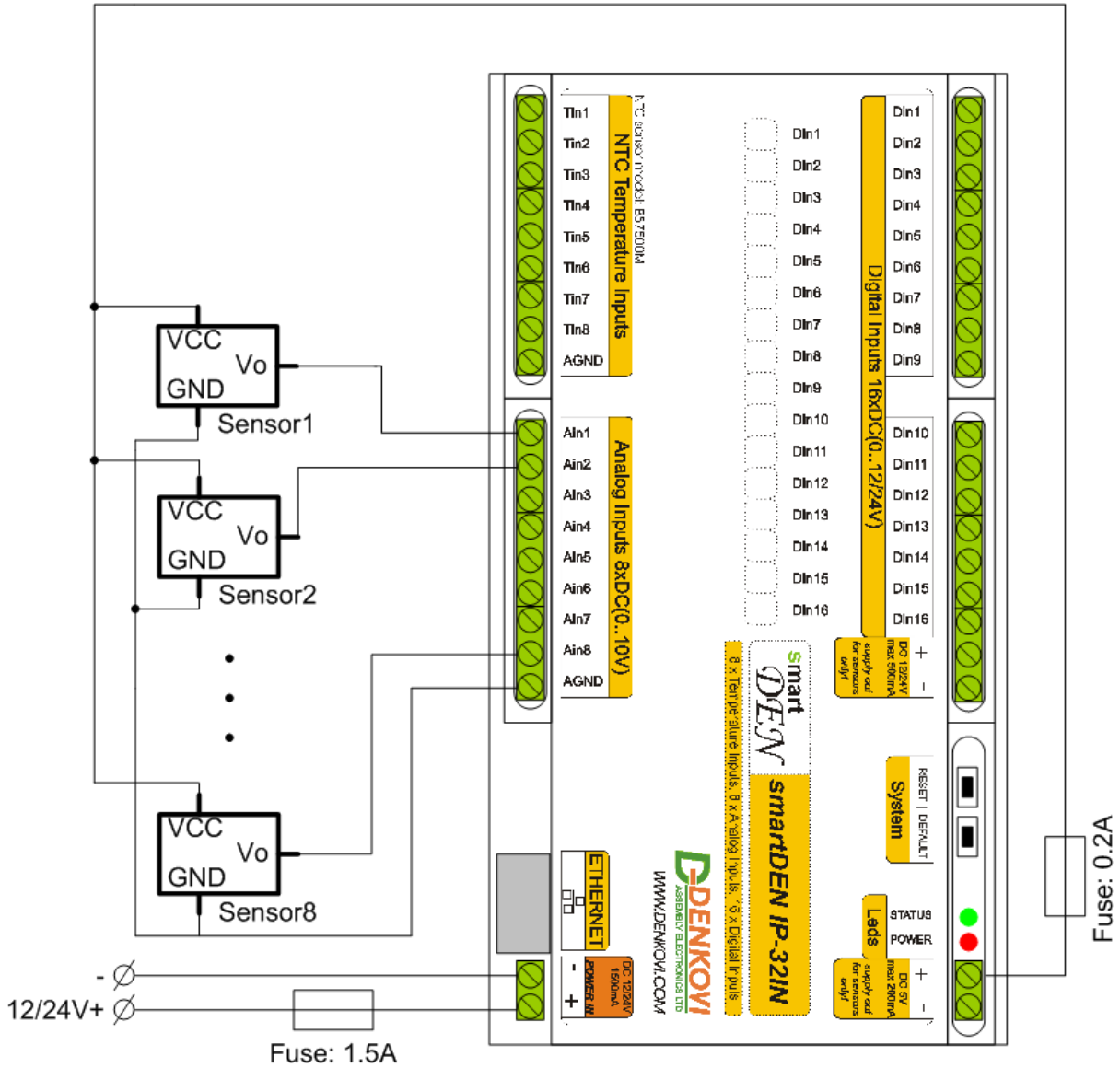


Figure 5.7. Connecting analog sensors with output from 0 up to 10V DC to the analog inputs requiring power supply voltage 5V DC.

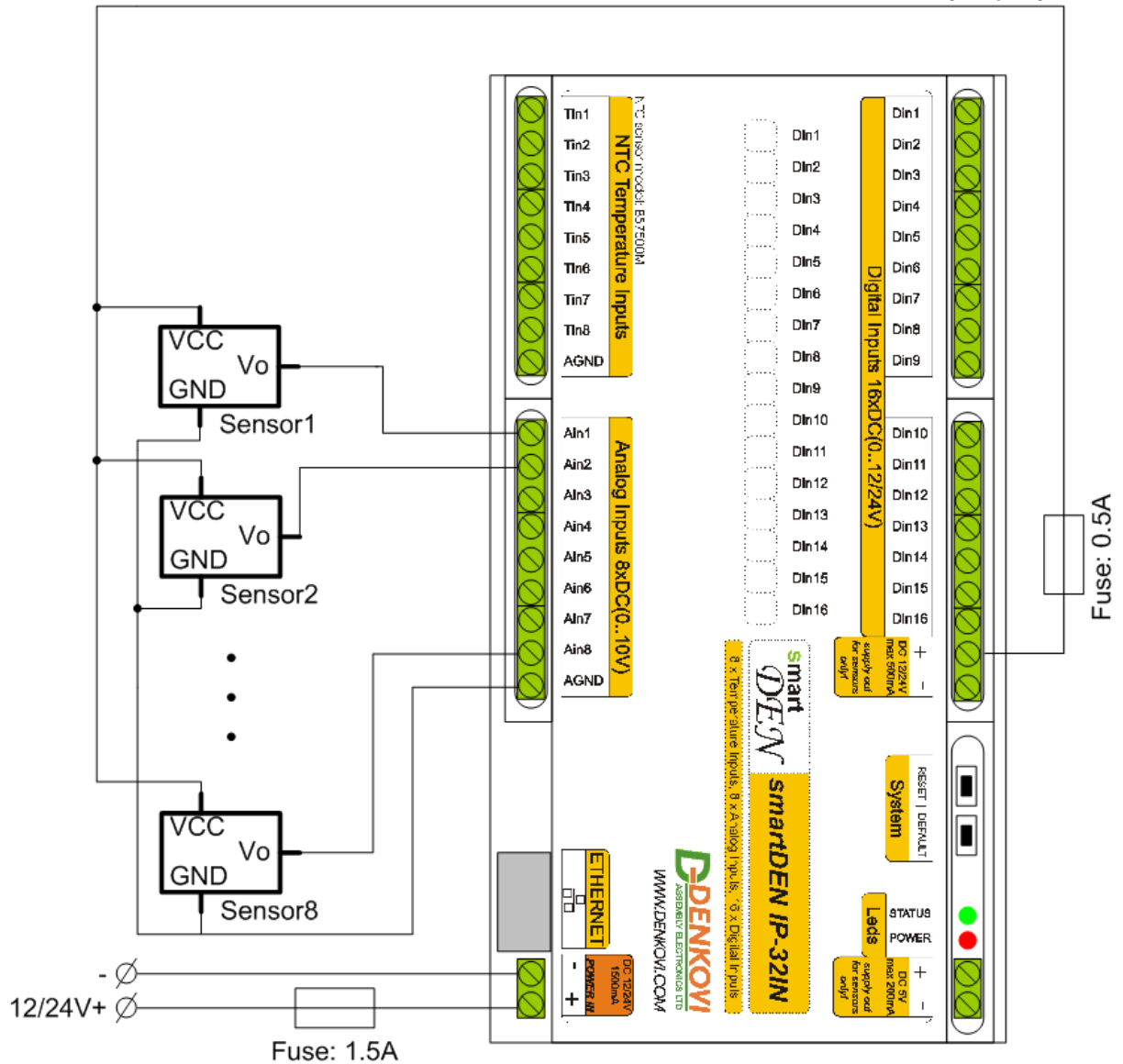


Figure 5.8. Connecting analog sensors with output from 0 up to 10V DC to the analog inputs requiring power supply voltage 12/24V DC.

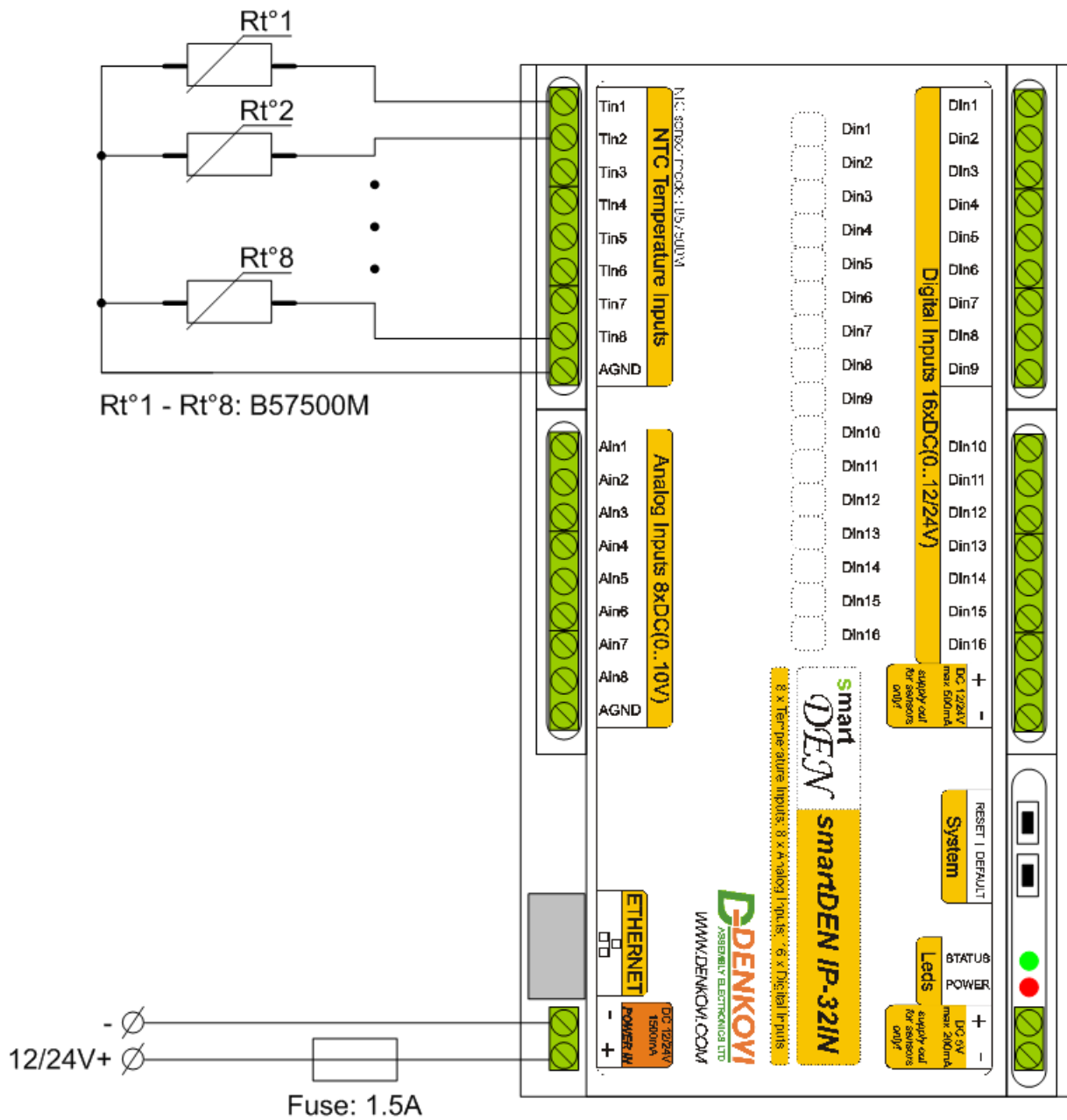


Figure 5.9. Connecting thermoresistor NTC sensors type B57500M to the analog inputs.

5.4. Network connection

smartDEN IP-32IN-XX supports AUTO-MDIX so either "crossover" or "straight-through" network cable can be used.



Figure 5.10. Connecting **smartDEN IP-32IN-XX** to a computer directly. This is the recommend initial connection



Figure 5.11. Connecting **smartDEN IP-32IN-XX** to a wireless router

5.5. Communication setup

smartDEN IP-32IN-XX is shipped with the following default parameters:

- IP address: **192.168.1.100**
- Subnet mask: **255.255.255.0**
- Gateway: **192.168.1.1**
- Web password: **admin**

Initially it is recommended to connect the module directly to the computer.

Next you have to change your PC's IP address.



You can google how to change you computer IP settings or just visit this web page: <http://www.howtochangeipaddress.com/changeip.php>

For Windows 7 OS for example you can do that in the following way:
Navigate to *Control Panel* -> *Network and Internet* -> *View network and status tasks* -> *Change adapter settings*

Then just select the local area connection with right click and select *Properties*:

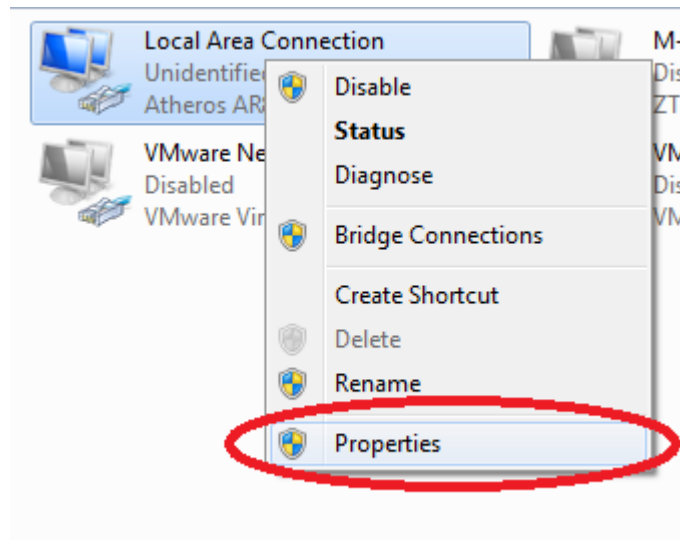


Figure 5.12. LAN card properties

The next step is to enter into IPv4 properties.

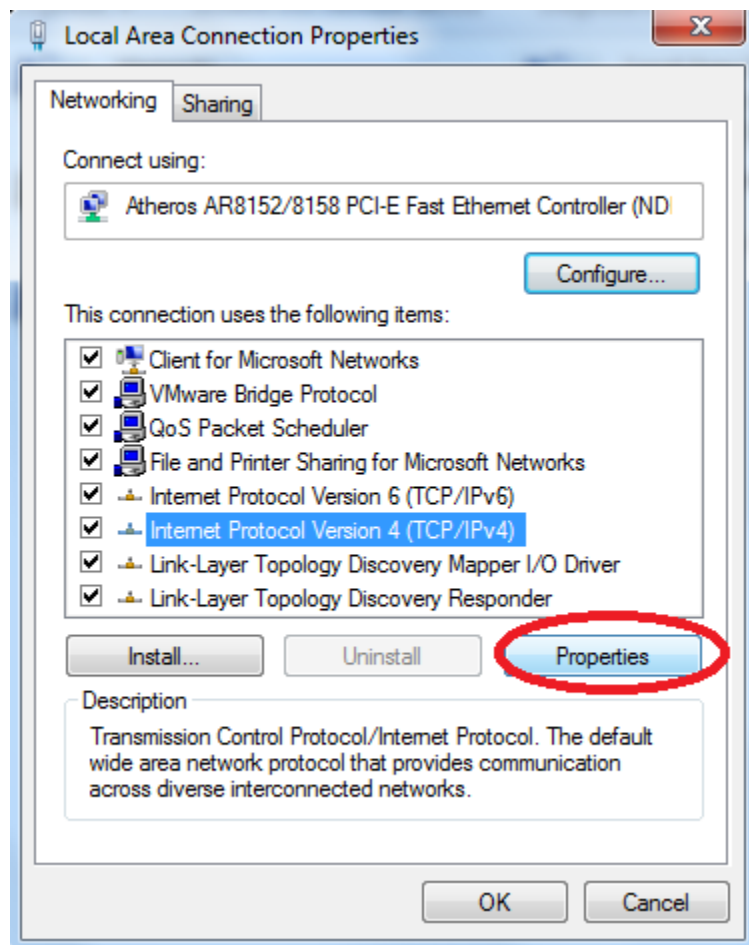


Figure 5.13. Enter in IPv4 properties section

Set the IP address of your PC to be in the same network.

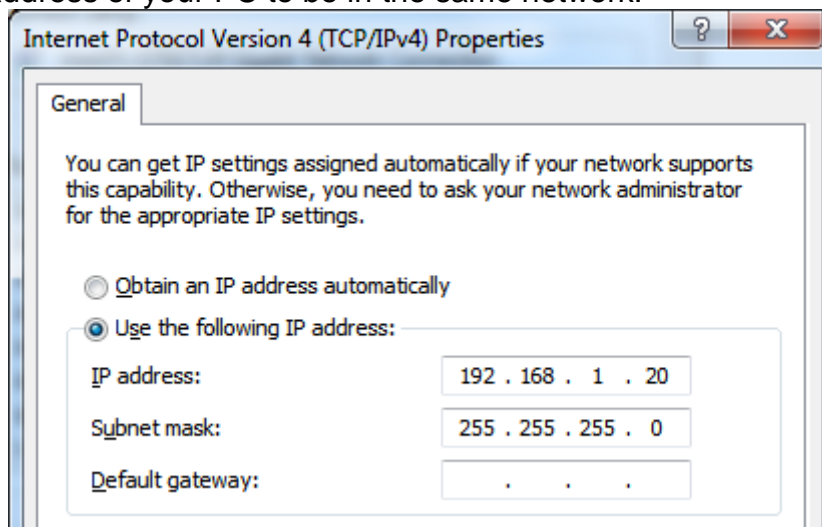


Figure 5.14. Set the IP address

Finally, in order to access **smartDEN IP-32IN-XX** just type in your browser 192.168.1.100

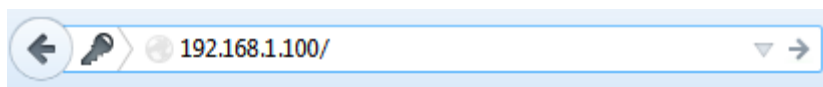
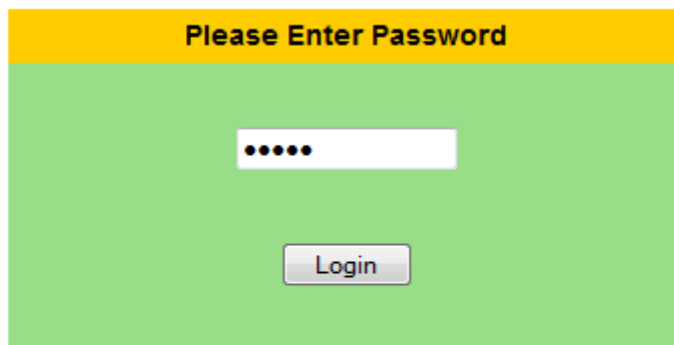


Figure 5.15. Open the device via browser

If the network settings are O’K, the log-in page should appear:



Logged out

Figure 5.16. Login page

 **smartDEN IP-32IN-XX** modules connected locally can be easily scanned and found via the tool [Denkovi Finder](#) as well.

