




# smartDEN IP-Maxi-XX

## *Web-enabled Ethernet-based I/O Relay Modules*

### *User Manual*

*Date: 30 Oct 2023*

Device	Short Name	Integration Protocol	Firmware version
	smartDEN IP-Maxi	SNMPv2	v1.27 / Jan 2022
	smartDEN IP-Maxi-MT	Modbus TCP	v1.27 / Feb 2023
	smartDEN IP-Maxi-MQ	MQTT V3.1.1	v1.26 / Jul 2021

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## Content

1. Features.....	4
2. Ordering codes.....	6
3. Application examples .....	7
4. Technical parameters.....	15
5. Connectors, ports and led indicators .....	18
6. Installation.....	19
7. Default settings .....	31
8. Web access .....	35
9. HTTP XML/JSON operation .....	67
10. Integration Protocols .....	73
11. Software.....	88
12. Security considerations .....	91
13. Appendix 1. Application reply formats .....	92
14. Appendix 2. Mechanical drawing.....	94
15. Appendix 3. Disclaimer.....	95

## 1. Features

**smartDEN IP-Maxi-XX** is an Ethernet module (IP controller) that can be used in a wide range of remote monitoring, control, measurement and data-acquisition applications. Thank to its multi-channel design (8 digital inputs, 4 analog inputs, 4 temperature inputs, 8 SPDT relays and 2 analog outputs) this device can perform simultaneously a variety of measurement and control functions. The Web interface allows users to configure the **smartDEN IP-Maxi-XX**, as well as to monitor/control input/output channels. **smartDEN IP-Maxi-XX** provides various integration (communication) protocol interface with third-party developed applications.

A list of **smartDEN IP-Maxi-XX** features includes:

### Communication:

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

### Inputs:

- 8 digital inputs with On/Off LED (input voltage range: 0-12V DC / 0-24V DC);
- 8 counters (32 bit) attached to digital inputs;
- 4 analog inputs (input voltage range: 0-10V DC);
- 4 temperature inputs for sensors NTC thermistors type B57500M;
- Linearization (scaling) for the analog inputs;
- Programmable temperature units: Celsius/Fahrenheit;
- Configurable filters for the digital/analog inputs;

### Outputs:

- 8 SPDT relays (with NO and NC contacts);
- 2 analog outputs: 0-10V DC (10 bit resolution);
- Single pulse feature for the relay outputs;

### Web Interface:

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

### TCP/IP Services:

- HTTP server:
  - Read (GET) current input/output values in XML/JSON format;
  - Set outputs along with GET request parameters;
- Encrypted login can be used to access XML/JSON values;

### Integration Protocol:

- SNMPv2 - for smartDEN IP-Maxi;
- Modbus TCP – for smartDEN IP-Maxi-MT;
- MQTT V3.1.1 - for smartDEN IP-Maxi-MQ;

### Standalone Mode:

- Single digital input can be configured to control several relays;
- Single or differential analog input can be configured to control several relays;
- Week schedule table for switching relays ON/OFF at specific time without computer (up to 30 events);

- Real time clock (can sync up with network time servers);

**Power Supply:**

- Supply voltage: 12V DC or 24V DC (selectable during purchase);
- Additional source voltage 12V DC or 24V DC provided to power input sensors;
- Power supply protection against reverse polarity;

**Physical and Environment:**

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

## 2. Ordering codes

**Table 2.1.** Ordering codes

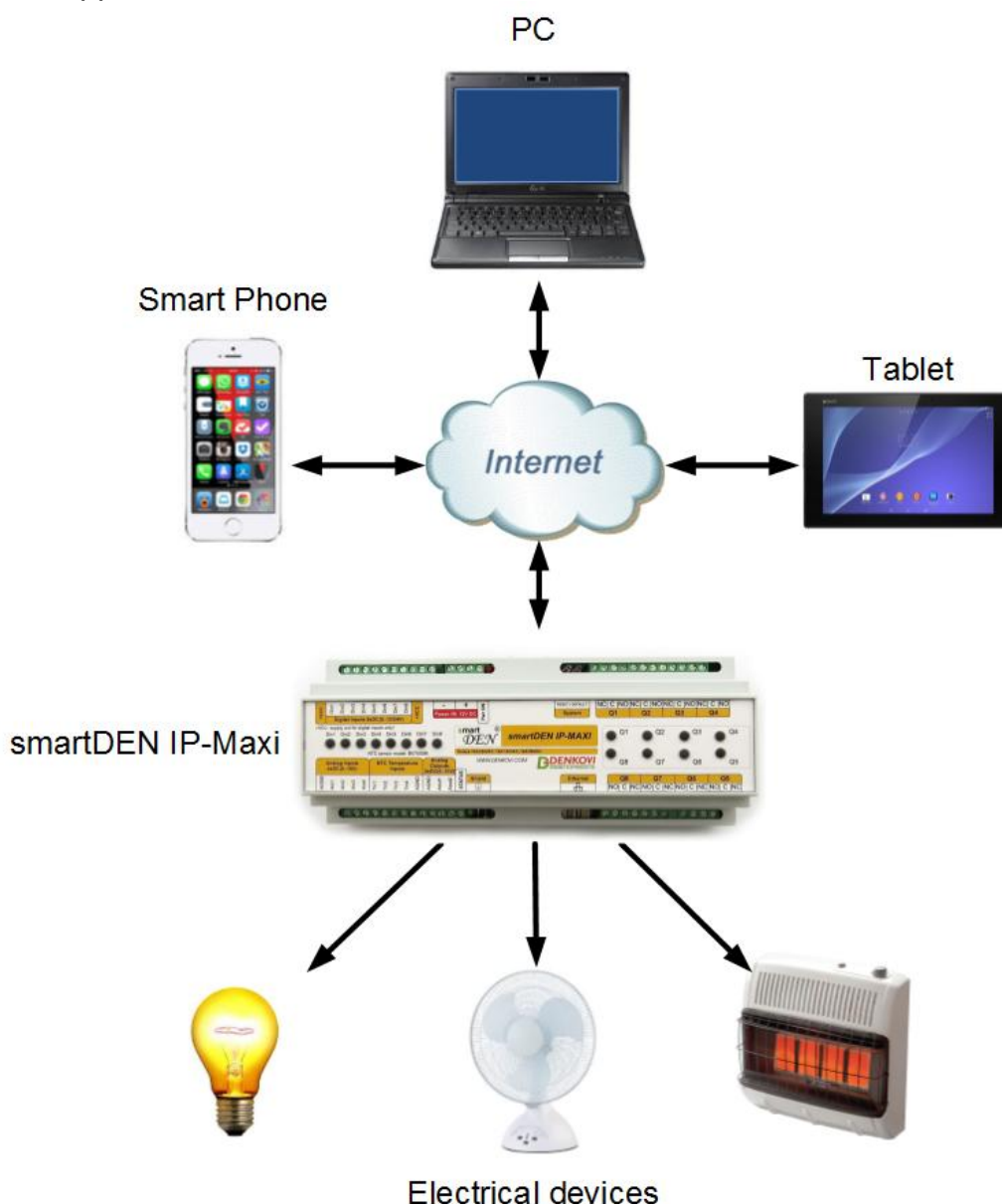
Short Name	Ordering Codes	Description
smartDEN IP-Maxi	smartDEN IP-Maxi-12V	SNMP model, 12VDC supply voltage
	smartDEN IP-Maxi-24V	SNMP model, 24VDC supply voltage
smartDEN IP-Maxi-MT	smartDEN IP-Maxi-MT-12V	Modbus TCP model, 12VDC supply voltage
	smartDEN IP-Maxi-MT-24V	Modbus TCP model, 24VDC supply voltage
smartDEN IP-Maxi-MQ	smartDEN IP-Maxi-MQ-12V	MQTT model, 12VDC supply voltage
	smartDEN IP-Maxi-MQ-24V	MQTT model, 24VDC supply voltage