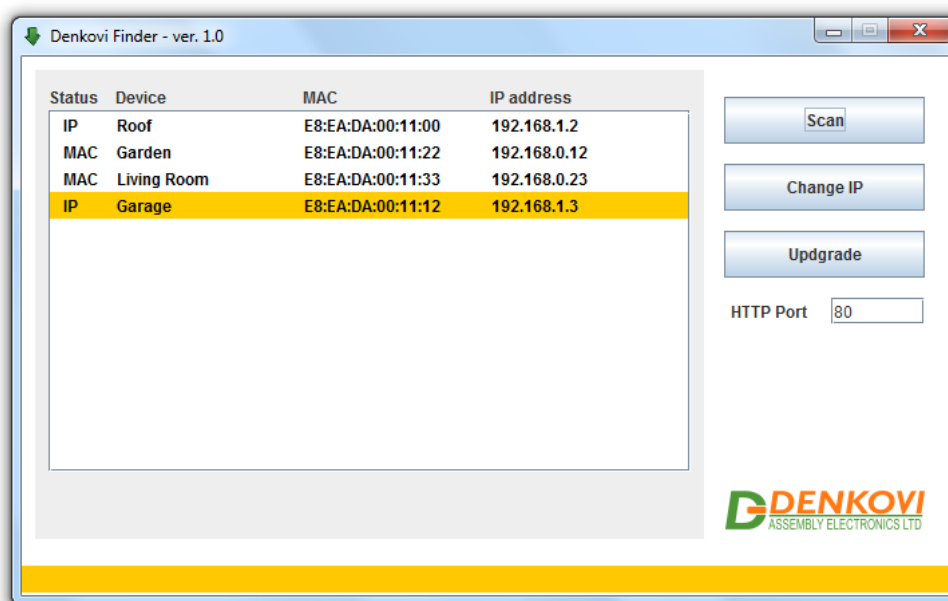


Figure 5.17. Denkovi Finder utility

6. Default settings

6.1. Table with default settings

The **smartDEN IP-32IN-XX** module is shipped with default (factory) settings shown in Table 6.1. The default settings can be reloaded, if necessary (see **point 6.2**).

Table 6.1. Default settings

Settings group	Parameter (according Web pages)	Value
General Settings	Password	admin
	Temperature Scale	Celsius
	Analog Inputs Filter, sec	0
	Temperature Inputs Filter, sec	0
	Monitoring Timeout, sec	3
	Max. Monitoring Errors	5
Network Settings	DHCP	Disabled
	IP Address	192.168.1.100
	Gateway	192.168.1.1
	Subnet Mask	255.255.255.0
	Primary DNS	192.168.1.1
	Secondary DNS	0.0.0.0
HTTP/XML/JSON Settings	HTTP Port	80
	Access IP Address	192.168.1.0
	Access Mask	0.0.0.0
	Access MAC Address	00:00:00:00:00:00
	Session Timeout, min	3
	Enable Access	Enabled
	Encrypt Password	Disabled
Data Logging Settings ⁽¹⁾	Enable	Disabled
	HTTP Server Address / Path	0.0.0.0/current_state.xml
	Server Port	80
	Logging Period, sec	5
	Server Response Timeout, sec	2
Remote Relay Control ⁽¹⁾	Enable	Disabled
	Remote Board Type	smartDEN IP-16R-XX
	Remote Board Address	0.0.0.0
	Remote Board Port	80

	Remote Board Password	
	Remote Board Response Timeout, sec	2
SNMP Agent⁽¹⁾	Enable SNMP	Enabled
	SNMP Port	161
	Read-only Community1	public
	Read-only Community2	read
	Read-write Community1	private
	Read-write Community2	write
SNMP Traps⁽¹⁾	Enable Trap	Disabled
	Trap Receiver IP Address	0.0.0.0
	Trap Receiver Port	162
	Trap Community	
	Trap Sending	Level Triggered
MQTT Settings⁽²⁾	Enable	Disabled
	MQTT Server	iot.eclipse.org
	Server Port	1883
	Username	
	Password	
	Publish Mode	Periodically
	Publish Period, sec	10
Modbus TCP⁽³⁾	Enable Modbus-TCP	Yes
	Modbus-TCP Port	502
	Idle Timeout, min	5
Digital Inputs	Description	DI<n>, where <n> = 1..16
	Counter	0
	Filter (ms)	0
	SNMP Trap ⁽¹⁾ / MQTT ⁽²⁾	Disabled
	SNMP Trap Value ⁽¹⁾ / Edge ⁽²⁾	0 (Off)
	Remote Relay Control ⁽¹⁾	Disabled
	Remote Relay Mode ⁽¹⁾	Normal
Analog Inputs	Description	AI<n>, where <n> = 1..8
	Min	0.0
	Max	10.0
	Label	Volt
	Low Threshold	0
	High Threshold	0
	SNMP Trap ⁽¹⁾ / MQTT ⁽²⁾	Disabled

	Remote Relay Control ⁽¹⁾	Disabled
	Remote Relay Mode ⁽¹⁾	Normal
Temperature Inputs	Description	TI<n>, where <n> = 1..8
	Tolerance, %	0
	Low Threshold	0
	High Threshold	0
	SNMP Trap ⁽¹⁾ / MQTT ⁽²⁾	Disabled
	Remote Relay Control ⁽¹⁾	Disabled
	Remote Relay Mode ⁽¹⁾	Normal

⁽¹⁾ smartDEN IP-32IN only

⁽²⁾ smartDEN Notifier only

⁽³⁾ smartDEN IP-32IN-MT only

6.2. Steps for loading default settings

When necessary, the factory (default settings) may be applied so the module parameters will be returned back as those in **point 6.1** from the current document.

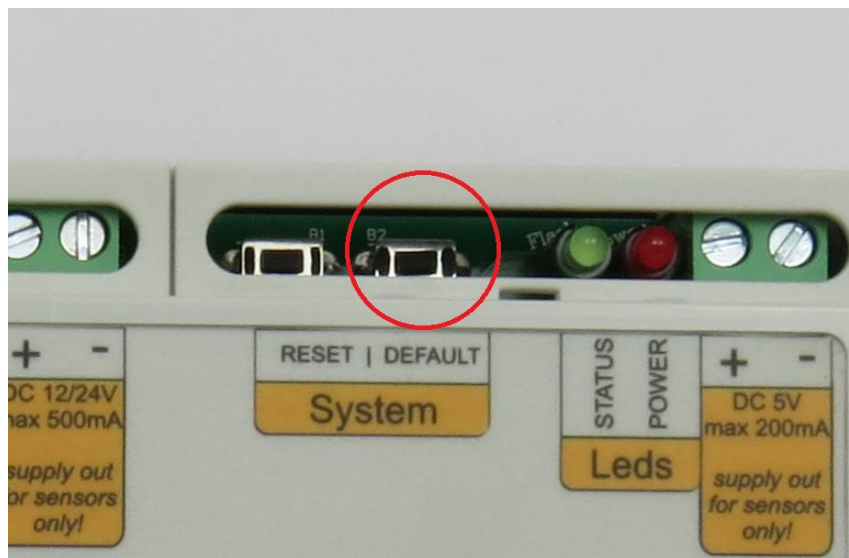


Figure 6.1. Loading the default settings

1. Turn off the power supply of the device;
 2. Press and hold the default button;
 3. Turn on the power supply of the device;
 4. Wait for until STATUS led indicator become ON (approximately after 10 sec);
 5. Release the default button;
- The module is configured with default settings.

7. Web access

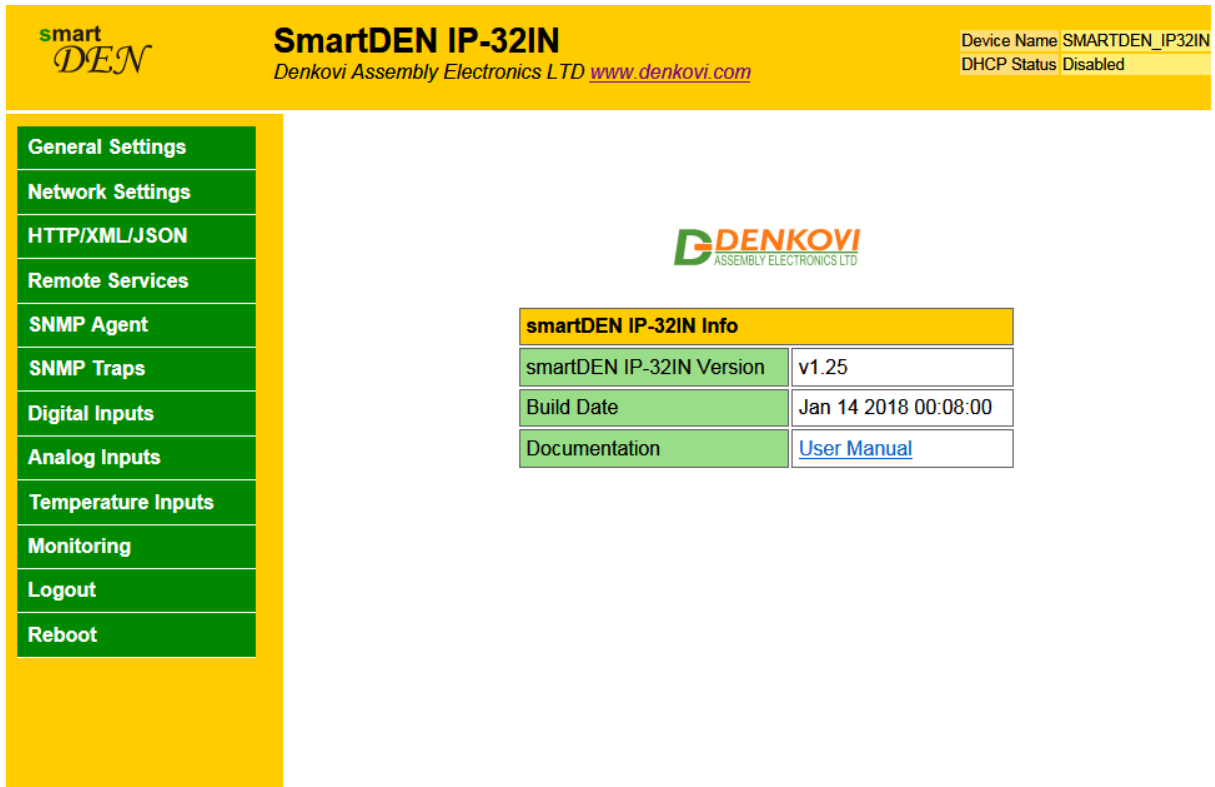


Figure 7.1. Web access

To access the setup pages, run a web browser (Internet Explorer, Mozilla Firefox or similar), and enter the **smartDEN IP-32IN-XX** IP address, for example: <http://192.168.1.100>

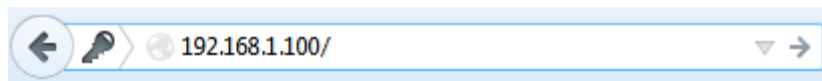


Figure 7.2. Open via browser

Note: You will need to have JavaScript enabled in your browser.

7.1. Login

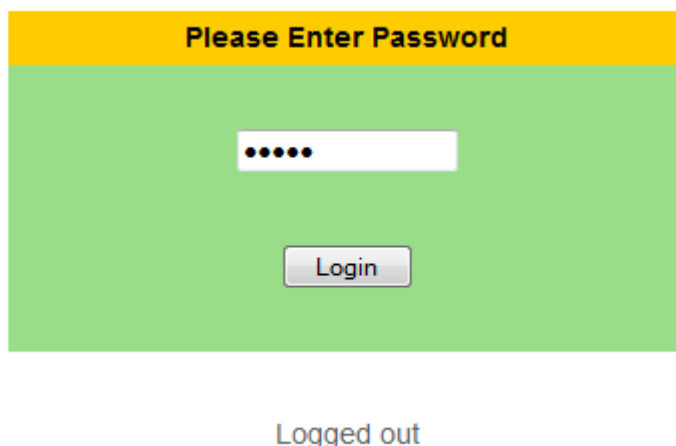


Figure 7.3. Login page

Enter the password and click "Login" button. This will bring you to the **smartDEN IP-32IN-XX** main configuration page which contains details for the current firmware version and build date and provides buttons and links to obtain further details.

Note: The default password is admin (passwords are case sensitive).

Note: When the password is entered, it is transmitted across the network in encrypted form, so eavesdropping on the data transmission will not reveal the password.

Note: In order to prevent setup/control conflicts, at any given moment, only one user can be logged in.

Note: If there is no data traffic between the Web-browser and the **smartDEN IP-32IN-XX** for time, specified by **Session Timeout** parameter, the session "times out" and a new login is required.


7.2. General settings

General Settings

General Settings	
Device Name	SMARTDEN_IP32IN
Password	*****
Temperature Scale	Celsius ▾
Analog Inputs Filter, sec	0
Temperature Inputs Filter, sec	0
Monitoring Timeout, sec	3
Max. Monitoring Errors	5

Figure 7.4. General settings

- **Device Name** - the name of the module (max 15 symbols). Every module can have different name in your network so they can be distinguished;
- **Password** - the password used for logging into the web admin and XML operation (max. 10 chars);

 When typed, the password in this screen is not hidden. Only in this case, when the password is being changed, it is transmitted across the network "in the open". Therefore, set passwords in a secure environment where you can make sure that no one is "eavesdropping". Subsequent transmissions of the password to "login" onto the device are encrypted and "safe".

- **Temperature Scale** – Celsius / Fahrenheit;
- **Analog Inputs Filter, sec** – Analog Inputs filter constant (0 to 30 sec), 0 disables filtering;
- **Temperature Inputs Filter, sec** – Temperature Inputs filter constant (0 to 30 sec), 0 disables filtering;
- **Monitoring Timeout, sec** - the connection timeout for the Web-browser;
- **Max. Monitoring Errors** – the number of successive timeouts before the connection error is reported by the Web-browser;
- **Save button** - once you have changed the settings as required, click this button.

7.3. Network settings

Network Configuration

Network Configuration	
MAC Address	E8:EA:DA:00:00:01
Enable DHCP	<input type="checkbox"/>
IP Address	192.168.1.100
Gateway	192.168.1.1
Subnet Mask	255.255.255.0
Primary DNS	192.168.1.1
Secondary DNS	0.0.0.0

Figure 7.5. Network settings

This menu lets you configure the network settings of **smartDEN IP-32IN-XX** input module:

- **Enable DHCP** - this option allows DHCP to be enabled or disabled. If DHCP is set to Enabled, the Network page must be saved and **smartDEN IP-32IN-XX** must be rebooted before obtaining an IP address;
- **IP address** - this is the IP address of the **smartDEN IP-32IN-XX**. It needs to be manually assigned only if DHCP is disabled. With DHCP enabled, this field displays the currently assigned address;
- **Gateway** - this specifies the IP address of the gateway router. It is used for accessing public time servers for automatic time synchronization;
- **Subnet Mask** - this is the subnet mask for the network on which the **smartDEN IP-32IN-XX** is installed;
- **Primary DNS** - primary DNS (Domain Name Service) address;
- **Secondary DNS** - secondary DNS address;
- **Save button** - once you have changed the settings as required, click this button.

 You have to reboot the device for these settings to apply.

7.4. HTTP/XML/JSON

HTTP/XML/JSON


HTTP Access	
HTTP Port	<input type="text" value="80"/>
Access IP Address	<input type="text" value="192.168.1.0"/>
Access Mask	<input type="text" value="0.0.0.0"/>
Access MAC Address	<input type="text" value="00:00:00:00:00:00"/>
Session Timeout, min	<input type="text" value="1"/>
XML/JSON Access	
Enable Access	<input checked="" type="checkbox"/>
Encrypt Password	<input type="checkbox"/>

Figure 7.6. HTTP/XML/JSON access


These settings let you configure the HTTP and XML/JSON access parameters of smartDEN IP-32IN-XX:


- **HTTP Port** - port that the Web server listens for HTTP requests (default port is 80). You have to reboot the device for a new port setting to apply;
- **Access IP Address/Access Mask** - these fields can be used to restrict the HTTP/XML/JSON access by specifying the IP address and subnet mask of the HTTP client;
- **Access MAC Address** - this field can be used to restrict the HTTP/XML/JSON access by specifying the MAC address of the HTTP client;
- **Session Timeout, min** - Specifies the timeout period for HTTP and XML/JSON sessions in minutes;
- **Enable Access** - this option enables or disables XML/JSON access to the smartDEN IP-32IN-XX;
- **Encrypt Password** - when XML/JSON access is enabled, this option adds additional security level by encrypting the login password;
- **Save button** - once you have changed the settings as required, click this button.


 You have to reboot the device for these settings to apply.

 It is highly recommended to log out from the web server after finishing the parameters setup.

 If you don't want to restrict the HTTP/XML/JSON access by IP address, set the **Access Mask** to 0.0.0.0.

 If you don't want to restrict the HTTP/XML/JSON access by MAC address, set the **MAC Address** to 00:00:00:00:00:00.

 Setting the **Access Mask** to 255.255.255.255 allows the HTTP/XML/JSON access only from the exactly specified **Access IP Address**.



 You can allow the HTTP/XML/JSON access to a range of IP addresses by setting an appropriate value for **Access Mask**. For example setting the **Access IP Address** to 192.168.1.0 and **Access Mask** to 255.255.255.0 allows the access from IP addresses in range from 192.168.1.0 to 192.168.1.255.

7.5. Digital Inputs

Digital Inputs			For smartDEN Notifier				For smartDEN IP-32IN			
Digital Input	Description	Counter	Filter (ms)	Edge	MQTT	e-Mail	SNMP Trap	SNMP Trap Value	Remote Relay Control	Remote Relay Mode
Input 1	ALRM PH	0	2	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2 (Both)	1	Normal
Input 2	DI2	16	2	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	2	Normal
Input 3	DI3	0	2	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	3	Normal
Input 4	DI4	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	0	Normal
Input 5	DI5	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	0	Normal
Input 6	DI6	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	0	Normal
Input 7	DI7	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	0	Normal
Input 8	DI8	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	0	Normal
Input 9	DI9	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	0	Normal
Input 10	DI10	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	0	Normal
Input 11	DI11	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	0	Normal
Input 12	DI12	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	0	Normal
Input 13	DI13	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	0	Normal
Input 14	DI14	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	0	Normal
Input 15	DI15	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0 (Off)	0	Normal
Input 16	DI16	0	0	2 (Both)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 (On)	1	Normal

Save Reload

Figure 7.7. Digital Inputs settings

- **Description** - digital input identification string (max 7 chars);
 This description will appear in XML/JSON files, as well as in the Monitoring & Control page.
- **Counter** - every digital input works as a 16 bit software counter as well. The counter is incremented at rising, falling, or both edges depending on the **SNMP Trap Value (for smartDEN IP-32IN)** or **Edge (smartDEN Notifier)**. The counter is cyclic and it can be set or cleared by the user anytime via this parameter. The values which can be for this parameters are from 0 up to 65535;
-  The counters are software and not hardware. Due to this there are some considerations which must be taken in mind when work with them:
 - In case of 0 ms for **Filter** and no requests are sent to the controller (no SNMP/MQTT/Modbus TCP, no HTTP, logged out from web server) but just counting pulses, it is possible to achieve frequency about 10Hz or this is 50ms ON and 50ms OFF. This is the recommend state for counting pulses;
 - In case of 0 ms for **Filter** but there is active web session in web server and the monitoring page is opened, then it is possible to

count pulses with frequency about 1Hz or this is 500ms ON and 500ms OFF;

- In case the controller is working with the EEPROM in that moment it is not possible to count pulses due to the blocking time which may be several seconds. This state is not suitable for counting pulses but only for adjustments!
- **Filter (ms)** - the input may be adjusted to work with a digital filter. It is valid for the input visualization, counting, SNMP traps and controlling the outputs as well. This parameter sets the time (in milliseconds) for this filter and it can be from 0 up to 200 ms;
- **SNMP Trap (for smartDEN IP-32IN only)** - determines if the Digital Input will send traps or not;
- **SNMP Trap Value (for smartDEN IP-32IN only)** - this parameter determines how the traps will be sent and how counter will work:
 - *0 (Off)* - If the parameter **Trap Sending** is set with value "Level Triggered" then the trap message is sent when the Digital Input is in low level (0) every 5 seconds. If the parameter **Trap Sending** is set with value "Edge Triggered" then the trap message is sent when the Digital Input's is falling edge (1->0); In this mode the counter will be increased when the Digital Input value transits from 1 to 0.

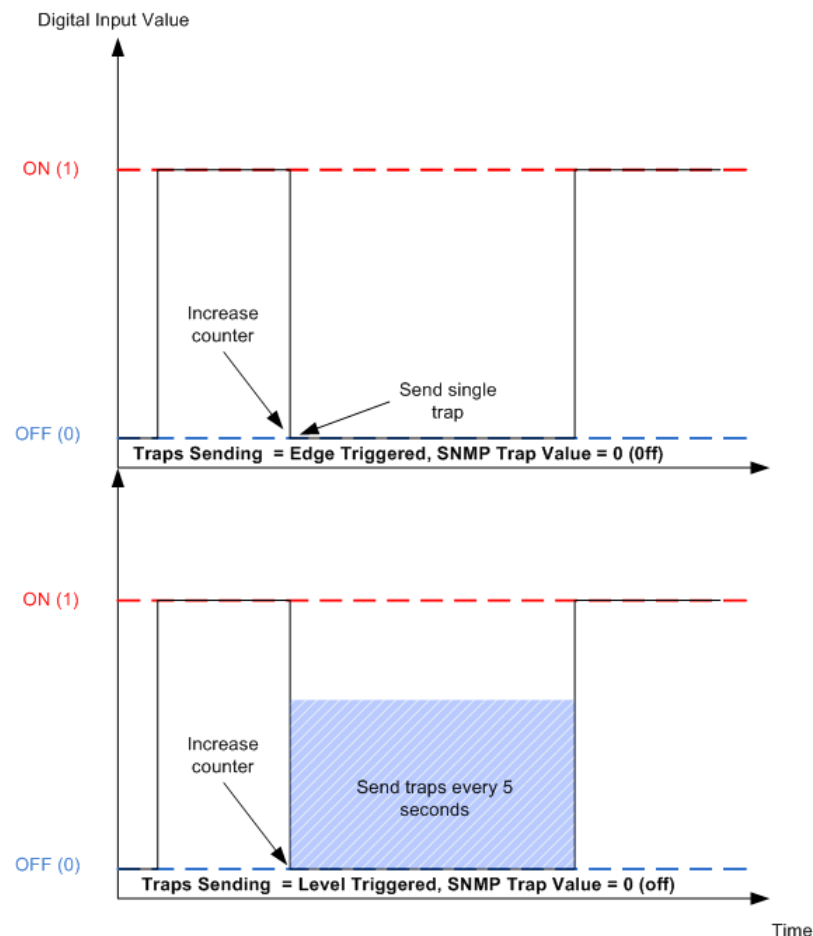


Figure 7.8. Traps and counter when SNMP Trap Value is "0 (off)"

- 1 (On) - If the parameter **Trap Sending** is set with value "Level Triggered" then the trap message is sent when the Digital Input is in high level (1) every 5 seconds. If the parameter **Trap Sending** is set with value "Edge Triggered" then the trap message is sent during the Digital Input's rising edge (0->1); In this mode the counter will be increased when the Digital Input value transits from 0 to 1.

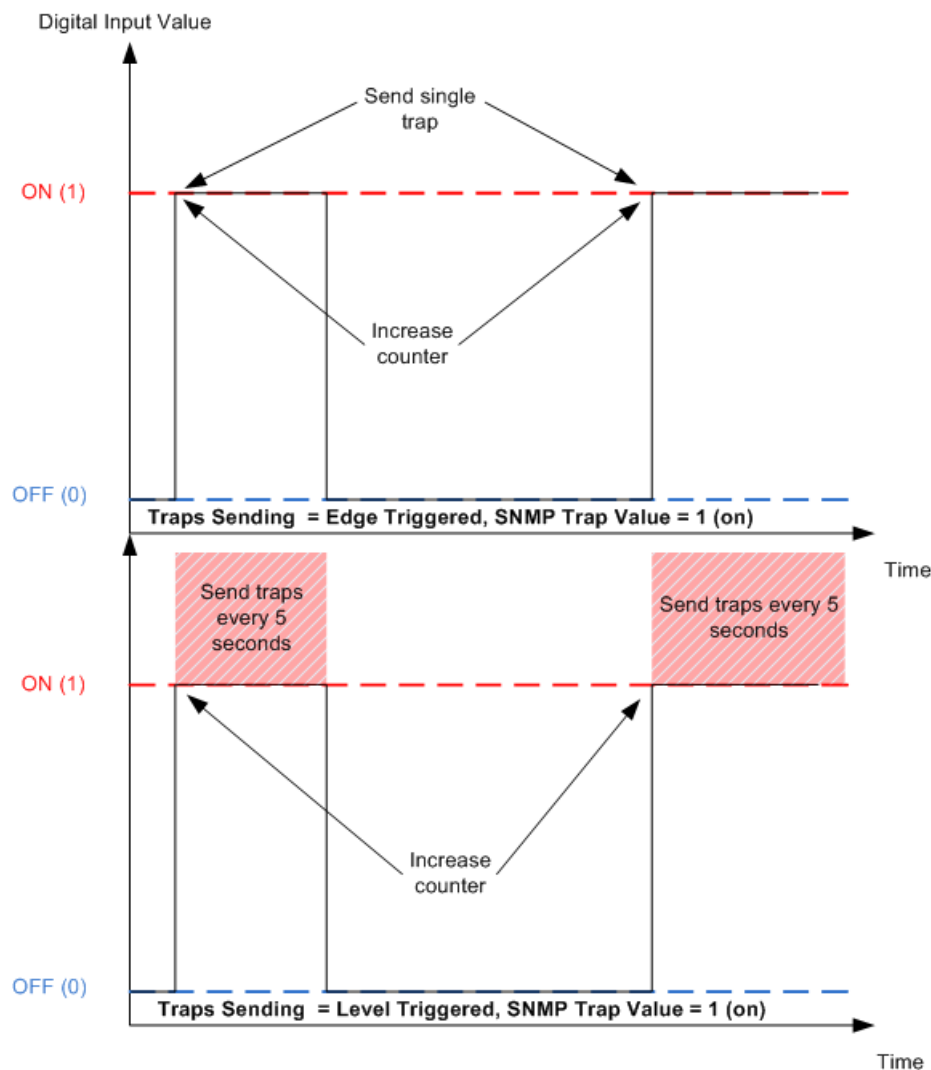


Figure 7.9. Traps and counter when SNMP Trap Value is "1 (on)"

- 2 (Both) - If the parameter **Trap Sending** is set with value "Level Triggered" then the trap message is sent constantly every 5 seconds. If the parameter **Trap Sending** is set with value "Edge Triggered" then the trap message is sent every time when the Input changes its state (falling and rising edge). In this mode the counter will be increased when the Digital Input value transits from 1 to 0 and from 0 to 1.

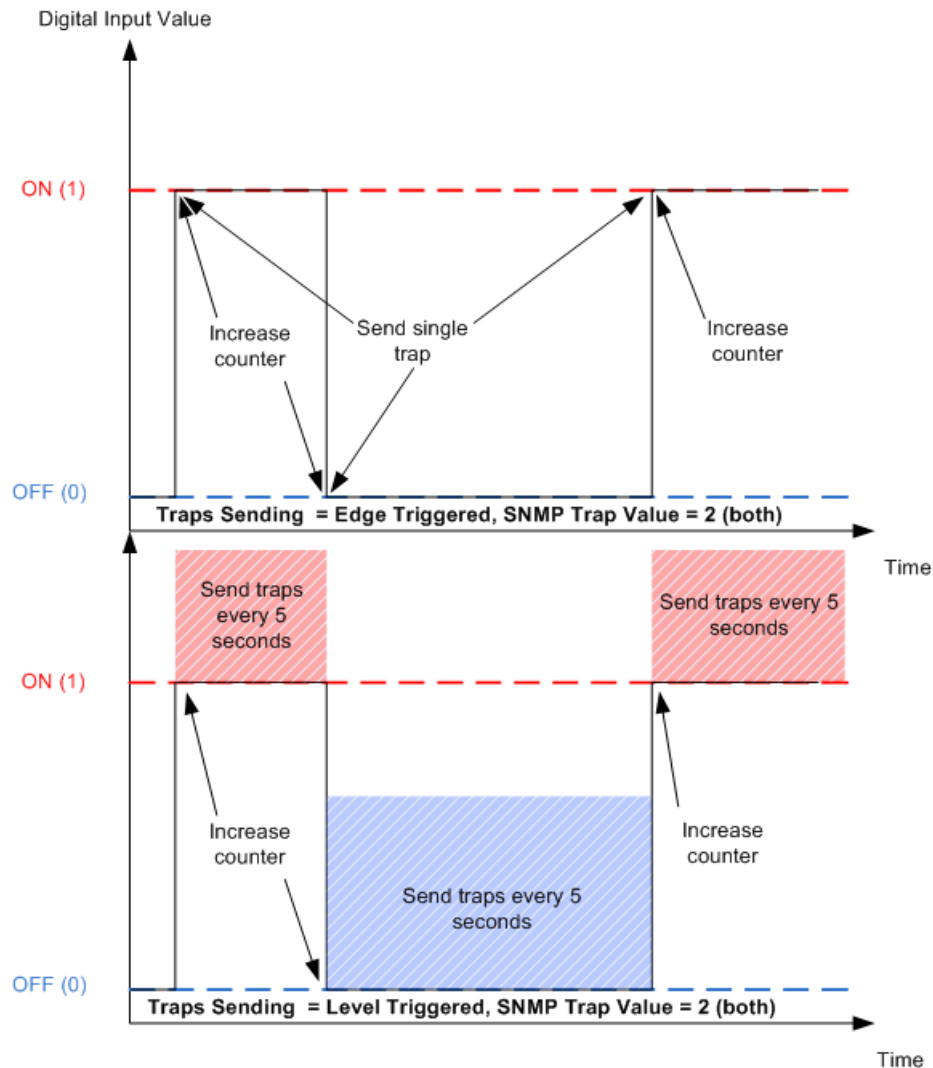


Figure 7.10. Traps and counter when SNMP Trap Value is "2 (both)"

- **Remote Relay Control (for smartDEN IP-32IN only)** - this is the remote relay number "attached" to this digital input from the remote network device selected from the list from page "Remote Services". Commands for **Remote Relay Control** are sent:
 - When the digital input state is changed;
 - After reset of **smartDEN IP-32IN**;
 - When new relay is selected from the field **Remote Relay Control**;
 - When **Remote Relay Mode** is changed;
- **Remote Relay Mode (for smartDEN IP-32IN only)** - determines how the remote relay will be controlled:
 - *Normal* - when the digital input is ON, the relay will be ON. Then the input is OFF, the relay will be OFF as well;

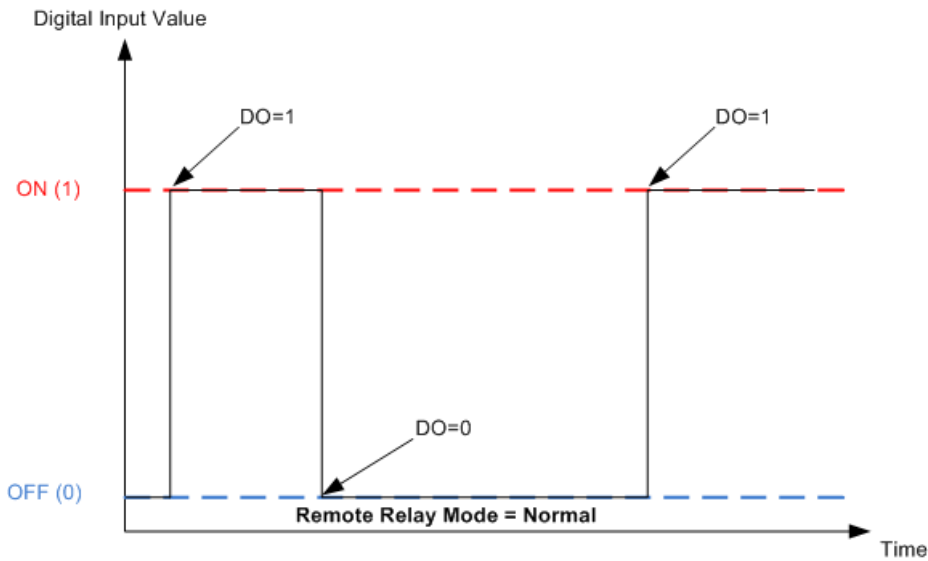


Figure 7.11. Controlling remote relay when **Remote Relay Mode** parameter is "Normal"

- *Inversed* - when the digital input is ON, the relay will be OFF. Then the input is OFF, the relay will be ON;

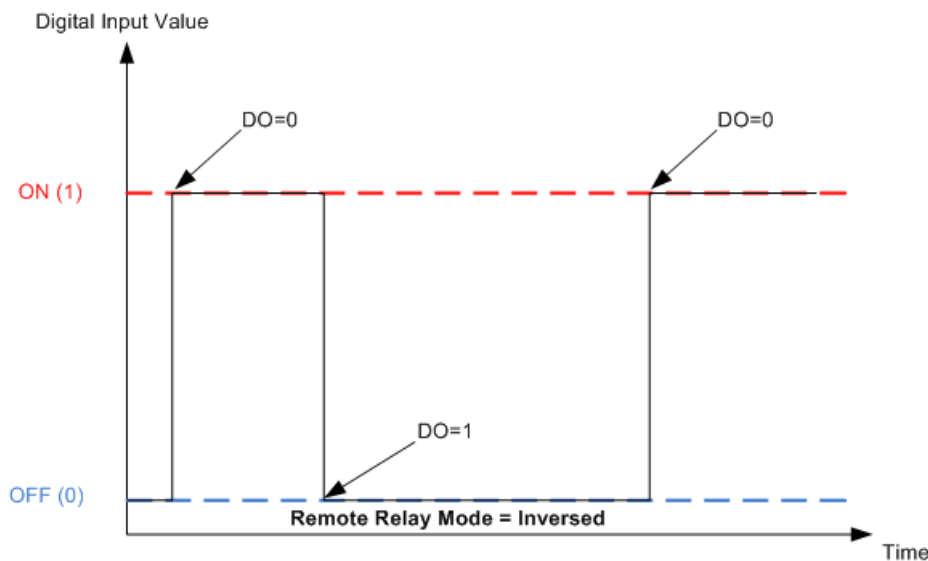


Figure 7.12. Controlling remote relay when **Remote Relay Mode** parameter is "Inversed"

- **Edge (for smartDEN Notifier only)** - this parameter determines when the counter is incremented and MQTT and e-Mail notifications are sent:
 - **0 (Off)** – The counter is incremented on the falling edge (1 -> 0). With MQTT enabled and **MQTT Publish Mode=Edge Triggered** the falling edge triggers a notification message. The e-Mail (if enabled) is sent on falling edge (Figure. 7.12).