### 3. Application examples

The following examples show some basic applications of **smartDEN IP-Maxi-XX**. The examples are only conceptual and additional equipment/connections can be required in actual implementations.

#### 3.1. Electrical appliances remote control applications

**smartDEN IP-Maxi-XX** can be used to control remotely electrical appliances (Fig. 3.1). Up to 8 electrical devices connected to Relays can be controlled independently. Various integration protocols depending on the model (SNMP, MQTT, Modbus TCP, HTTP/XML/JSON, Web-browser access) can be used by any modern device to control the appliances from all over the world.



**Figure 3.1.** Controlling electrical appliances remotely

### 3.2. Monitoring and logging applications

smartDEN IP-Maxi-XX can be used to build monitoring and logging systems. Up to 8 various kinds of sensors for temperature, humidity, distance, light etc. can be connected to the Analog Inputs of the device (Fig. 3.2 and Fig. 3.3). Provided SNMP, MQTT or Modbus TCP (depending on the model) along with the HTTP/XML/JSON APIs allow for easy integration with third-party applications.

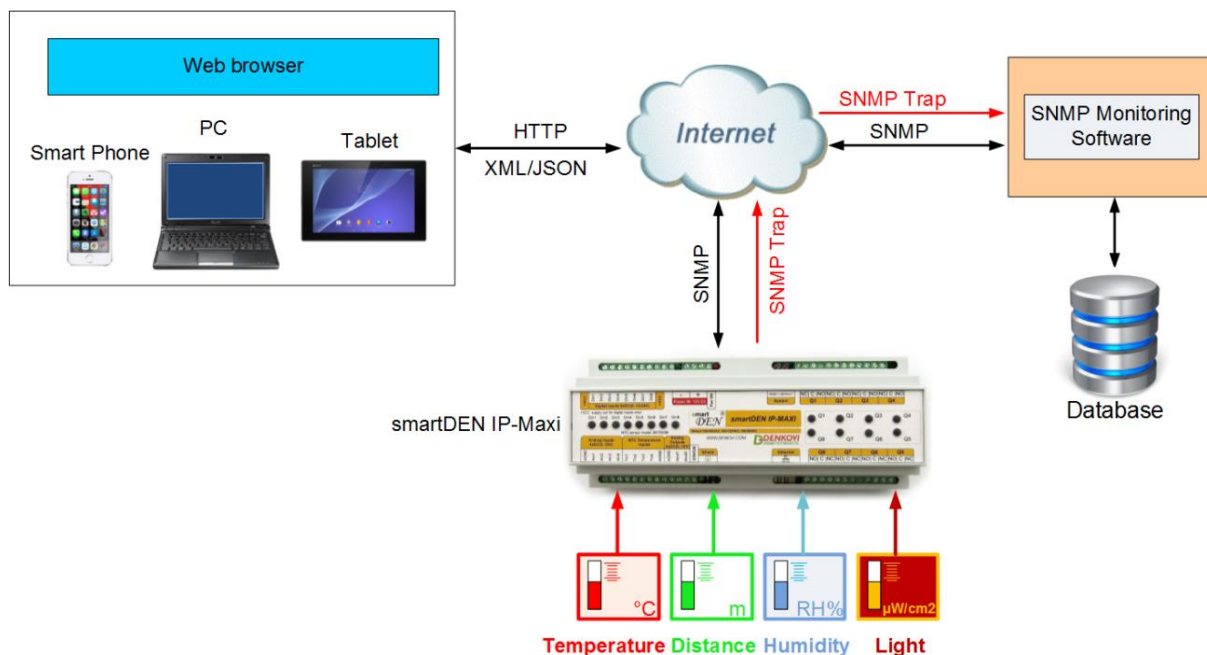


Figure 3.2. Remote sensors monitoring