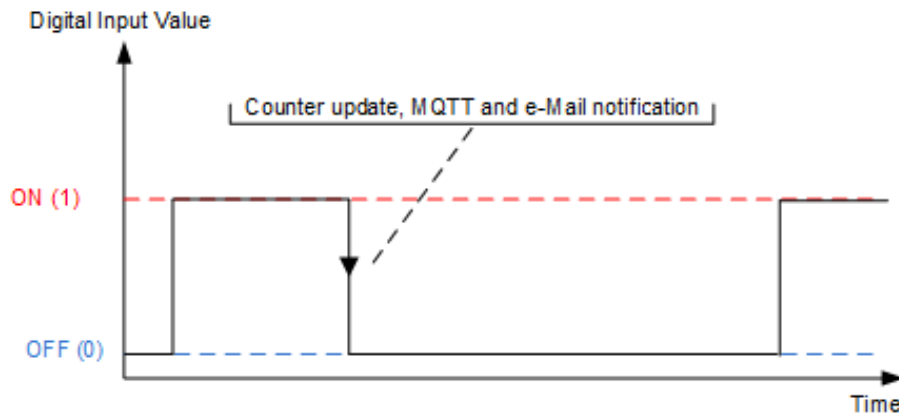


Figure 7.13. Counter update and notifications when **Edge** is set to "0 (Off)"

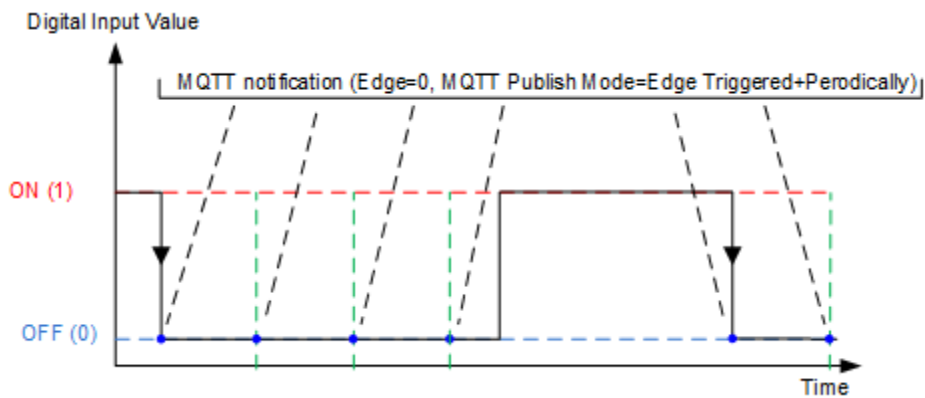


Figure 7.14. MQTT Publish Mode = "Edge Triggered + Periodically " and Edge=0

- **1 (On)** – The counter is incremented on the rising edge (0 -> 1). With MQTT enabled and **MQTT Publish Mode=Edge Triggered** the rising edge triggers a notification message. The e-Mail (if enabled) is sent on rising edge (Figure. 7.15).

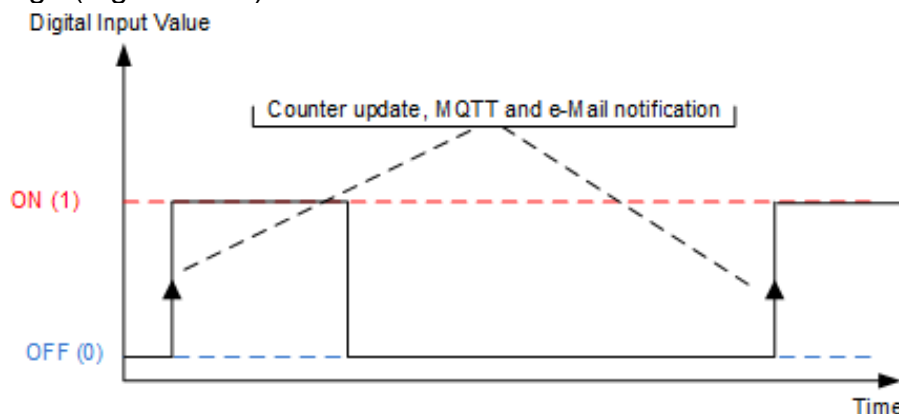


Figure 7.15. Counter update and notifications when **Edge** is set to "1 (On)"

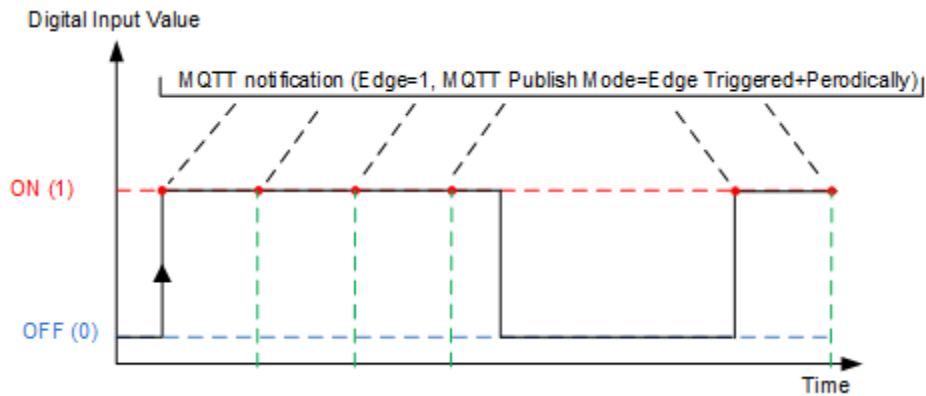


Figure 7.16. MQTT Publish Mode = "Edge Triggered + Periodically " and Edge=1

- **2 (Both)** – Counter update and notifications take place on every digital input state change (both falling and rising edges) (Figure. 7.17).

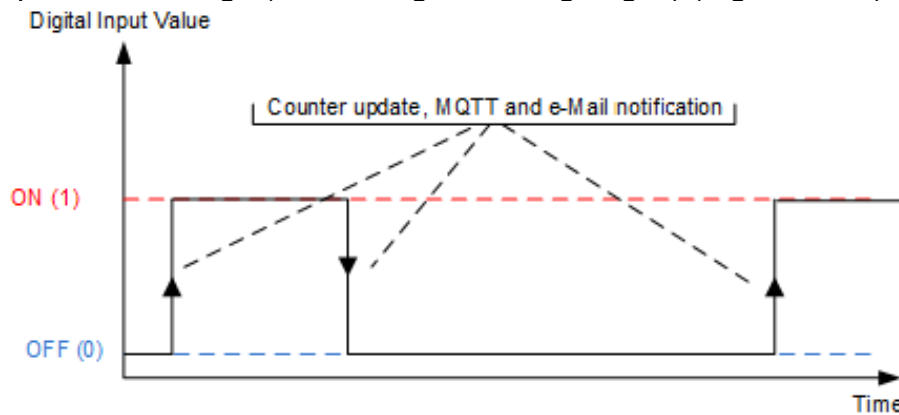


Figure 7.17. Counter update and notifications when **Edge** is set to "2 (Both)"

- **MQTT (for smartDEN Notifier only)** - determines if the digital input will send MQTT notification or not;
- **e-Mail (for smartDEN Notifier only)** - determines if the digital input will send e-Mail message or not;
- **Save button** - once you have changed the settings as required, click this button.

7.6. Analog Inputs

Analog Inputs					smartDEN Notifier		smartDEN IP-32IN				
Analog Input	Description	Min	Max	Label	Low Threshold	High Threshold	MQTT	e-Mail	SNMP Trap	Remote Relay Control	Remote Relay Mode
Input 1	AI1	0.0	10.0	V	0	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 2	AI2	0.0	1023.0	Unit	0	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 3	AI3	0.0	1023.0	Unit	0	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 4	AI4	0.0	1023.0	Unit	0	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 5	AI5	0.0	1023.0	Unit	0	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 6	AI6	0.0	1023.0	Unit	0	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 7	AI7	0.0	1023.0	Unit	0	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 8	AI8	0.1	1023.5	mv	2	6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal

Save Reload

smartDEN Notifier and smartDEN IP-32IN

Figure 7.18. Analog Inputs

- **Description** - Analog Input identification string (max 7 chars);
- **Min** - the measured value used for scaling corresponding to analog input value = 0 (range: from -9999.9 to 9999.9);
- **Max** - the measured value used for scaling corresponding to analog input value = 1023 (range: from -9999.9 to +9999.9);
- **Label** - the label for the measured value for example: m,A,KG,V...(max 4 chars);
- **Low Threshold** - the low threshold for the measured value (range: from -9999 to **High Threshold**);
- **High Threshold** - the high threshold for the measured value (range: from **Low Threshold** to 9999);
- **SNMP Trap (for smartDEN IP-32IN only)** - determines if the Analog Input will send traps or not. When this parameter is set, the trap(s) are sent in the following cases:
 - If **Traps Sending** parameter from web page "**SNMP Traps Settings**" is set to "**Level Triggered**" and if the Analog Input measured value is less or equal than **Low Threshold** or greater or equal than **High Threshold** traps will be sent every 5 seconds (Figure. 7.19);

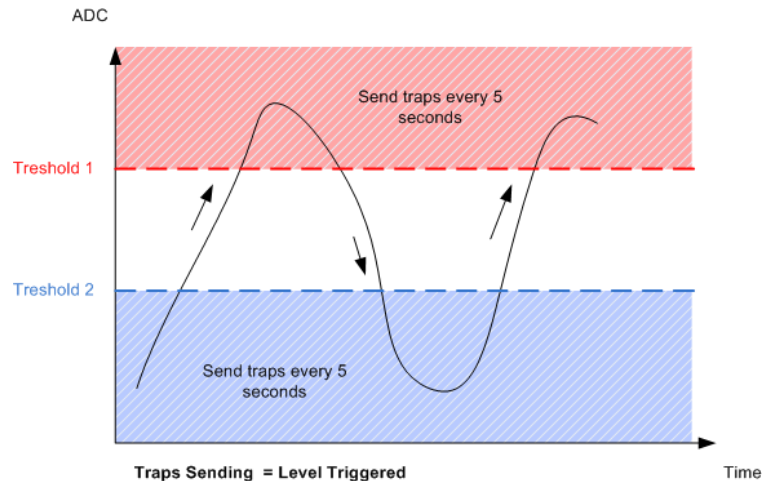


Figure 7.19. Sending tarps with Traps Sending = "Level Triggered"

- If **Traps Sending** parameter from web page "**SNMP Traps Settings**" is set to "**Edge Triggered**" a single trap is sent when measured value crosses over the **High Threshold** or below the **Low Threshold** values (Figure. 7.20).

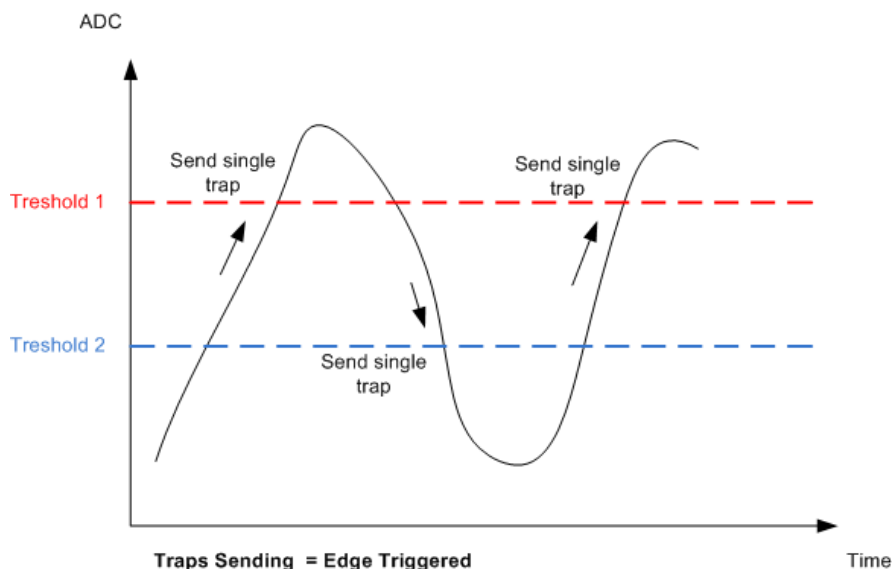


Figure 7.20. Sending tarps with Traps Sending = "Edge Triggered"

- When the parameter **Low Threshold** is changed and the Analog Input measured value is less or equal than the new value of **Low Threshold**;
- When the parameter **High Threshold** is changed and the Analog Input measured value is greater or equal than the new value of **High Threshold**;
- **Remote Relay Control (for smartDEN IP-32IN only)** - this is the remote relay number "attached" to this analog input from the remote network device selected from the list from page "Remote Services". Commands for **Remote Relay Control** are sent:
 - When the Analog Input measured value is less or equal than **Low Threshold**;
 - When the Analog Input measured value is greater or equal than **High Threshold**;

- When parameter **Low Threshold** is changed and the measured value is less or equal than **Low Threshold**;
- When parameter **High Threshold** is changed and the measured value is greater or equal than **High Threshold**;
- After reset of **smartDEN IP-32IN**;
- When new relay is selected from the field **Remote Relay Control**;
- When **Remote Relay Mode** is changed;
- **Remote Relay Mode (for smartDEN IP-32IN only)** - determines what will be the control command for the remote relay:
 - *Normal* - when the rising analog input value crosses the **High Threshold**, the remote relay (digital output) will be OFF (0). When the falling value crosses the **Low Threshold** the remote relay (digital output) will be ON (1) (Figure. 7.21).

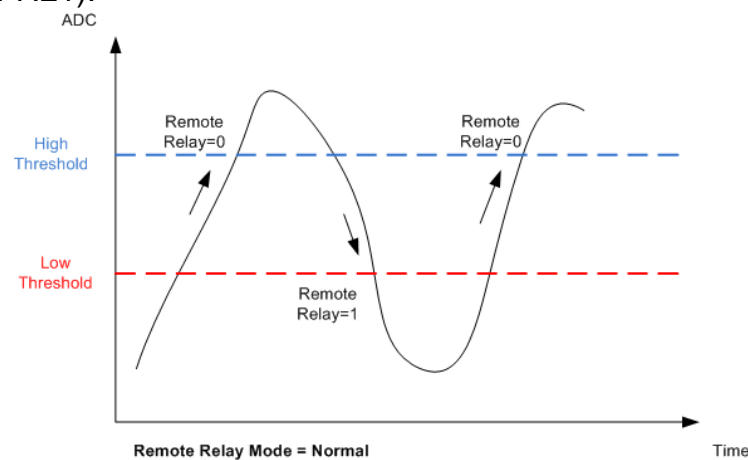


Figure 7.21. Controlling remote relay when **Remote Relay Mode** parameter is "Normal"

- *Inversed* - when the rising analog input value crosses the **High Threshold**, the remote relay (digital output) will be ON (1). When the falling value crosses the **Low Threshold** the remote relay (digital output) will be OFF (0) (Figure. 7.22).

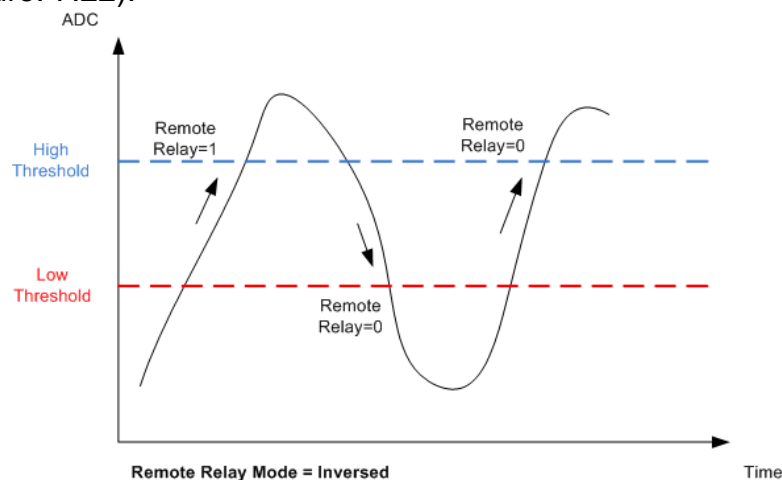



Figure 7.22. Controlling remote relay when **Remote Relay Mode** parameter is "Inversed"

- **Save button** - once you have changed the settings as required, click this button.