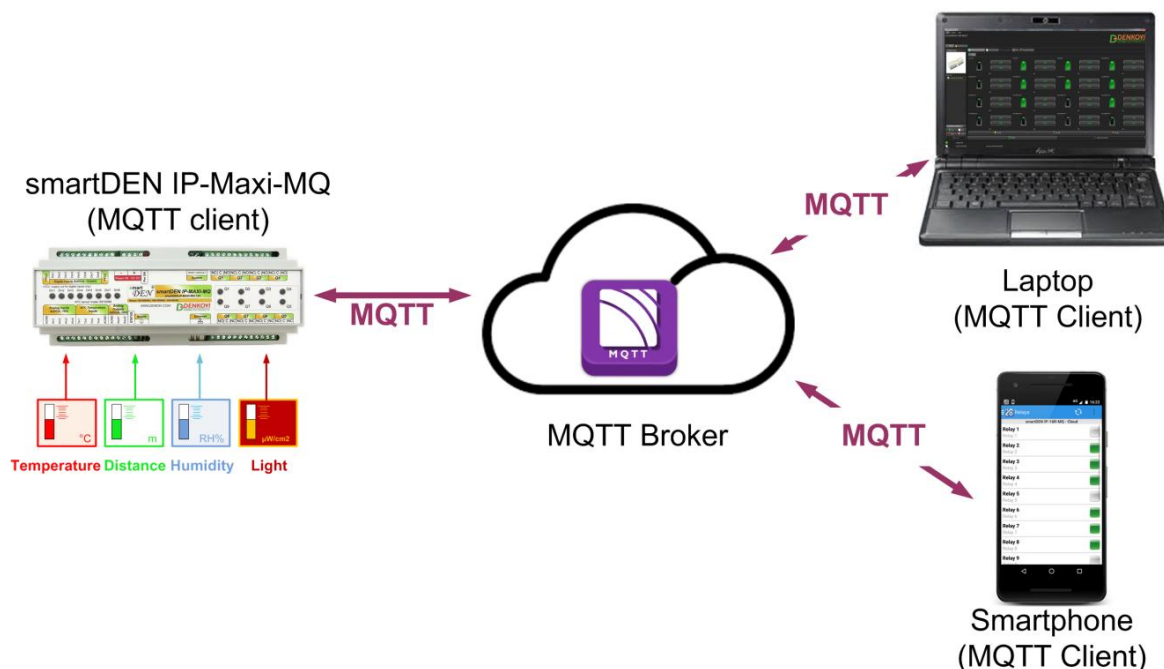
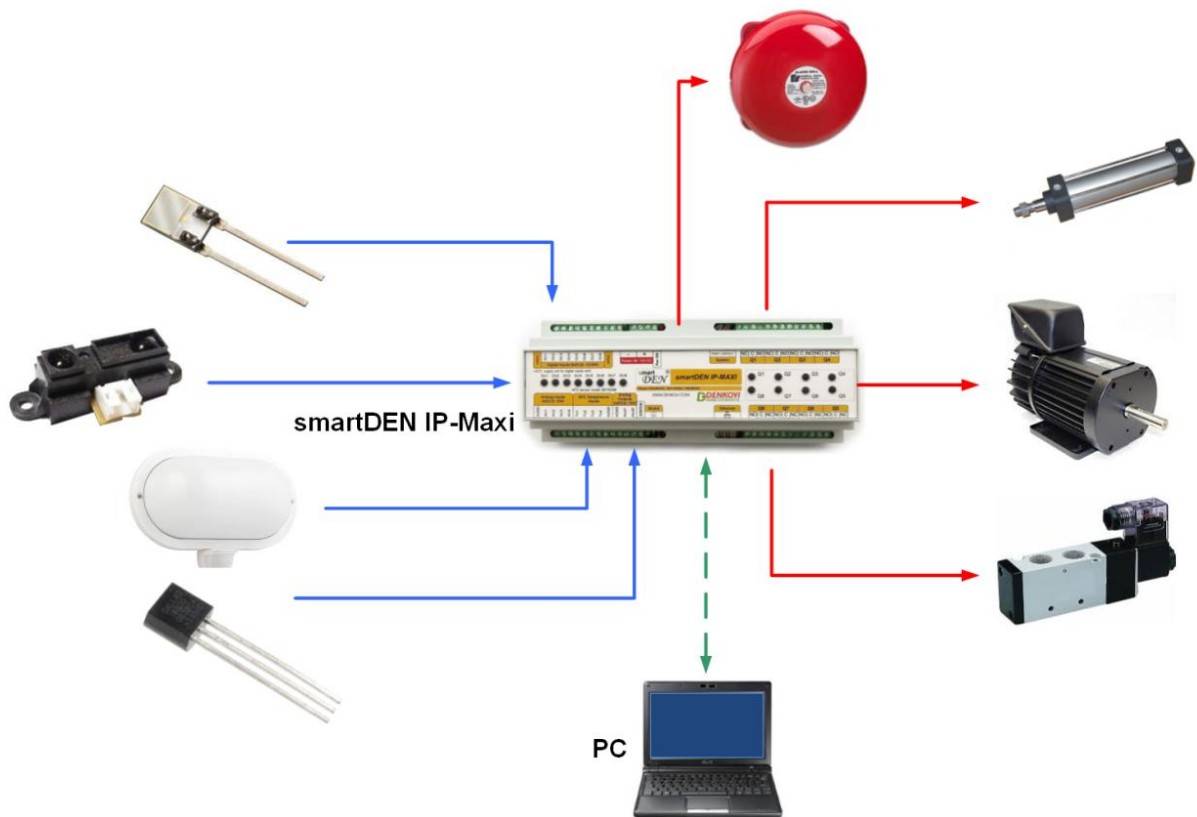


Figure 3.3. Remote sensors monitoring (MQTT)

### 3.3. Standalone applications with sensors and electrical devices

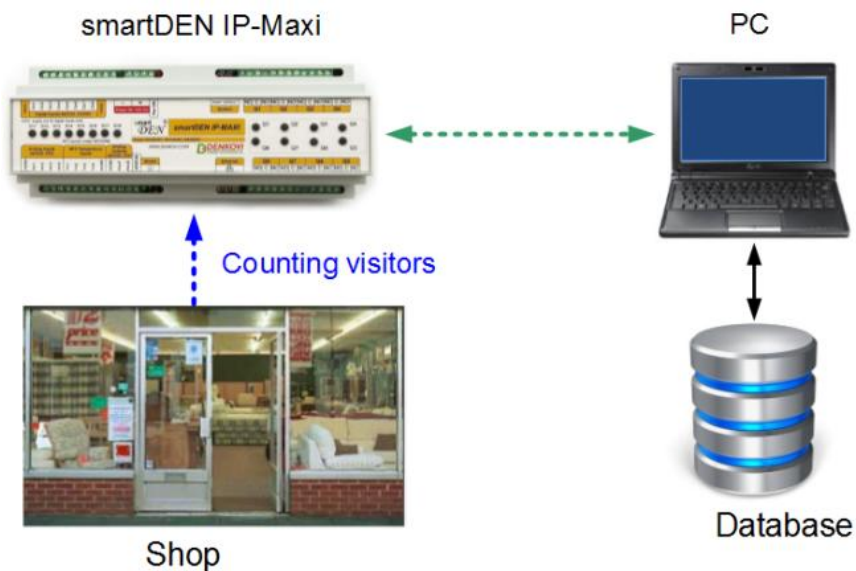
Once configured, **smartDEN IP-Maxi-XX** can be used in standalone control applications. For example, the events from Digital Inputs or threshold conditions of single/differential Analog Inputs can be configured to control various devices connected to Relay outputs (Fig. 3.4). In addition, a Week Schedule table for switching Relays On/Off at specific time can be specified.



**Figure 3.4.** Standalone control of electrical devices

### 3.4. Events counter

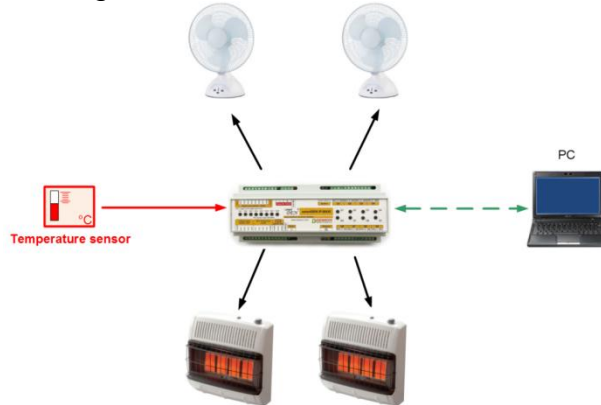
**smartDEN IP-Maxi-XX** provides 8 x 32-bit Counters (from 0 up to  $2^{32}-1$ ) attached to the Digital Inputs that can be used to count various events - for example detect when a person enters in a shop through the door (Fig. 3.5). Upon detecting the specified edge/level condition **smartDEN IP-Maxi-XX** increments the corresponding Counter. With suitable software and database one could easily organize a simple monitoring and statistic system.



**Figure 3.5.** Counting visitors in a shop

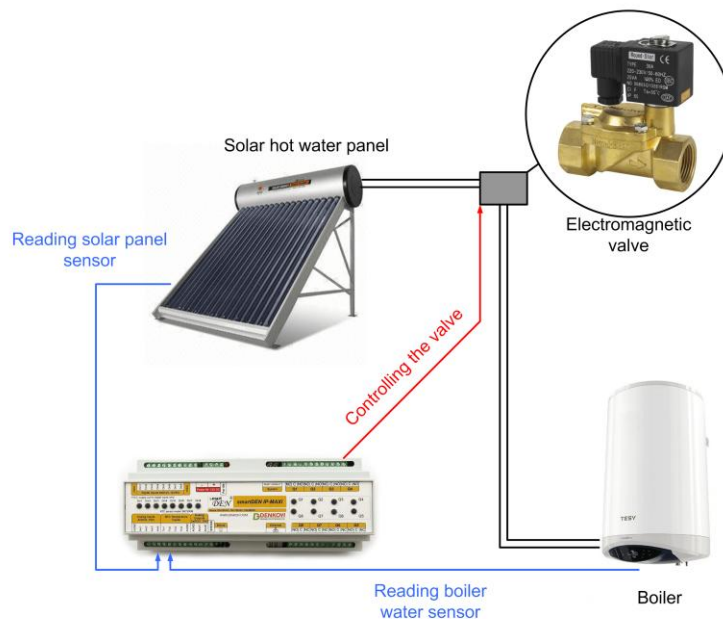
### 3.5. Web based thermo-regulator

Each Relay can be set to work in Regulator mode where it can be controlled only from an Analog Input. The controller can be configured to switch different Relays upon the value of single/differential Analog Input (one input can control many Relays). For example, one Relay can be set for heating, another for cooling and etc. (Fig. 3.6). All the process may be monitored online and this makes **smartDEN IP-Maxi-XX** suitable for building standalone Web enabled thermo-regulators.



**Figure 3.6.** Web based thermo-regulator

Another possible application for **smartDEN IP-Maxi-XX** is differential thermo-regulator very useful in cases when solar hot water panel must be monitored and controlled based on two temperature sensors values. The first sensor monitors the temperature of the panel water and the second monitors the temperature from the boiler water. If the boiler water is cooler than the panel water, the valve is opened and the hot water from the panel comes in to the boiler.



**Figure 3.7.** Differential thermo-regulator

### 3.6. Home automation

smartDEN IP-Maxi-XX can be used in a variety of home automation tasks:

- Climate: heating, ventilation and air conditioning;
- Lighting: switching On/Off the electric lights in the house;
- Shading: opening and closing the blinds and curtains;
- Security: monitoring and control of central locking, doors and windows, etc.

A number of flexible control schemes can be set up, for example:

- Use of Regulator mode of the Relays for opening and closing the blinds and curtains depending on the level of the outside sunlight;
- Use of Pulse mode of the Relays for controlling garage doors, windows, roofs and for any other application where a certain period of time should be maintained, etc.;
- Use of integrated Week Schedule features to switch On/Off appliances up to 30 times per day in a standalone mode;
- Use of “many inputs to one relay” controlling mode – each Relay can be paired simultaneously with a Digital Input (button, switch...), Analog Input (sensor for temperature, humidity, distance, light...), Week Schedule command, as well can be controlled remotely (browser, SNMP, MQTT, HTTP/XML/JSON).



**Figure 3.8.** smartDEN IP-Maxi-XX can be used in home automation systems

### 3.7. Irrigation systems

Other applications of **smartDEN IP-Maxi-XX** include irrigation systems. Two different modes can be combined:

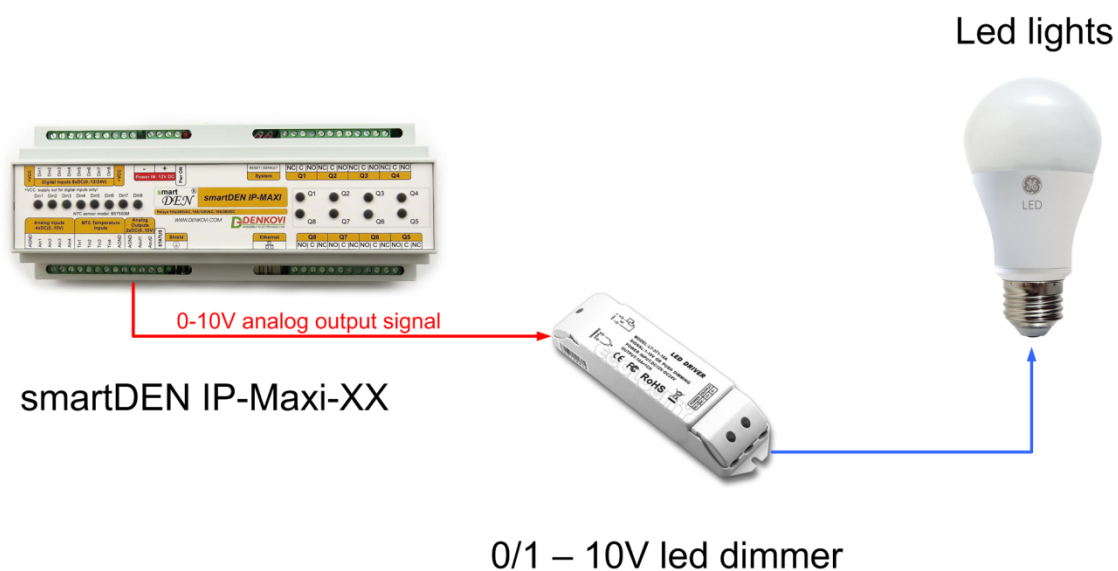
- Start and stop the irrigation at specific times using the Week Schedule features;
- Start and stop the irrigation depending on humidity level by applying a control loop including a humidity or rain sensor and solenoid valve controlled by a Relay.



**Figure 3.9.** smartDEN IP-Maxi-XX can be used in home irrigation systems

### 3.8. Dimming

The analog outputs (0-10V) can be used for dimming led lights as well. Please note that a separate dimmer could be necessary.