 The measured value for the analog inputs is calculated in the following way:

$$MeasuredValue = Min + \frac{Max - Min}{1024} \cdot ADCValue$$

7.7. Temperature Inputs

Temperature Inputs			smartDEN Notifier			smartDEN IP-32IN			
Temp. Input	Description	Tolerance, %	Low Threshold, °C	High Threshold, °C	MQTT	e-Mail	SNMP Trap	Remote Relay Control	Remote Relay Mode
Input 1	TI1w	0	0	30	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	0	Normal
Input 2	TI2	0	0	29	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 3	TI3	0	0	28	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 4	TI4	0	0	27	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 5	TI5	0	0	26	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 6	TI6	0	0	25	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 7	TI7	0	0	24	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal
Input 8	Alm tmp	0	28	30	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	Normal

Figure 7.23. Temperature Inputs

- **Description** - Temperature Input identification string (max 7 chars);
- **Tolerance, %**: The tolerance for the Temperature Input - from -5% to +5%; This can be set if there is significant difference in the sensor value otherwise must be left with value of 0;
- **Low Threshold, °C/°F** - the low threshold limit for this input (range: from -55°C/-67°F up to **High Threshold**);
- **High Threshold, °C/°F** - the high threshold limit for this input (from **Low Threshold** up to +155°C/ 311°F);
- **SNMP Trap (for smartDEN IP-32IN only)** - determines if the Temperature Input will send traps or not. When this parameter is set, the trap(s) are sent in the following cases:
 - If **Traps Sending** parameter from web page "**SNMP Traps Settings**" is set to "**Level Triggered**" and if the Temperature Input value is less or equal than **Low Threshold** or greater or equal than **High Threshold** traps will be sent every 5 seconds (Figure 7.24);

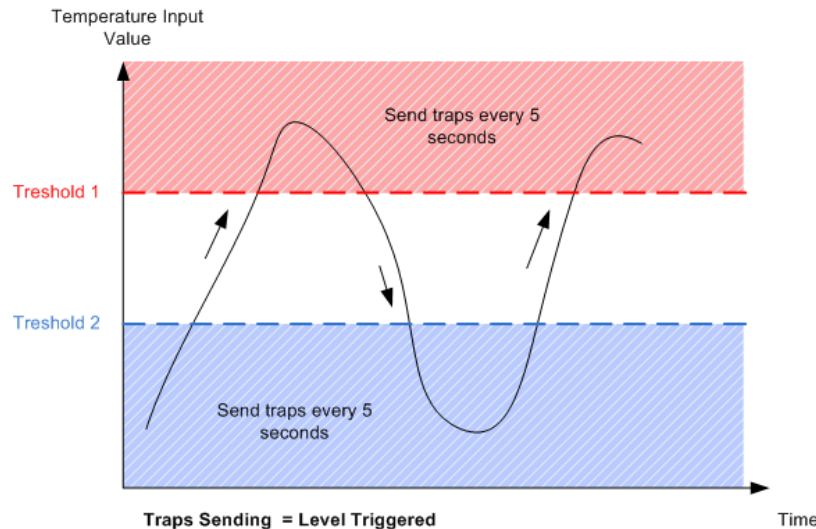


Figure 7.24. Sending tarps with **Traps Sending** = "Level Triggered"

- If **Traps Sending** parameter from web page "**SNMP Traps Settings**" is set to "**Edge Triggered**" and if the rising Temperature Input value the **High Threshold** or the falling Temperature Input value crosses the **Low Threshold**, a single trap will be sent (Figure. 7.25);

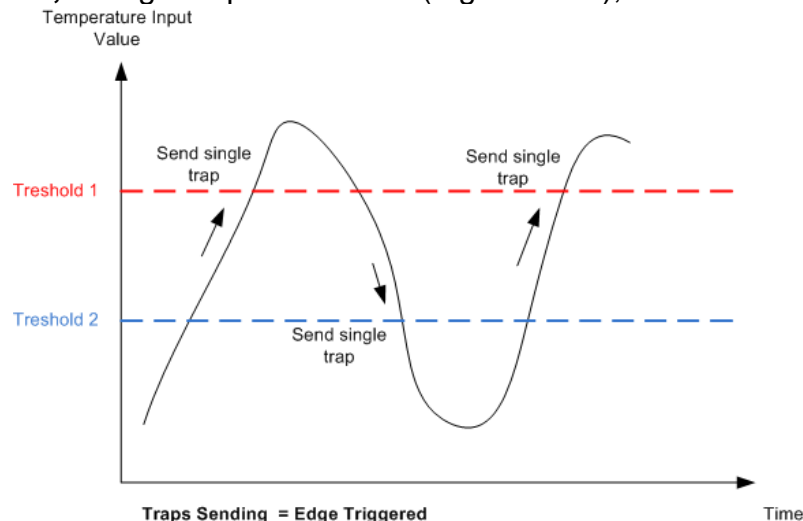


Figure 7.25. Sending tarps with **Traps Sending** = "Edge Triggered"

- When the parameter **Low Threshold** is changed and the Temperature Input value is less or equal than the new value of **Low Threshold**;
- When the parameter **High Threshold** is changed and the Temperature Input value is greater or equal than the new value of **High Threshold**;
- **Remote Relay Control (for smartDEN IP-32IN only)** - this is the remote relay number "attached" to this Temperature Input from the remote network device selected from the list from page "Remote Services". Commands for **Remote Relay Control** are sent:
 - When the Temperature Input value is less or equal than **Low Threshold**;
 - When the Temperature Input value is greater or equal than **High Threshold**;

- When parameter **Low Threshold** is changed and the input value is less or equal than **Low Threshold**;
- When parameter **High Threshold** is changed and the input value is greater or equal than **High Threshold**;
- After reset of **smartDEN IP-32IN**;
- When new relay is selected from the field **Remote Relay Control**;
- When **Remote Relay Mode** is changed;
- **Remote Relay Mode (for smartDEN IP-32IN only)** - determines what will be the control command for the remote relay:
 - *Normal* - when the rising Temperature Input value crosses the **High Threshold**, the remote relay (digital output) will be OFF (0). When the falling value crosses the **Low Threshold** the remote relay (digital output) will be ON (1) (Figure. 7.26).

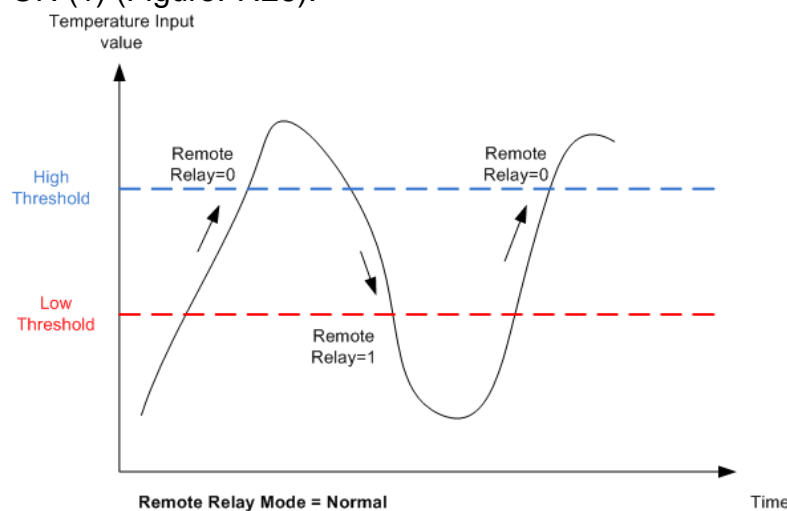


Figure 7.26. Controlling remote relay when **Remote Relay Mode** parameter is "Normal"

- *Inversed* - when the rising Temperature Input value crosses the **High Threshold**, the remote relay (digital output) will be ON (1). When the falling value crosses the **Low Threshold** the remote relay (digital output) will be OFF (0) (Figure. 7.27).

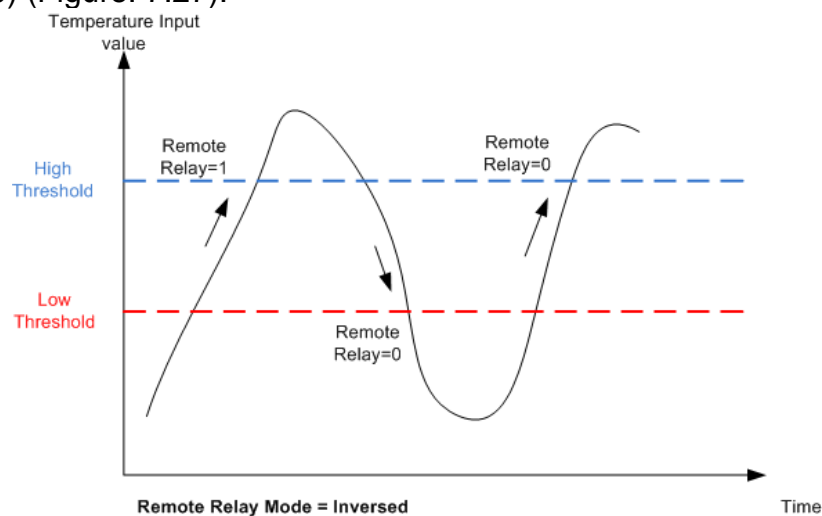


Figure 7.27. Controlling remote relay when **Remote Relay Mode** parameter is "Inversed"

- **MQTT (for smartDEN Notifier only)** - determines if the temperature input will send MQTT notification or not;
- **e-Mail (for smartDEN Notifier only)** - determines if the temperature input will send e-Mail message or not;

With MQTT enabled and **MQTT Publish Mode=Edge Triggered** a notification message is sent when temperature value crosses over the **High Threshold** or below the **Low Threshold** values (Figure. 7.28). The same crossing conditions trigger sending of an e-Mail.

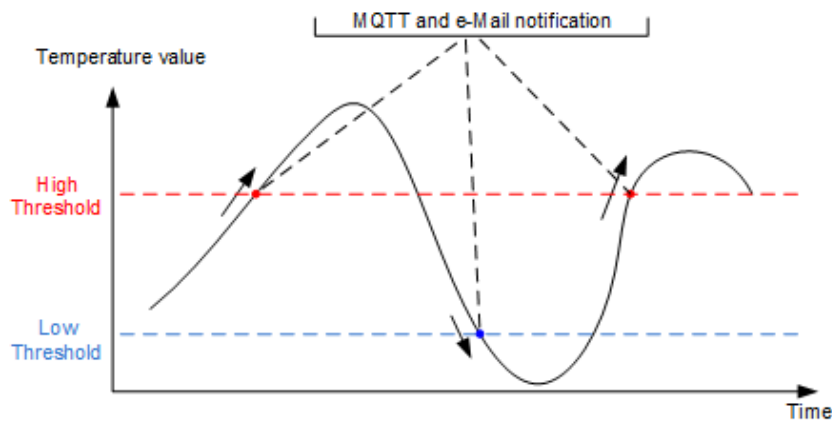


Figure 7.28. Sending Temperature input notifications

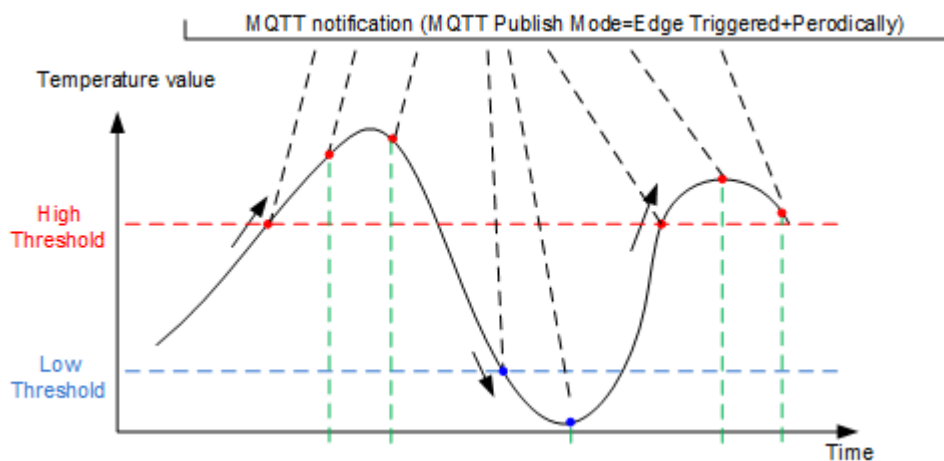


Figure 7.29. Sending temperature input notifications during Publish Mode = "Edge Triggered + Periodically"

- **Save button** - once you have changed the settings as required, click this button.

7.8. Monitoring

Digital Inputs (1..8)							
DIn1	DIn2	DIn3	DIn4	DIn5	DIn6	DIn7	DIn8
0 (Off)	0 (Off)	0 (Off)	1 (On)	0 (Off)	1 (On)	0 (Off)	0 (Off)
8	12	110	108	0	0	0	0

Digital Inputs (9..16)							
DIn9	DIn10	DIn11	DIn12	DIn13	DIn14	DIn15	DIn16
0 (Off)	1 (On)	0 (Off)	0 (Off)	0 (Off)	0 (Off)	0 (Off)	0 (Off)
0	0	0	0	0	0	0	0

Analog Inputs							
AIn1	AIn2	AIn3	AIn4	AIn5	AIn6	AIn7	AIn8
0	0	0	0	504	0	0	0
0.0 Volt	0.0 mA	-9000.0 mV	0.0 Volt	49.2 %PH	0.0 Kg	0.0 Volt	0.0 Volt

Temperature Inputs, °C							
TIn1	TIn2	TIn3	TIn4	TIn5	TIn6	TIn7	TIn8
-9.0	-	-	29.1	-	92.4	22.1	-

Figure 7.30. Monitoring page

7.9. Logout

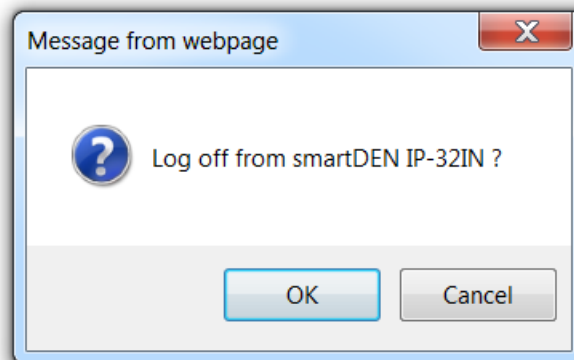


Figure 7.31. Log off

7.10. Reboot

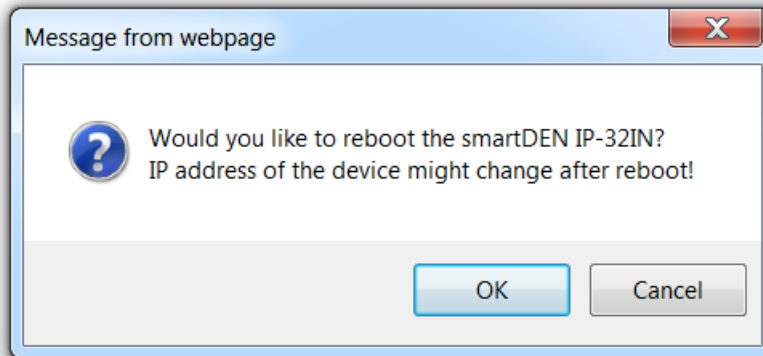


Figure 7.32. Reboot

7.11. Remote services (for smartDEN IP-32IN only)

Remote Services Settings

Data Logging	
Enable	<input checked="" type="checkbox"/>
HTTP Server Address / Path	denkovi.com / sd/index.php
Server Port	80
Logging Period, sec	5
Server Response Timeout, sec	5
Remote Relay Control	
Enable	<input type="checkbox"/>
Remote Board Type	smartDEN IP-16R
Remote Board Address	192.168.1.2
Remote Board Port	80
Remote Board Password	admin
Remote Board Response Timeout, sec	2

Figure 7.33. Remote services

smartDEN IP-32IN supports sending HTTP GET/POST messages based on particular input events or periodically. This is so called "Remote Services" mode. In

this mode the **smartDEN IP-32IN** works as client and it sends messages to the server. From this page all the settings regarding this mode can be set. There are two modes available:

- **Data Logging** - in this mode the HTTP server is located on some remote machine and it must process the XML file containing the input values sent via POST request by the **smartDEN IP-32IN** module. Parameters are:
 - **Enable** - activate this mode;
 - **HTTP Server Address** - the remote HTTP server IP address or domain name (max 22 chars);
 - **HTTP Server Path** - the remote path after the HTTP Server Address (max 22 chars);
 - **Server Port** - the remote HTTP server listening port;
 - **Logging period, sec** - the time interval in seconds between two sequential POST requests during the logging (from 1 to 250 seconds);
 - **Server Response Timeout, sec** - the timeout for the server response (from 1 to 250 seconds).



The timeout period must be less than the logging period!

- **Remote Relay Control** - In this mode the **smartDEN IP-32IN** controls via HTTP GET request remote relays, located at our relay boards or IP controllers through the LAN network (or Internet). Parameters are:
 - **Enable** - activate this mode;
 - **Remote Board Type** - it can be: [DAEnetIP3](#) and all *denkovi* devices based on this IP controller, [DAEnetIP4](#) and all *denkovi* devices based on this IP controller, [Wi-Fi Relays](#), and [smartDEN relay modules](#);
 - **Remote Board Address** - the IP address or domain name of the remote board;
 - **Remote Board Port** - the remote board HTTP listening port;
 - **Remote Board Password** - the password for the remote board (max 10 chars);
 - **Remote Board Response Timeout, sec** - the timeout for the remote board response (from 1 to 250 seconds).



Please note the module can work only in one of the both modes at one moment!

7.12. SNMP agent (for smartDEN IP-32IN only)

SNMP Agent Configuration

SNMP Agent	
Enable SNMP	<input checked="" type="checkbox"/>
SNMP Port	161
Read-only Community1	public
Read-only Community2	read
Read-write Community1	private
Read-write Community2	write

Figure 7.34. SNMP settings

These settings let you configure the SNMP (Simple Network Management Protocol) access to the **smartDEN IP-32IN**:

- **Enable SNMP** - This option enables or disables SNMP access to the **smartDEN IP-32IN**;
- **SNMP Port** - UDP port number the SNMP agent receives requests on (default port is 161);
- **Read-only Community1/2** - Community string for client's authentication, used in read operations;
- **Read-write Community1/2** - Community string for client's authentication, used in read/write operations.
- **Save button** - Once you have changed the settings as required, click this button.

 You have to reboot the device for these settings to apply.

7.13. SNMP traps (for smartDEN IP-32IN only)

SNMP Trap Settings


SNMP Trap Settings	
Enable Trap	<input checked="" type="checkbox"/>
Trap Receiver IP Address	192.168.1.105
Trap Receiver Port	162
Trap Community	password
Trap Sending	Level Triggered

Figure 7.35. SNMP trap settings

smartDEN IP-32IN can send SNMP traps upon input event (detected by a Digital and/or Analog Input) to a Trap server and its parameters can be set from this web page:

- **Enable Trap** - global parameter that enables or disables sending traps to the server;
- **Trap Receiver IP Address** - the IP address of the trap server;
- **Trap Receiver Port** - determines the UDP port the trap message will be sent to;
- **Trap Community** - the trap community;
- **Trap Sending** - determines how the traps will be sent:
 - **Level Triggered** - the trap message will be sent every 5 seconds when the input is in position to generate traps. This is because the SNMP traps are UDP messages and UDP protocol does not guarantee that the packet will be received at all.
 - **Edge Triggered** - the trap message will be sent upon input event only once.

Save button - once you have changed the settings as required, click this button.

 If the traps are enabled, on boot so called "cold start" message is send indicating **smartDEN IP-32IN** is started.

7.14. MQTT Settings (for smartDEN Notifier only)

These settings let you configure the MQTT notification mode of **smartDEN Notifier** (Figure. 7.36).

MQTT Settings	
Enable	<input checked="" type="checkbox"/>
MQTT Server	iot.eclipse.org
Server Port	1883
Username	
Password	
Publish Mode	Periodically
Publish Period, sec	<div style="border: 1px solid black; padding: 2px;"> Periodically Edge Triggered Edge Triggered + Periodically </div>
Encrypt Topic	<input checked="" type="checkbox"/>
Non-encrypted Topic	SmartDEN_Notifier/E8EADA00245B/#
Encrypted Read Topic	f15be6b5e6b1675f17f1160b70e1cdb9
Encrypted Write Topic	2416b01600cc5b2755e0ca82f39836ec
Encrypted Notify Topic	c555b50f7324b0a2cb219f1847c708f1
Status	Disconnected

Figure 7.36. MQTT settings

- **Enable** – enable/disable the MQTT notifications;

- **MQTT Server** - the MQTT server (broker) IP address or domain name (max. 22 chars);
- **Server Port** – the MQTT server listening port (the default port is 1883);
- **Username** – username, if used (max. 10 chars);
- **Password** – password, if used (max. 10 chars);
- **Publish Mode:**
 - **Periodically** – notifications are send periodically (the period is defined by the **Publish Period** value);
 - **Edge Triggered** – notifications are triggered by events (change of digital inputs state or crossing of analog value/temperature over or below the predefined threshold values);
 - **Edge Triggered + Periodically** - combination of the above two modes. In that mode notifications are send just like the mode **Edge Triggered** but periodically (the period is defined by the **Publish Period** value);
- **Publish Period, sec** – the time interval between two successive notifications (from 5 to 250 seconds);
- **Encrypt Topic** – when enabled, the MQTT topic is encrypted;
- **Non-encrypted Topic** – plain (non-encrypted) topic the clients can subscribe to receive notifications from **smartDEN Notifier**;
- **Encrypted Read Topic, Encrypted Write Topic, Encrypted Notify Topic** - encrypted topics for communication with the Android [DAE-aModules](#) application or customized MQTT libraries.
- **Save button** - once you have changed the settings as required, click this button.



A list of sample publically-accessible MQTT servers (brokers):
iot.eclipse.org, test.mosquitto.org



Two configuration options are used by default: Publish QoS (Quality of Service) = 0; Keep Alive value = 120 seconds.



The plain topics are supposed to be used with general MQTT clients.
The encrypted topics are designed for communication with the Android [DAE-aModules](#) application or customized MQTT libraries.



The communication protocol, used in working with encrypted topics, is available upon request.



You have to reboot the device for these settings to apply.

7.15. e-Mail Settings (for smartDEN Notifier only)

This page let you configure the e-Mail notification mode of **smartDEN Notifier** (Figure. 7.37).

e-Mail Settings	
Enable	<input checked="" type="checkbox"/>
SMTP Server	smtp.srvden.com <input type="button" value="Test"/>
Server Port	587
Username	send@srvden.com
Password	*****
Mail To	test@srvden.com
Last Result	Success

Figure 7.37. e-Mail settings

- **Enable** – enable/disable the e-Mail notifications;
- **SMTP Server** - the SMTP (**S**imple **M**ail **T**ransfer **P**rotocol) server IP address or domain name (max. 22 chars);
- **Test** – this button initiates sending of a test e-Mail message;
- **Server Port** – the SMTP server listening port;
- **Username** – the SMTP authentication username (max. 22 chars);
- **Password** – the SMTP authentication password (max. 10 chars);
- **Mail To** – the e-Mail address of the recipient;
- **Save button** - once you have changed the settings as required, click this button.

7.16. Modbus-TCP Settings (for smartDEN IP-32IN-MT only)

These settings let you configure the Modbus-TCP parameters of **smartDEN IP-32IN-MT**

Modbus-TCP Settings

Modbus-TCP Settings	
Enable Modbus-TCP	<input checked="" type="checkbox"/>
Modbus-TCP Port	502
Idle Timeout, min	5
Client State	CONNECTED

Figure 7.38. Modbus-TCP Settings page

- **Enable Modbus-TCP** - this option enables or disables the Modbus-TCP communication;
- **Modbus-TCP Port** - port on which the Modbus-TCP server listens for requests (default port is 502);
- **Idle Timeout, min** - the length of time that a connection is idle before the connection is closed by the Modbus-TCP server. The timeout is disabled when its value is set to 0;
- **Client State** - Modbus-TCP client state;
- **Save** button - once you have changed the settings as required, click this button.



You have to reboot the device for these settings to apply.



Please note that only one TCP socket connection is supported at a time. Multiple concurrent TCP connections are not supported.



To refresh the Modbus-TCP client state, click the Reload button.

8. HTTP XML/JSON operation

This operation mode allows custom applications to control the **smartDEN IP-32IN-XX** without using a Web-browser. The custom application acts as a HTTP client, sending HTTP GET requests to the **smartDEN IP-32IN-XX** (Figure. 8.1). As a reply the **smartDEN IP-32IN-XX** returns data as either JSON or XML file for parsing and/or processing by the custom application.

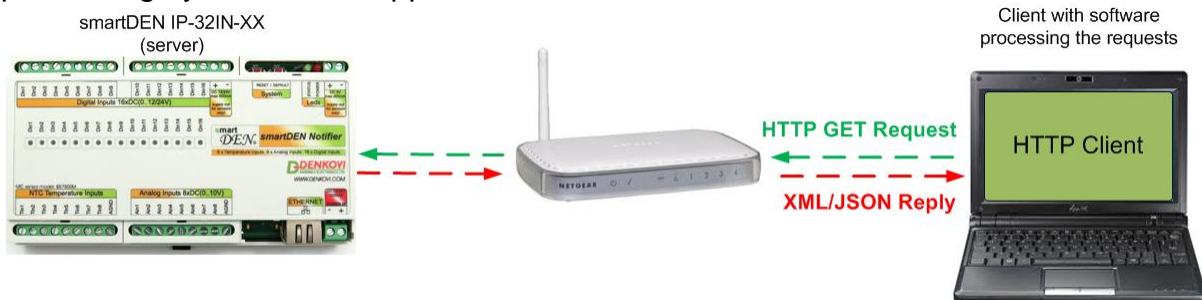


Figure 8.1. smartDEN IP-32IN-XX working as a HTTP server

To receive the current state of the **smartDEN IP-32IN-XX**, the application requests the page **current_state.xml / current_state.json**, for example:

http://192.168.1.100/current_state.xml

http://192.168.1.100/current_state.json



In order to use this mode, XML/JSON access should be enabled.

The XML/JSON login process differs depending on the selected **Encrypt Password** option.

8.1. Login (Encrypted Password)

In this mode a two-step login sequence is provided as a protection against unauthorized access. The first time the custom application requests the page **current_state.xml / current_state.json**, a random login key is issued in the reply. Next the custom application uses this key to encrypt the password. The encrypted password is sent as a parameter with the next request to the page **current_state.xml / current_state.json**.

Below is an example of login process:

Step 1:

Request

http://192.168.1.100/current_state.xml

Reply (login required):

<CurrentState>

<LoginKey>65156</LoginKey>

</CurrentState>

http://192.168.1.100/current_state.json

Reply (login required):

`{"CurrentState": {"LoginKey": "65156"}}`

Step 2:

Request (password is sent as a parameter)

http://192.168.1.100/current_state.xml?pw=28237099263eabfd88626124a822c64c

or

http://192.168.1.100/current_state.json?pw=28237099263eabfd88626124a822c64c

Reply (password is O'K, login accepted): See: [Appendix 1. Application reply formats](#)



Password encryption algorithm to be implemented in custom application is available upon request.

8.2. Login (Non-Encrypted Password)

In this mode the password is passed as non-encrypted parameter with the request:

http://192.168.1.100/current_state.xml?pw=admin

http://192.168.1.100/current_state.json?pw=admin

Getting the <LoginKey> in the answer in this mode means only that the provided password is wrong or the login session has been expired.



If there is no data traffic between the custom application and the **smartDEN IP-32IN-XX** for time, specified by **Session Timeout** parameter, the session "times out" and a new login is required.

8.3. Getting the current state

After a login the custom application can obtain the **smartDEN IP-32IN-XX** current state by a request to the page *current_state.xml* / *current_state.json* :

http://192.168.1.100/current_state.xml

The reply contains page in XML format, see: [Appendix 1. Application reply formats](#)

http://192.168.1.100/current_state.json

The reply contains page in JSON format, see: [Appendix 1. Application reply formats](#)

9. HTTP client for smartDEN IP-32IN

9.1. Data Logging mode

Data Logging mode (push notifications mode) is designed in order to help solving cases like remote monitoring and Internet/Ethernet logging. The **smartDEN IP-32IN** acts like a client and it sends (pushes) HTTP POST messages in XML format to the HTTP server periodically (Figure. 9.1).

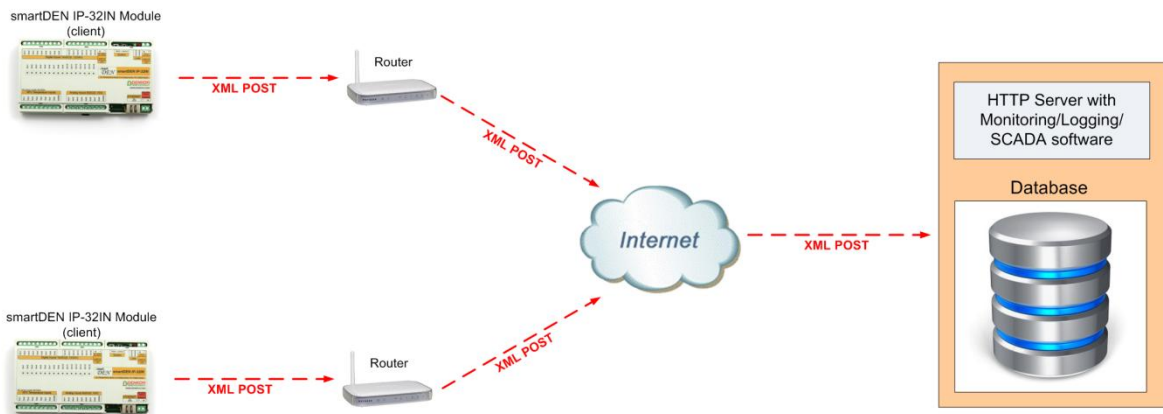


Figure 9.1. Data logging mode



Data Logging mode is adjusted from the "Remote Services Settings" web page -> "Data Logging" section.



Please note the module does not support internal memory data storage for logging, but it can send only messages to remote server-logger!

9.1.1. HTTP POST header

Bellow is shown the header of example POST message sent by **smartDEN IP-32IN**:

```
POST /current_state.xml HTTP/1.0
Host: 192.168.1.124
Content-Type: text/xml; charset=UTF-8
Content-Length: 3046
Connection: close
```

current_state.xml is actually the **HTTP Server Path** from the page "Remote Services Settings".

192.168.1.124 is the **HTTP Server Address**.

Content-Type may be *text/xml* or *application/json*

9.1.2. HTTP POST body

9.1.2.1. XML format:

“<?xml version='1.0' encoding='UTF-8'?>”

Followed by the

XML format described in [Appendix 1. Application reply formats](#)

9.1.2.2. JSON format

JSON format described in [Appendix 1. Application reply formats](#)

9.2. Remote Relay Control mode

This mode allows you to control relays over the local network or Internet from some **smartDEN IP-32IN** input up on input event like analog/temperature value threshold crossing or changing digital input value. **smartDEN IP-32IN** sends specific HTTP GET message to the selected remote relay board.

💡 **Remote Relay Control** mode is adjusted from the "Remote Services Settings" web page -> "Remote Relay Control" section.

💡 Please note single **smartDEN IP-32IN** input module can control only one remote relay board at a time.

⚠️ **smartDEN IP-32IN** input module must "see" the IP of the Remote Relay Board in order to work in this mode. In case of LAN, both modules must be in same local network segment. In case of WAN, the Remote Relay Board address must be static IP address.

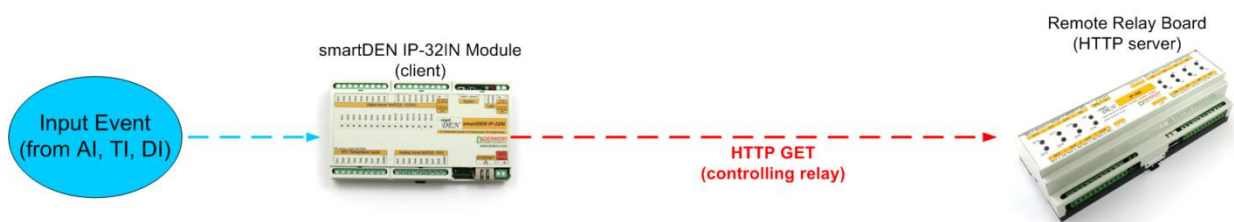


Figure 9.2. Controlling relay example (direct connection)

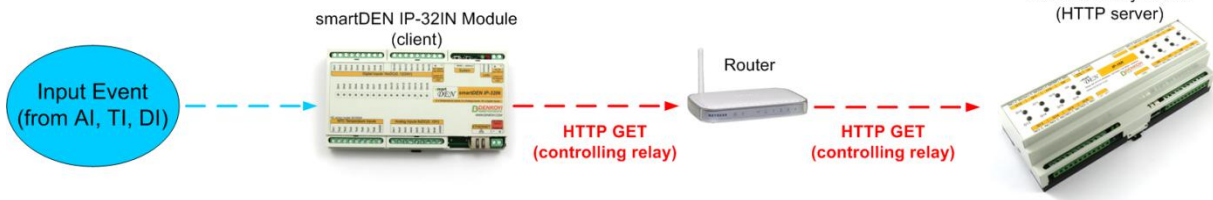


Figure 9.3. Controlling relay example (through router)

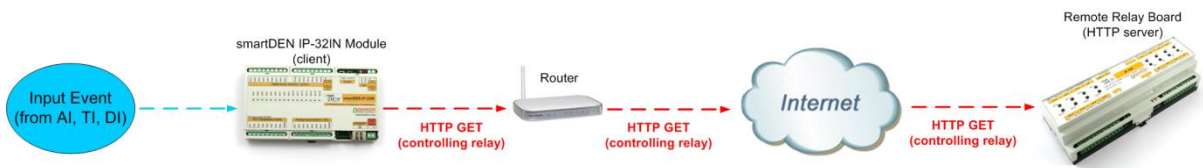



Figure 9.4. Controlling relay example (through Internet)

10. Integration Protocols

10.1. SNMP (for smartDEN IP-32IN only)

smartDEN IP-32IN supports SNMP snmpget and snmpset commands. Most of the parameters can be configured/read via these commands. Read-only community string is used for reading and Read-Write Community String is used for changing the parameters. Parameters that can be changed, are grouped according to their functions in the tables below. To obtain a valid OID number it is necessary to replace the "x" symbol with the prefix ".1.3.6.1.4.1.42505". Also all the snmp commands are described in the [MIB](#) file.

 During SNMP access, it must be used snmpget and snmpset only to one OID and not to group of OIDs.