**Figure 3.10.** Controlling led lights with analog outputs

## 4. Technical parameters

**Table 4.1.** Physical parameters

Parameter	Value
Size (L / W / H), mm	210 x 85 x 58
Weight, g	420
Operating temperature, °C	0 to 70

**Table 4.2.** System parameters

Parameter	Value
Power supply voltage, V DC	12 or 24 (depends on the model) ±2
Maximum current consumption, mA	450 at 12V, 300 at 24V
Protection against reverse polarity	Yes
Hardware Real Time Clock (RTC)	Yes
Default settings restore button	Yes
Reset button	Yes

**Table 4.3.** Digital inputs

Parameter	Value
Digital inputs number	8
Digital inputs voltage range, V DC	0 up to 30
Input switching threshold from 0 to 1, V DC	> 7.6
Input switching threshold from 0 to 1, mA	> 3.2
Input switching threshold from 1 to 0, V DC	< 4.5
Input switching threshold from 1 to 0, mA	< 1.8
Supported sensor output type	PNP
Input type	Resistive with Schmitt trigger
Protection against reverse polarity	Yes

**Table 4.4.** Counters

Parameter		Value
Counters number		8
Max. pulses frequency	Digital Inputs 1, 2, 3	1 ..10 Hz (See point <a href="#">8.6</a> )
	Digital Inputs 4, 5, 6, 7	9 kHz
	Digital Input 8	40 kHz

**Table 4.5. Analog inputs**

Parameter	Value
Analog inputs number	4
Analog inputs full scale voltage range, V DC	0 up to 10
Analog inputs absolute maximum non-destructive voltage, V DC	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 4.6. Temperature inputs**

Parameter	Value
NTC inputs number	4
Sensor type	B57500M
Units	Celsius/Fahrenheit
Sensor working temperature range	-55°C/-67°F to +155°C/311°F
Accuracy	±0.5°C / 0.9°F
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 4.7. Relays**

Parameter		Value
Relays number		8
Max. Voltage		250V AC
Max. switchable current	Voltage=250V AC	10A
	Voltage=125V AC	15A
	Voltage=28V DC	10A

**Table 4.8. Analog outputs**

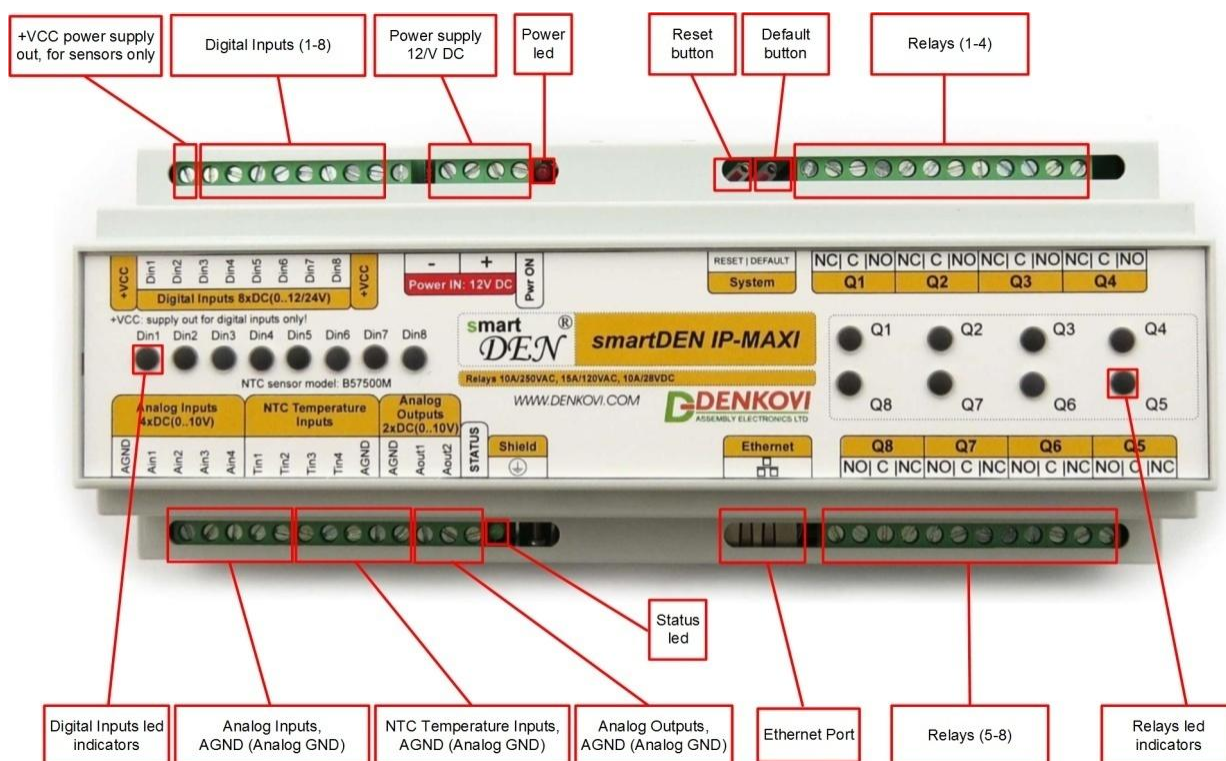
Parameter	Value
Analog outputs number	2
Output voltage	0 to 10V DC

**Table 4.9.** 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-Maxi SNMPv2 - smartDEN IP-Maxi MQTT V3.1.1 - smartDEN IP-Maxi-MQ
Web server for configuration/access	Yes
Secure HTTP/XML/JSON access	Yes

## 5. Connectors, ports and led indicators

A picture with the **smartDEN IP-Maxi-XX** connectors, ports and led indicators is shown in Fig. 5.1.



**Figure 5.1.** Device overview

## 6. 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.

### 6.1. Box mounting

smartDEN IP-Maxi-XX can be mounted to a standard (35 mm by 7.55 mm) DIN rail (Fig. 6.1). 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.



**Figure 6.1.** Mounting the device to a DIN rail

## 6.2. Power supply

**smartDEN IP-Maxi-XX** must be powered with 12V DC stabilized and filtered voltage. 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 (Fig. 6.2).