10.1.1. Product

Table 10.1. Product OID-s

OID	Name	Access	Description	Syntax
x.7.1.1.0	Name	read-only	Description of the module	DISPLAYSTRING
x.7.1.2.0	Version	read-only	Current firmware version	DISPLAYSTRING
x.7.1.3.0	Date	read-only	Current firmware version build date	DISPLAYSTRING

10.1.2. Setup

Table 10.2. Digital Inputs OID-s

Start OID	End OID	Name	Access	Description	Syntax
x.7.2.1.1.2.0	x.7.2.1.1.2.15	DigitalInput Description	read-write	Digital Input Description (maxlen=7)	DISPLAYSTRING (SIZE (0..7))
x.7.2.1.1.3.0	x.7.2.1.1.3.15	DigitalInput Counter	read-write	Digital Input Counter (0..65535)	INTEGER32 (0..65535)
x.7.2.1.1.4.0	x.7.2.1.1.4.15	DigitalInput Filter	read-write	Digital Input Filter (0..200), ms	INTEGER (0..200)
x.7.2.1.1.5.0	x.7.2.1.1.5.15	DigitalInput TrapEnabled	read-write	Digital Input Trap Enable Flag (Disabled-0, Enabled-1)	INTEGER { no(0),yes(1) }
x.7.2.1.1.6.0	x.7.2.1.1.6.15	DigitalInput TrapValue	read-write	Digital Input Trap Value (off-0, on-1, both-2)	INTEGER { closed(0),open(1),both(2) }
x.7.2.1.1.7.0	x.7.2.1.1.7.15	DigitalInput State	read-only	Digital Input State (off-0,on-1)	INTEGER { closed(0),open(1) }

Table 10.3. Analog Inputs OID-s

Start OID	End OID	Name	Access	Description	Syntax
x.7.2.2.1.2.0	x.7.2.2.1.2.7	AnalogInputDescription	read-write	Analog Input Description (maxlen=7)	DISPLAYST RING (SIZE (0..7))
x.7.2.2.1.3.0	x.7.2.2.1.3.7	AnalogInputTrapLowThreshold	read-write	Analog Input Trap Low Threshold (0..1023)	INTEGER (0..1023)
x.7.2.2.1.4.0	x.7.2.2.1.4.7	AnalogInputTrapHighThreshold	read-write	Analog Input Trap High Threshold (0..1023)	INTEGER (0..1023)
x.7.2.2.1.5.0	x.7.2.2.1.5.7	AnalogInputTrapEnabled	read-write	Analog Input Trap Enable Flag (Disabled-0, Enabled-1)	INTEGER { no(0),yes(1) }
x.7.2.2.1.6.0	x.7.2.2.1.6.7	AnalogInputValue	read-only	Analog Input Value	INTEGER (0..1023)
x.7.2.2.1.7.0	x.7.2.2.1.7.7	AnalogInputMin	read-write	Analog Input Min Value (maxlen=7)	DISPLAYST RING (SIZE (0..7))
x.7.2.2.1.8.0	x.7.2.2.1.8.7	AnalogInputMax	read-write	Analog Input Max Value (maxlen=7)	DISPLAYST RING (SIZE (0..7))
x.7.2.2.1.9.0	x.7.2.2.1.9.7	AnalogInputLabel	read-write	Analog Input Label (maxlen=4)	DISPLAYST RING (SIZE (0..3))
x.7.2.2.1.10.0	x.7.2.2.1.10.7	AnalogInputMeasure	read-write	Analog Input Measured Value	DISPLAYST RING

Table 10.4. Temperature Inputs OID-s


Start OID	End OID	Name	Access	Description	Syntax
x.7.2.3.1.2.0	x.7.2.3.1.2.7	TemperatureInputName	read-write	Temperature Input Name (maxlen=7)	DISPLAYST RING (SIZE (0..7))
x.7.2.3.1.3.0	x.7.2.3.1.3.7	TemperatureInputSensorTolerance	read-write	Temperature Input Sensor Tolerance (-5..+5)	INTEGER (-5..+5)
x.7.2.3.1.4.0	x.7.2.3.1.4.7	TemperatureInputTrapLowThreshold	read-write	Temperature Input Trap Low Threshold (-55..155)	INTEGER (-55..155)
x.7.2.3.1.5.0	x.7.2.3.1.5.7	TemperatureInputTrapHighThreshold	read-write	Temperature Input Trap High Threshold (-55..155)	INTEGER (-55..155)

x.7.2.3.1.6.0	x.7.2.3.1.6.7	Temperature InputTrapEnabled	read-write	Temperature Input Trap Enable Flag (Disabled-0, Enabled-1)	INTEGER { no(0),yes(1) }
x.7.2.3.1.7.0	x.7.2.3.1.7.7	Temperature InputValue	read-only	Temperature Input Value	DISPLAYSTRING

10.1.3. Control

Table 10.5. Control OID-s

OID	Name	Access	Description	Syntax
x.7.3.1.0	DigitalInputs State	read-write	Digital Inputs State (0..65535)	INTEGER32 (0..65535)
x.7.3.2.0	Reboot	read-write	Reboot smartDEN IP-32IN-XX Module	INTEGER (0..255)
x.7.3.3.0	sysUpTime	read-only	The time (in hundredths of a second) since the device was last re-initialized.	TIMETICKS
x.7.3.4.0	analogInput Filter	read-write	Analog Input Filter Constant (0..30), sec	Integer (0..30)
x.7.3.5.0	temperatureInputFilter	read-write	Temperature Input Filter Constant (0..30), sec	Integer (0..30)
x.7.3.6.0	temperature Scale	read-write	Temperature Scale	INTEGER { Celsius(0), Fahrenheit(1) }

 To reboot the device via SNMP, set the Reboot value to the ASCII code of the first char of your Web password. For example, if this is the char 'a', code in decimal is 97.

10.1.4. Traps

Configuration parameters related with the SNMP traps are shown in the below **Table 10.6.**

Table 10.6. Traps parameters




Start OID	Name	Access	Description	Syntax
x.7.4.1.0	TrapEnabled	read-write	Trap Enable Flag (Disabled-0, Enabled-1)	INTEGER { no(0),yes(1) }
x.7.4.2.0	TrapReceiverIPAddress	read-write	Trap Receiver IP Address	IPADDRESS
x.7.4.3.0	TrapReceiverPort	read-write	Trap Receiver Port (0..65535)	INTEGER32 (0..65535)
x.7.4.4.0	TrapCommunity	read-write	Community in Sending Trap	DISPLAYSTRING (SIZE (0..7))

x.7.4.5.0	TrapSending	read-write	Trap Sending (Level Triggered-0, Edge Triggered-1)	INTEGER {(0),(1)}
-----------	-------------	------------	--	----------------------

smartDEN IP-32IN generates SNMP v1 traps described in **Table 10.7**.

Table 10.7. SNMP v1 traps generated by smartDEN IP-32IN

Generic Type	Specific Type	Variable Bindings			Description
		No	Name	Value	
coldStart	0				Reboot trap
authenticationFailure	0				Wrong SNMP community request trap
enterpriseSpecific	1	1	x.7.2.1.1.7.0 - x.7.2.1.1.7.15	Digital Input State (off-0,on-1)	Digital Input trap
		2	x.7.2.1.1.2.0 - x.7.2.1.1.2.15	Digital Input Description (maxlen=7)	
enterpriseSpecific	2	1	x.7.2.2.1.10.0 - x.7.2.2.1.10.7	Analog Input Measured Value	Analog Input trap
		2	x.7.2.2.1.2.0 - x.7.2.2.1.2.7	Analog Input Description (maxlen=7)	
enterpriseSpecific	3	1	x.7.2.3.1.7.0 - x.7.2.3.1.7.7	Temperature Input Value	Temperature Input trap
		2	x.7.2.3.1.2.0 - x.7.2.3.1.2.7	Temperature Input Description (maxlen=7)	

-  With **Level Triggered** option selected the trap message will be sent every 5 seconds when the trap condition is met.
-  With **Edge Triggered** option selected the trap message will be sent upon input event only once.
-  If the traps are enabled, so called "cold trap" (coldStart) message indicating **smartDEN IP-32IN** is started will be send on power-on or reboot.

10.2. Modbus TCP (for smartDEN IP-32IN-MT only)

Modbus-TCP is an application layer messaging protocol, which provides master/slave (client/server) communication between devices connected on Ethernet networks. A Modbus-TCP message consists of a header (7 bytes) and the protocol data unit, which is encapsulated by the transmitting device into a standard TCP frame:

Modbus Application Protocol (MBAP) Header (7 Bytes)				Protocol Data Unit (PDU)	
Transaction Identifier	Protocol Identifier	Length Field	Unit ID	Function Code	Data
(2 Bytes)	(2 Bytes)	(2 Bytes)	(1 Byte)	(1 Byte)	Varies

The MBAP header includes the following fields:

- **Transaction Identifier** - used for transaction pairing when multiple messages are sent along the same TCP connection by a client without waiting for a prior response;
- **Protocol Identifier** - this field is always set to 0 for Modbus-TCP services;
- **Length** – number of bytes in the remaining fields (unit identifier byte, function code byte, and data fields);
- **Unit Identifier** - used to identify a remote server located on a non TCP/IP network (for serial bridging). In a typical Modbus-TCP server application, the unit ID is set to 0;

The function code field of the message contains one byte that specifies what kind of action the slave needs to take. When the server responds to the client, it echoes the same function code to indicate a normal (error-free) response. If the server cannot process a request, it will instead return an error function code (exception response) that is the original function code plus 80h (i.e. with its most significant bit set to 1).

Modbus-TCP uses a 'big-Endian' representation for addresses and data fields (when a numerical quantity larger than a single byte is transmitted, the most significant byte is sent first).

smartDEN IP-32IN-MT acts as a Modbus-TCP slave/server device, while a typical master device is a host computer running appropriate application software (for example a Raspberry Pi board running Home Assistant automation platform).

10.2.1. MODBUS Commands

This following table shows the standard Modbus-TCP functions supported by the **smartDEN IP-32IN-MT** module:

Table 10.8. Modbus commands

Function	Code	Resources	Access
Read Holding Registers	03 (0x03)	Configuration parameters, Scaled Analog/Temperature values	16-bit
Write Single Register	06 (0x06)	Counters, Configuration parameters	16-bit

Write Multiple Registers	16 (0x10)	Counters, Configuration parameters	16-bit
Read Input Status	02 (0x02)	Digital Inputs 1..16	bit
Read Input Registers	04 (0x04)	Counters, Analog Inputs 1..8, Temperature Inputs 1..8	16-bit

smartDEN IP-32IN-MT uses the following holding registers to represent the resources accessed by a Modbus command:

Table 10.9. Modbus registers

Resources	Start Address	End Address	Value Range	Cmd
Digital Inputs 1..16				
Description ⁽²⁾⁽³⁾⁽⁴⁾				3, 16
	DIN 1	0x1000	0x1003	7 ASCII chars max
	DIN 2	0x1010	0x1013	
	DIN 3	0x1020	0x1023	
	DIN 4	0x1030	0x1033	
	DIN 5	0x1040	0x1043	
	DIN 6	0x1050	0x1053	
	DIN 7	0x1060	0x1063	
	DIN 8	0x1070	0x1073	
	DIN 9	0x1080	0x1083	
	DIN 10	0x1090	0x1093	
	DIN 11	0x10A0	0x10A3	
	DIN 12	0x10B0	0x10B3	
	DIN 13	0x10C0	0x10C3	
	DIN 14	0x10D0	0x10D3	
	DIN 15	0x10E0	0x10E3	
	DIN 16	0x10F0	0x10F3	
Counter ⁽¹⁾	0x1100	0x110F	0..65535	3, 6, 16
Filter (ms)	0x1200	0x120F	0..200	3, 6, 16
Analog Inputs 1..8				
Description ⁽²⁾⁽³⁾⁽⁴⁾				3, 16
	AIN 1	0x2000	0x2003	7 ASCII chars max
	AIN 2	0x2010	0x2013	
	AIN 3	0x2020	0x2023	
	AIN 4	0x2030	0x2033	
	AIN 5	0x2040	0x2043	
	AIN 6	0x2050	0x2053	
	AIN 7	0x2060	0x2063	
	AIN 8	0x2070	0x2073	
Min (Ain1...Ain8) ⁽²⁾⁽³⁾⁽⁴⁾				3, 16
Value range: -9999.9...+9999.9	Min (AIN 1)	0x2100	0x2103	7 ASCII chars max
	Min (AIN 2)	0x2110	0x2113	
	Min (AIN 3)	0x2120	0x2123	
	Min (AIN 4)	0x2130	0x2133	

	Min (AIN 5)	0x2140	0x2143		
	Min (AIN 6)	0x2150	0x2153		
	Min (AIN 7)	0x2160	0x2163		
	Min (AIN 8)	0x2170	0x2173		
Max (Ain1...Ain8) ^{(2) (3) (4)}					3, 16
Value range: -9999.9..+9999.9	Max (AIN 1)	0x2200	0x2203	7 ASCII chars max	
	Max (AIN 2)	0x2210	0x2213		
	Max (AIN 3)	0x2220	0x2223		
	Max (AIN 4)	0x2230	0x2233		
	Max (AIN 5)	0x2240	0x2243		
	Max (AIN 6)	0x2250	0x2253		
	Max (AIN 7)	0x2260	0x2263		
	Max (AIN 8)	0x2270	0x2273		
Label (Ain1...Ain8) ^{(2) (3) (4)}					3, 16
	Label (AIN 1)	0x2300	0x2301	4 ASCII chars max (add a zero byte if shorter than 4)	
	Label (AIN 2)	0x2310	0x2311		
	Label (AIN 3)	0x2320	0x2321		
	Label (AIN 4)	0x2330	0x2331		
	Label (AIN 5)	0x2340	0x2341		
	Label (AIN 6)	0x2350	0x2351		
	Label (AIN 7)	0x2360	0x2361		
	Label (AIN 8)	0x2370	0x2371		
Ain1...Ain8 scaled value, read only ⁽²⁾					3
	AIN 1	0x2400	0x2406	14 ASCII chars max	
	AIN 2	0x2410	0x2416		
	AIN 3	0x2420	0x2426		
	AIN 4	0x2430	0x2436		
	AIN 5	0x2440	0x2446		
	AIN 6	0x2450	0x2456		
	AIN 7	0x2460	0x2466		
	AIN 8	0x2470	0x2476		
Temperature Inputs 1..8					
Description ^{(2) (3) (4)}					3, 16
	TIN 1	0x4000	0x4003	7 ASCII chars max	
	TIN 2	0x4010	0x4013		
	TIN 3	0x4020	0x4023		
	TIN 4	0x4030	0x4033		
	TIN 5	0x4040	0x4043		
	TIN 6	0x4050	0x4053		
	TIN 7	0x4060	0x4063		
	TIN 8	0x4070	0x4073		
Tin1...Tin8 value, read only ⁽²⁾					3
	TIN 1	0x4100	0x4106	14 ASCII chars max	
	TIN 2	0x4110	0x4116		
	TIN 3	0x4120	0x4126		
	TIN 4	0x4130	0x4136		
	TIN 5	0x4140	0x4146		

	TIN 6	0x4150	0x4156		
	TIN 7	0x4160	0x4166		
	TIN 8	0x4170	0x4176		
General Settings					
Firmware Version (read only)		0x6A00	0x6A00		3
Device Name ⁽²⁾⁽³⁾⁽⁴⁾		0x6B00	0x6B07	15 ASCII chars max	3, 16
Temperature Scale		0x6C00	0x6C00	0 - Celsius 1 - Fahrenheit	3, 6, 16
Analog Inputs filter, sec		0x6D00	0x6D00	0..30	3, 6, 16
Temperature Inputs filter, sec		0x6E00	0x6E00	0..30	3, 6, 16

- (1) Counters are 16-bit wide
- (2) Read operation should start from the first address
- (3) Write operation should start from the first address
- (4) Add a zero byte to terminate the string

10.4. MQTT (for smartDEN Notifier only)

The **smartDEN Notifier** supports MQTT protocol V3.1.1. The module runs a MQTT client that publishes its inputs states.

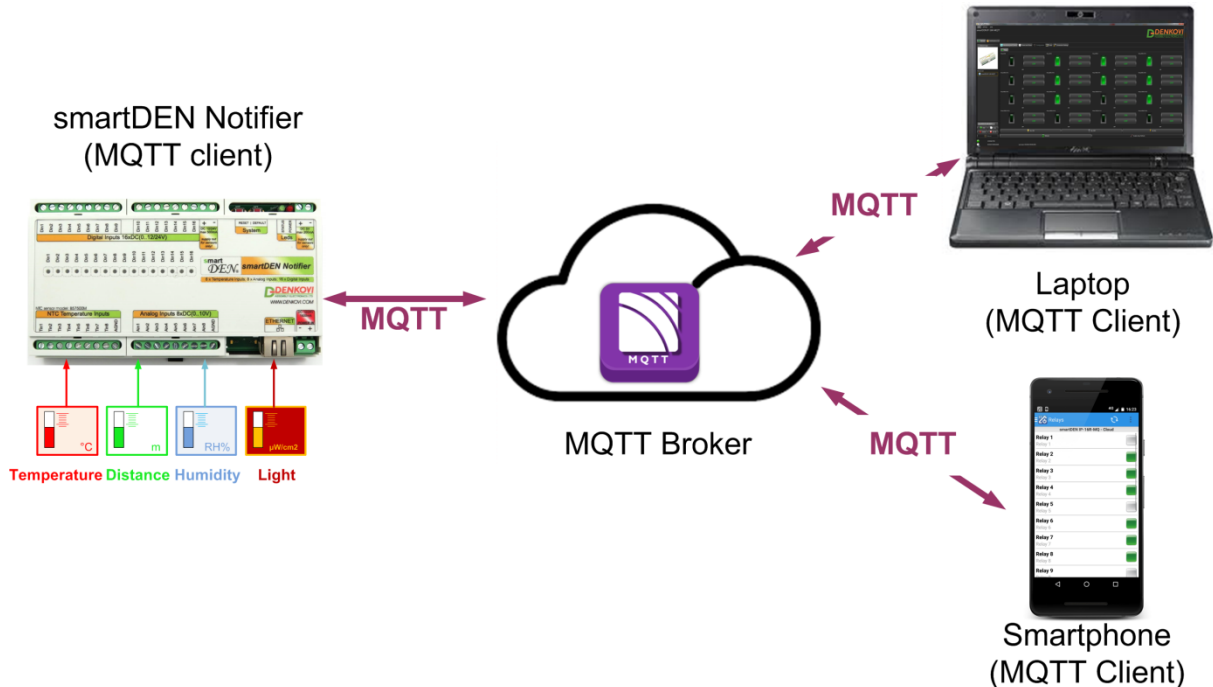


Figure 10.1. smartDEN Notifier working as MQTT client

Two types of publish/subscribe topics modes are supported: **plain (non-encrypted)** and **encrypted**.

10.4.1. Plain (non-encrypted) mode

In this mode, **smartDEN Notifier** uses non-encrypted topics to provide I/O monitoring/control and basic parameters configuration.



Encrypt option in *MQTT Settings* page must be turned off in order to work in this mode.