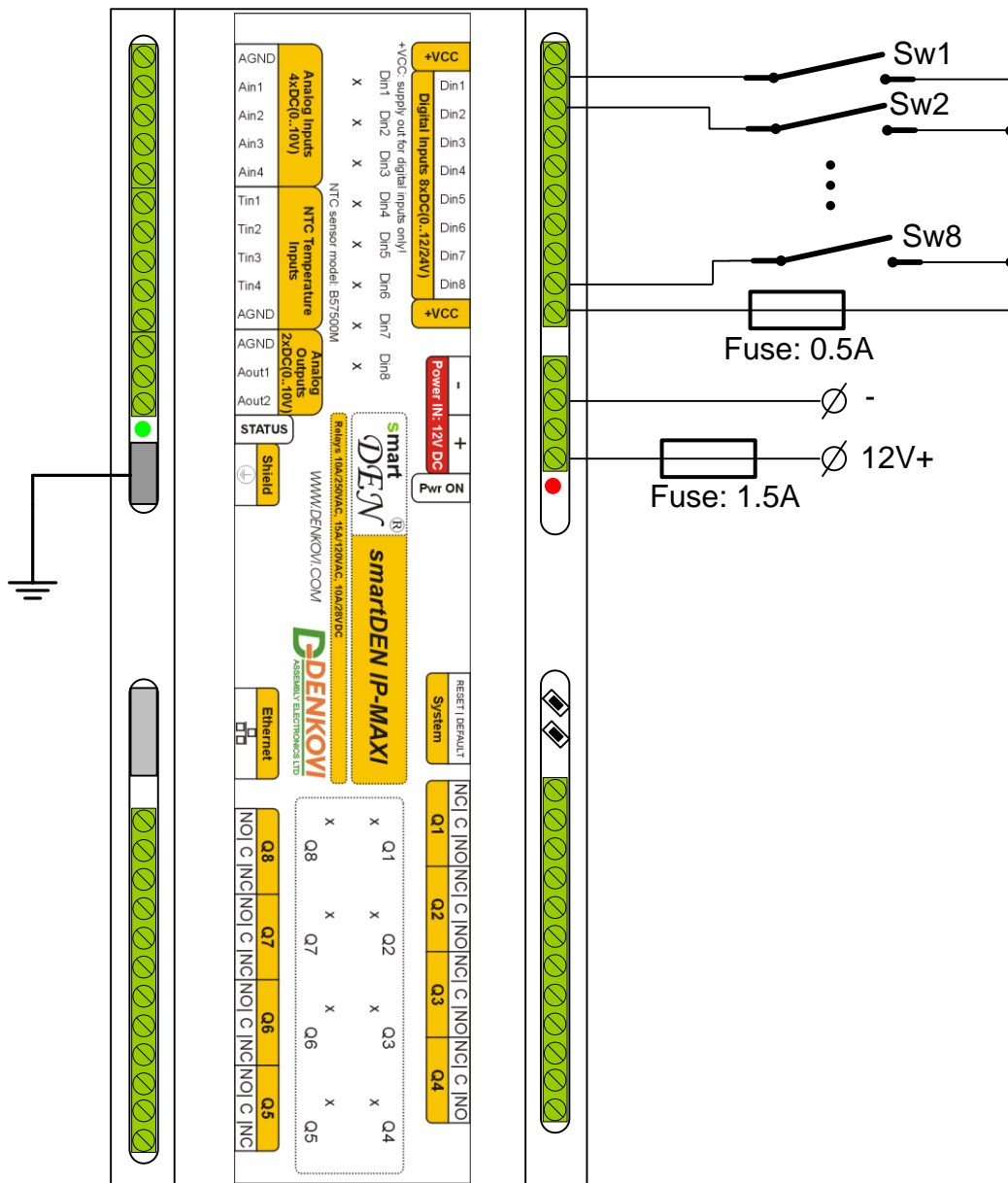


**Figure 6.2. smartDEN IP-Maxi-XX power supply**

- ❗ Please keep the polarity and the power supply voltage range!
- ❗ **smartDEN IP-Maxi-XX** does not accept AC power supply voltage. It is highly recommended to check the power supply source parameters before the module is powered on.
- ❗ 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.

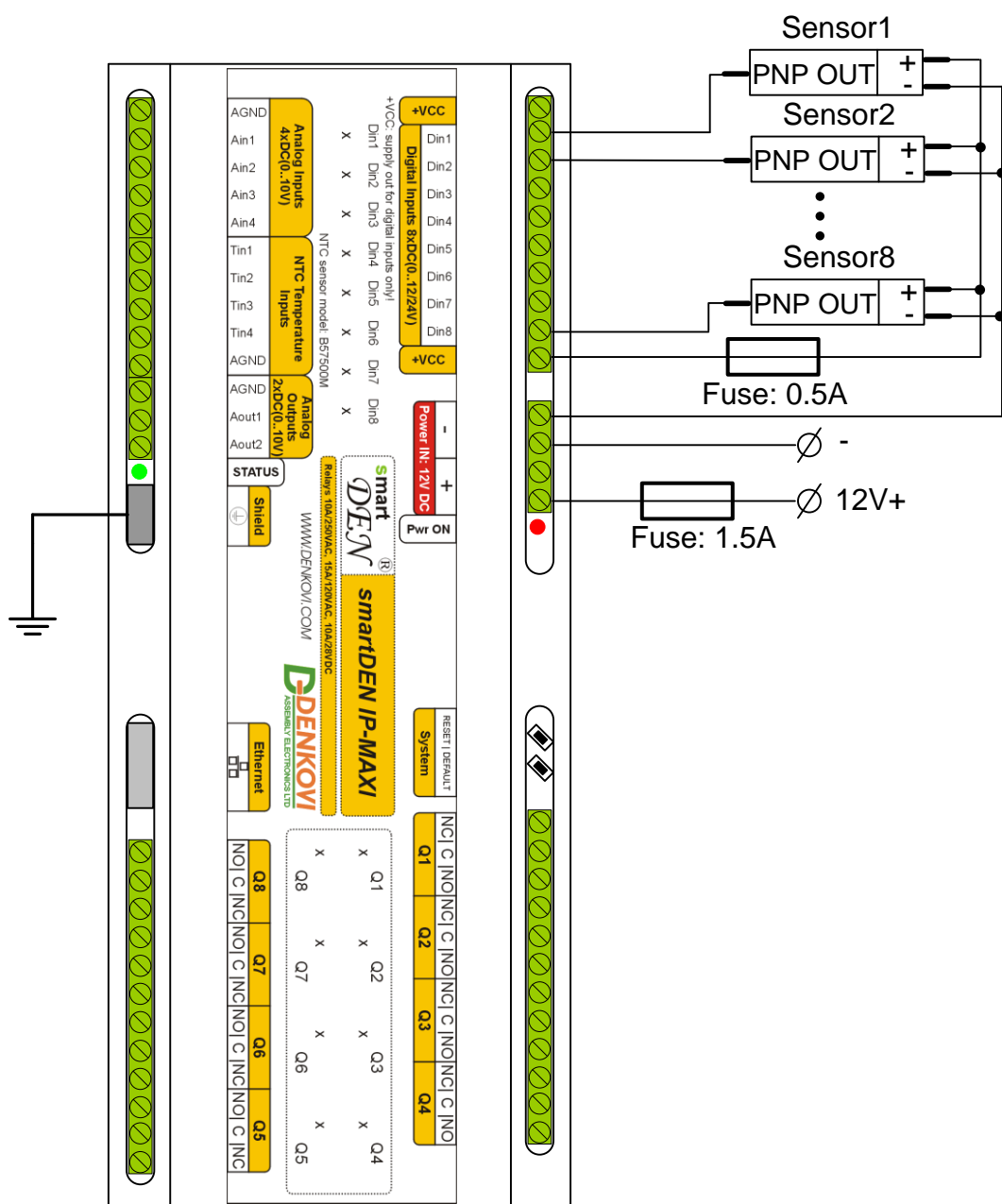
### 6.3. Connecting inputs

Fig. 6.3 shows the typical connection of dry contact sensors, switches, buttons, door sensors etc. to the Digital Inputs.