Below are described all the available topics in order to communicate with **smartDEN Notifier** via MQTT protocol. All topics begin with the following prefix:

SmartDEN_Notifier/<**MAC identifier**>

Where, <**MAC identifier**> is the MAC address of the board written without the colons. For example:

SmartDEN_Notifier/E8EADA123456/#
SmartDEN_Notifier/E8EADA123456/DI1

The **smartDEN Notifier** publishes data up-on certain conditions to these topics. Another MQTT client (Laptop, Smartphone) is subscribed to these topics and receives the data.

Table 10.10. MQTT plain (non-encrypted) topics

Topic	Application Message	Description
/#		All messages published by the mqtt clients
/Status	Rebooted, Connected, Disconnected	The module status related to the MQTT broker connection
/Di <i>i</i>	On, Off	Notification DI topic, containing the digital input (<i>i</i> =1...16) state*
/Ai <i>i</i>	0...1023	Notification AI raw topic, containing the analog input (<i>i</i> =1...8 - analog) raw value*
/Ti <i>i</i>	String	Notification TI topic, containing the temperature input (<i>i</i> =1...8 - temperature) value*

*Please note these messages (notifications) are published by the **smartDEN Notifier** module only if the "MQTT" option is checked (enabled) in the respective settings page for the Digital Inputs, Analog Inputs and Temperature Inputs. Also they are published:

- periodically (see the Publish Mode option from MQTT Settings page);
- in case of i/o state change (see the Publish Mode option from MQTT Settings page).

10.4.2. Encrypted topics mode

The encrypted topics mode is designed mainly for communication with Denkovi software applications (for example [DAE-aModules](#), [DRMv3 Software...](#)) or other customized MQTT libraries.



Encrypt option in *MQTT Settings* page must be turned on in order to work in this mode.

10.4.2.1. Topics



The encrypted topics generating process is available upon request.

- **Admin Read Topic** - MQTT client (Laptop, smartphone, DAE-aModules, DRMv3) publishes requests to this topic. The **smartDEN Notifier** is subscribed to this topic and replies back to Admin Write Topic;
- **Admin Write Topic** - the **smartDEN Notifier** publishes XML or JSON replies to this topic. Another MQTT client (Laptop, Smartphone) is subscribed to this topic and receives the data.
- **Notification Topic** - for notifications sent by the **smartDEN Notifier** module upon event - I/O event, module reboot etc.



Notification MQTT messages are published by the **smartDEN Notifier** module only if the **MQTT** option is checked (enabled) in the respective settings page for the Digital Inputs, Analog Inputs and Temperature Inputs.

10.4.2.2. Application messages (commands)

The below commands in Table 10.11 are published by the MQTT client (Laptop, smartphone, DAE-aModules) under the **Admin Read Topic** and the **smartDEN Notifier** publishes a reply under the **Admin Write Topic** in XML or JSON format (see [Appendix 1. Application reply formats](#))

All the below commands in table are with prefix **MQTT_COMMAND?**

Table 10.11. Application messages (commands)

XML Application Message (Command)	JSON Application Message (Command)	Description
GETSTATUS;	GETSTATUS2;	Get all the I/O states

11. Software

11.1. DRMv3 Software

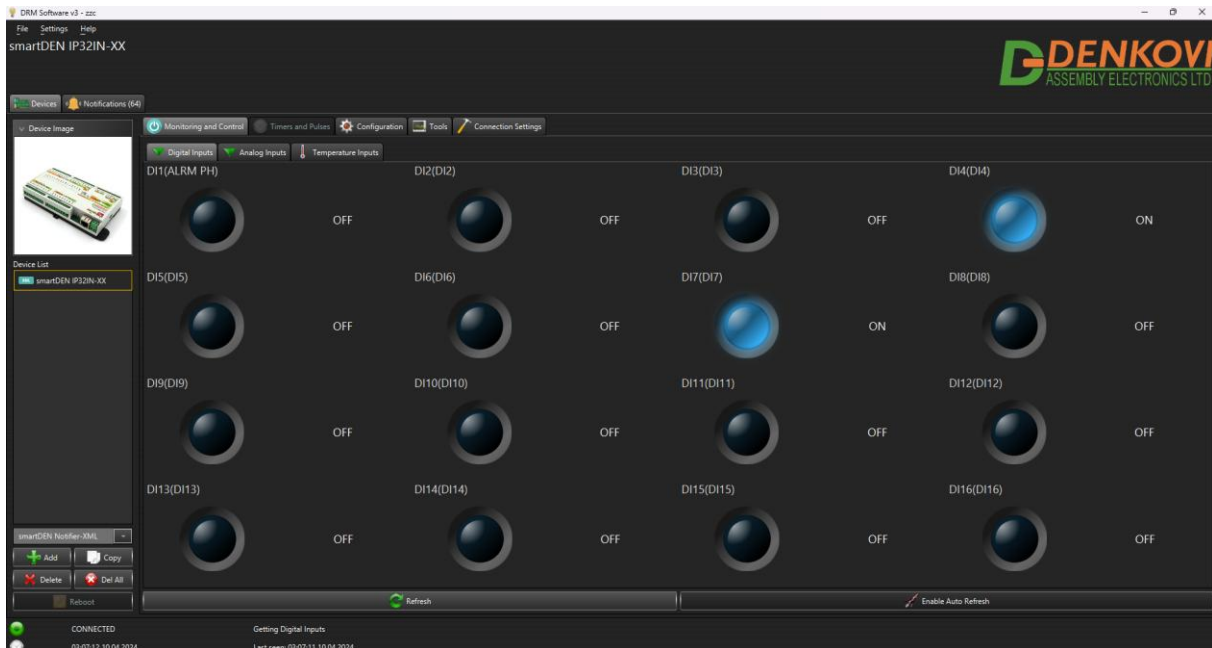


Figure 11.1. smartDEN IP-32IN-XX and DRMv3

Depending on the **smartDEN IP-32IN-XX** model, below is shown which device model to select from the [DRMv3 Software](#) device list:

11.1.1. smartDEN IP-32IN

Device from DRMv3 list: **smartDEN IP-32IN (device_snmp)**

Integration (communication) protocol: SNMP


SNMP must be enabled and settings from the *SNMP Agent Configuration* web server page must match.

11.1.2. smartDEN Notifier

Device from DRMv3 list: **smartDEN Notifier-MQTT (device_mqtt)**

Integration (communication) protocol: MQTT

MQTT must be enabled and settings from the *MQTT Settings* web server page must match.

 **Encrypt Topic** parameter the *MQTT Settings* web server page must be enabled in order to work with DRMv3.

11.1.3. smartDEN IP-32IN-MT

Device from DRMv3 list: **smartDEN IP-32IN-MT (device_snmp)**

Integration (communication) protocol: Modbus TCP

Modbus TCP must be enabled and settings from the *Modbus TCP Settings* web server page must match.

11.1.4. smartDEN IP-32IN-XX

Device from DRMv3 list: **smartDEN IP-32IN-XX (device_xml)**

Integration (communication) protocol: HTTP/XML

XML/JSON Access parameter must be enabled and settings from the *HTTP/XML/JSON Settings* web server page must mach.

The full documentation for the DRMv3 Software can be found on this link:
<http://denkovi.com/drm-software-v3>

11.2. DAE-aModules Android app

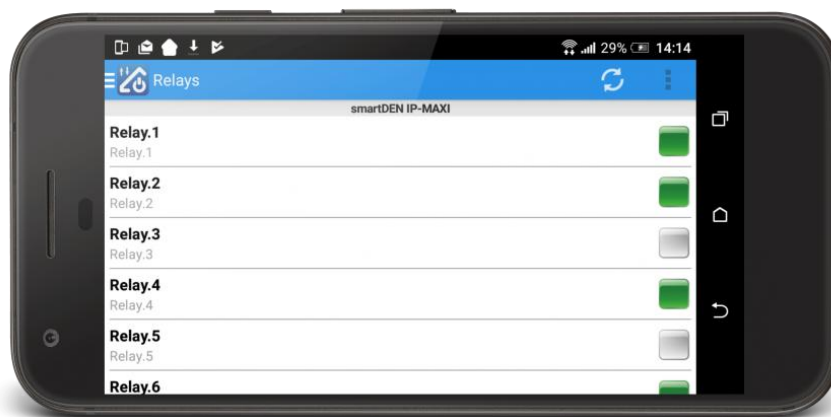


Figure 11.2. smartDEN IP-32IN-XX and DAE-aModules android app

Depending on the **smartDEN IP-32IN-XX** model, below is shown which device model to select from the [DAE-aModules](#) app device list:

11.2.1. smartDEN IP-32IN

Device from DAE-aModules Device Model list: **smartDEN IP-32IN**

Integration (communication) protocol: SNMP

SNMP must be enabled and settings from the *SNMP Agent Configuration* web server page must mach.

11.2.2. smartDEN Notifier

Device from DAE-aModules Device Model list: **smartDEN Notifier - Cloud**

Integration (communication) protocol: MQTT

MQTT must be enabled and settings from the *MQTT Settings* web server page must mach.

Encrypt Topic parameter the *MQTT Settings* web server page must be enabled in order to work with DAE-aModules.

11.2.1. smartDEN IP-32IN-XX

Device from DAE-aModules Device Model list: **smartDEN IP-32IN-XX - XML**

Integration (communication) protocol: HTTP/XML

XML/JSON Access parameter must be enabled and settings from the *HTTP/XML/JSON Settings* web server page must match.

The full documentation for the [DAE-aModules](http://denkovi.com/DAE-aModules) android app can be found on this link: <http://denkovi.com/DAE-aModules>

11.3. DAE-iModules iOS app

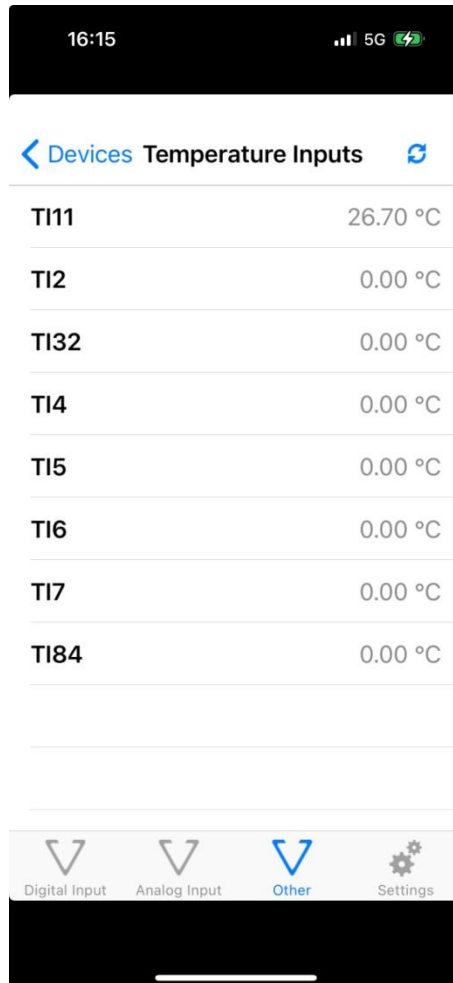


Figure 11.3. smartDEN IP-32IN and DAE-iModules iOS app

11.3.1. smartDEN IP-32IN

Device from DAE-iModules Device Model list: **smartDEN IP-32IN**

Integration (communication) protocol: SNMP

SNMP must be enabled and settings from the *SNMP Agent Configuration* web server page must match.

The full documentation for the [DAE-iModules](http://denkovi.com/DAE-aModules) iOS app can be found on this link:
<http://denkovi.com/DAE-aModules>

12. Security considerations

The **smartDEN IP-32IN-XX** runs a special firmware and do not have a general-purpose operating system. There are no extraneous IP services found on general-purpose operating systems (e.g. fingerd, tcp_wrapper, etc.) that can possibly be exploited by an unauthorized agent. In particular, the **smartDEN IP-32IN-XX** does not run protocols such as Telnet and FTP which may have the potential for security breach. The only exception from this is the integration protocol, that can be disabled.

Web-browser access

A challenge-response authentication is used in login process. When the password is entered, it is transmitted across the network in encrypted form, so eavesdropping on the data transmission will not reveal the password. Subsequent transmissions of the password to "login" onto the device are encrypted and "safe". The only case when the password is transmitted across the network "in the open", is when it is being changed and submitted in **General Settings** form. Therefore, you must set passwords in the secure environment where you can make sure that no one is "eavesdropping".

SNMP communication (for smartDEN IP-32IN only)

SNMPv1 does not implement encryption. Authentication of clients is performed only by a "community string", which is transmitted in clear text. SNMP communication should be used in trusted networks and disabled if not used.

Modbus-TCP communication (for smartDEN IP-32IN-MT only)

Modbus-TCP does not implement encryption. Modbus-TCP communication should be used in trusted networks and disabled if not used.

MQTT communication (for smartDEN Notifier only)

Within the current module implementation the MQTT does not implement any encryption. This communication should be used in trusted networks and disabled if not used.

XML/JSON operation

A challenge-response authentication can be used in login process. The password can be transmitted by custom application across the network in encrypted form.



Web and XML/JSON access can be restricted by IP Address (range of IP Addresses) or by MAC Address.

13. Appendix 1. Application reply formats

13.1. XML reply

```

-<CurrentState>
  -<DigitalInput1>
    <Name>13</Name>
    <Value>0</Value>
    <Count>0</Count>
  </DigitalInput1>
  +<DigitalInput2></DigitalInput2>
  +<DigitalInput3></DigitalInput3>
  +<DigitalInput4></DigitalInput4>
  +<DigitalInput5></DigitalInput5>
  +<DigitalInput6></DigitalInput6>
  +<DigitalInput7></DigitalInput7>
  +<DigitalInput8></DigitalInput8>
  +<DigitalInput9></DigitalInput9>
  +<DigitalInput10></DigitalInput10>
  +<DigitalInput11></DigitalInput11>
  +<DigitalInput12></DigitalInput12>
  +<DigitalInput13></DigitalInput13>
  +<DigitalInput14></DigitalInput14>
  +<DigitalInput15></DigitalInput15>
  +<DigitalInput16></DigitalInput16>
  -<AnalogInput1>
    <Name>AI1</Name>
    <Value>0</Value>
    <Measure>-10.0 V</Measure>
  </AnalogInput1>
  +<AnalogInput2></AnalogInput2>
  +<AnalogInput3></AnalogInput3>
  +<AnalogInput4></AnalogInput4>
  +<AnalogInput5></AnalogInput5>
  +<AnalogInput6></AnalogInput6>
  +<AnalogInput7></AnalogInput7>
  +<AnalogInput8></AnalogInput8>
  -<TemperatureInput1>
    <Name>TI11</Name>
    <Value>23.5 °C</Value>
  </TemperatureInput1>
  +<TemperatureInput2></TemperatureInput2>
  +<TemperatureInput3></TemperatureInput3>
  +<TemperatureInput4></TemperatureInput4>
  +<TemperatureInput5></TemperatureInput5>
  +<TemperatureInput6></TemperatureInput6>
  +<TemperatureInput7></TemperatureInput7>
  +<TemperatureInput8></TemperatureInput8>
  -<Device>
    <Name>SMARTDEN_IP32IN</Name>
    <MAC>E8:EA:DA:00:54:75</MAC>
  </Device>
</CurrentState>

```

13.2. JSON reply

```
{
  "CurrentState": {
    "DigitalInput": [
      {"Name": "I1", "Value": "0", "Count": "0"},
      {"Name": "DI2", "Value": "0", "Count": "0"},
      {"Name": "DI3", "Value": "0", "Count": "0"},
      {"Name": "DI4", "Value": "0", "Count": "0"},
      {"Name": "DI5", "Value": "0", "Count": "0"},
      {"Name": "DI6", "Value": "0", "Count": "0"},
      {"Name": "DI7", "Value": "0", "Count": "0"},
      {"Name": "DI8", "Value": "0", "Count": "0"},
      {"Name": "DI9", "Value": "0", "Count": "0"},
      {"Name": "DI10", "Value": "0", "Count": "0"},
      {"Name": "DI11", "Value": "0", "Count": "0"},
      {"Name": "DI12", "Value": "0", "Count": "0"},
      {"Name": "DI13", "Value": "0", "Count": "0"},
      {"Name": "DI14", "Value": "0", "Count": "0"},
      {"Name": "DI15", "Value": "0", "Count": "0"},
      {"Name": "test", "Value": "0", "Count": "0"}
    ],
    "AnalogInput": [
      {"Name": "AI1", "Value": "0", "Measure": "-10.0 V"},
      {"Name": "AI2", "Value": "0", "Measure": "0.0 V"},
      {"Name": "AI3", "Value": "0", "Measure": "0.0 V"},
      {"Name": "AI4", "Value": "0", "Measure": "0.0 V"},
      {"Name": "AI5", "Value": "0", "Measure": "0.0 V"},
      {"Name": "AI6", "Value": "0", "Measure": "0.0 V"},
      {"Name": "AI7", "Value": "0", "Measure": "0.0 V"},
      {"Name": "AI8", "Value": "0", "Measure": "0.0 V"}
    ],
    "TemperatureInput": [
      {"Name": "TI1", "Value": "23.6 C"},
      {"Name": "TI2", "Value": "--- C"},
      {"Name": "TI3", "Value": "--- C"},
      {"Name": "TI4", "Value": "--- C"},
      {"Name": "TI5", "Value": "--- C"},
      {"Name": "TI6", "Value": "--- C"},
      {"Name": "TI7", "Value": "--- C"},
      {"Name": "TI8", "Value": "--- C"}
    ],
    "Device": {
      "Name": "SMARTDEN_IP32IN",
      "MAC": "E8:EA:DA:00:54:75"
    }
  }
}
```

14. Appendix 2. Mechanical drawing



Figure 14.1. Device dimensions

15. Appendix 3. Disclaimer

Denkovi Assembly Electronics LTD products are not designed, authorized or warranted to be suitable for use in space, nautical, military, medical, life-critical or safety-critical devices or equipment.

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