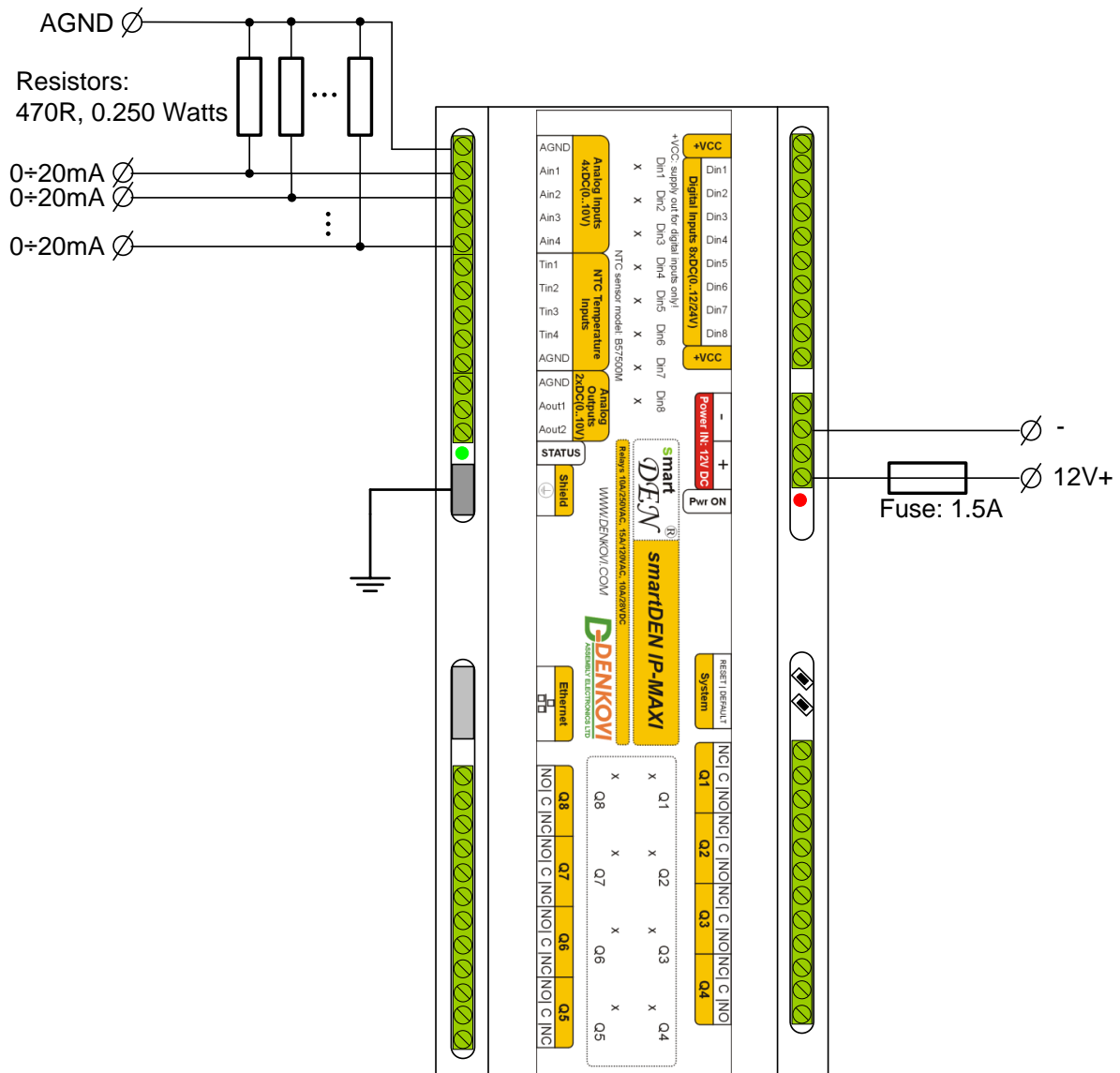
**Figure 6.3.** Connecting SPST NO output (dry contact) sensors, switches, buttons, door sensors etc. to the Digital Inputs

When connecting sensors with PNP output they can be powered from the additional internal 12V DC power source (Fig. 6.4).



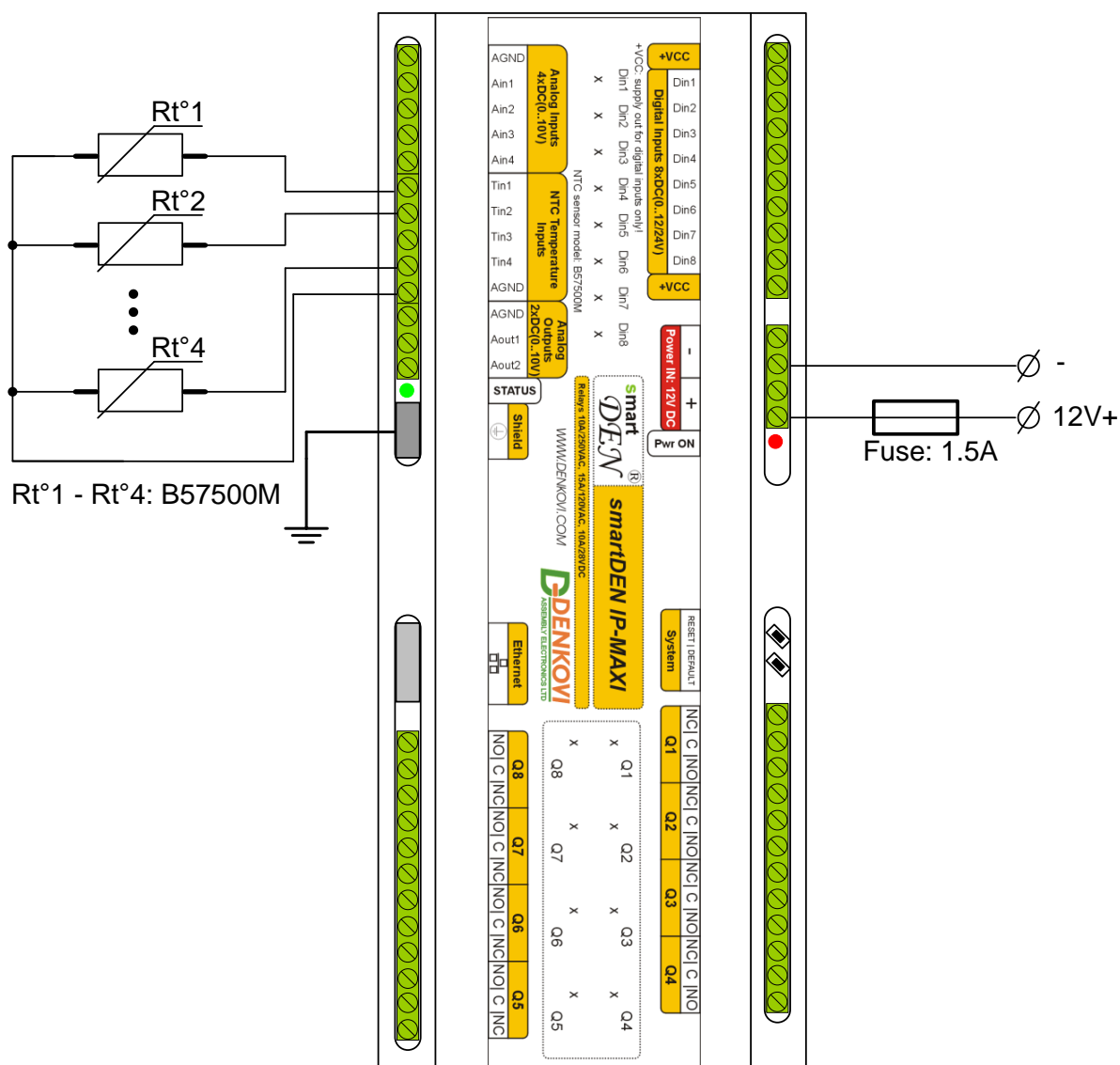
**Figure 6.4.** Connecting PNP output digital sensors requiring power supply voltage 12V DC to the Digital Inputs

Sensors with 0-20 mA output can be connected to the Analog Inputs as shown in Fig. 6.5.



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NTC thermistors type B57500M can be connected to the Temperature Inputs (Fig. 6.7).



**Figure 6.7.** Connecting NTC sensors type B57500M to the Temperature Inputs

Below is shown example connection how to control load with relays (lamp).

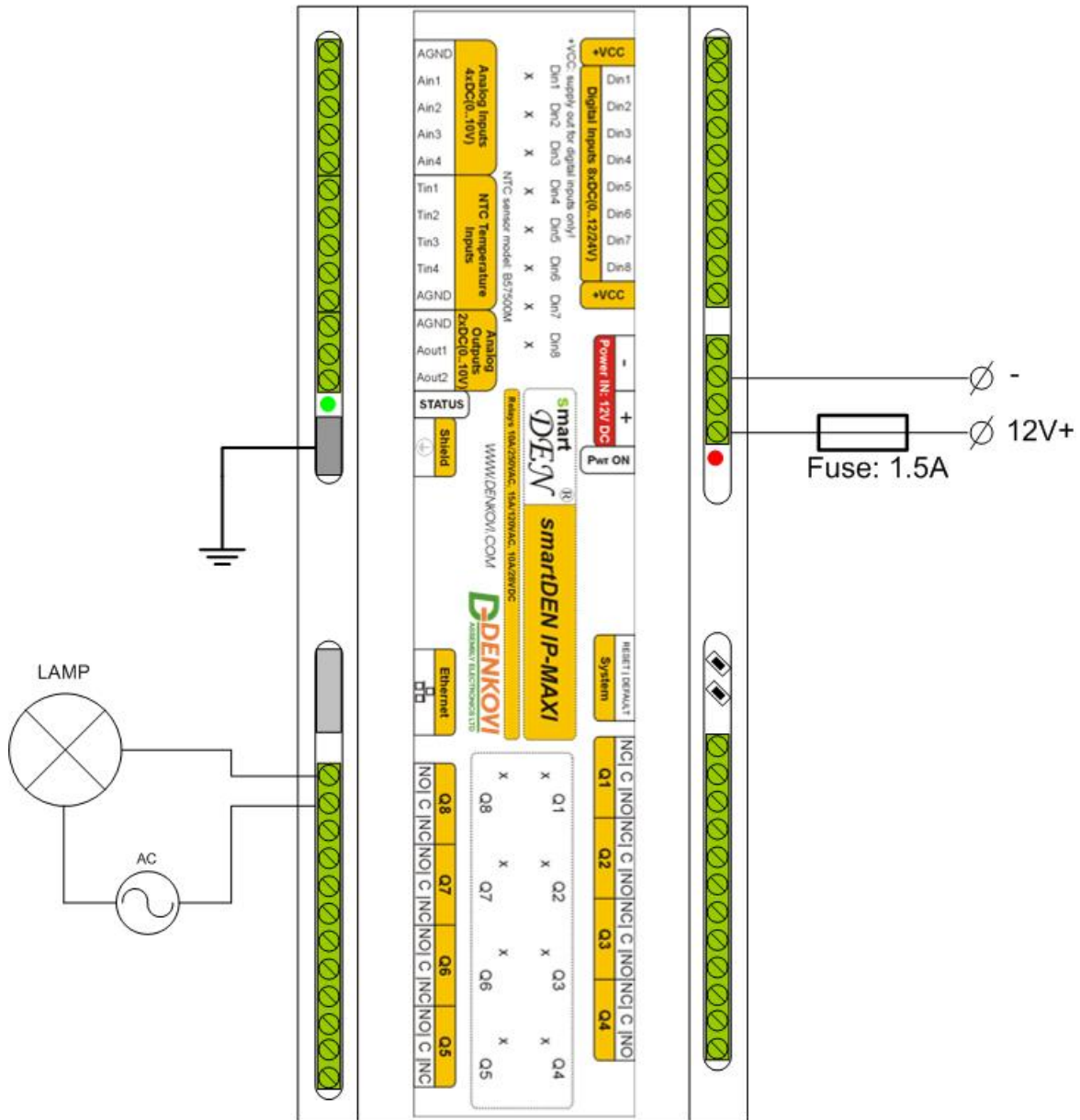


Figure 6.8. Connecting lamp to relay

## 6.4. Network connection

smartDEN IP-Maxi-XX supports AUTO-MDIX so either "crossover" or "straight-through" network cable can be used (Fig. 6.9, 6.10).



**Figure 6.9.** Direct connection of smartDEN IP-Maxi-XX to a computer



**Figure 5.10.** Connecting smartDEN IP-Maxi-XX to a wireless router

## 6.5. Communication setup

smartDEN IP-Maxi-XX ships 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.

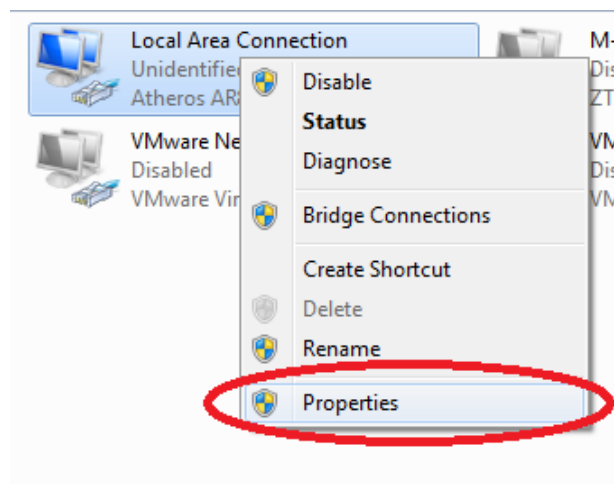


You can google how to change you computer IP settings or just visit this web page: <http://www.howtochangeipaddress.com/changeip.php>

For Windows 7 OS for example you can do that in the following way:

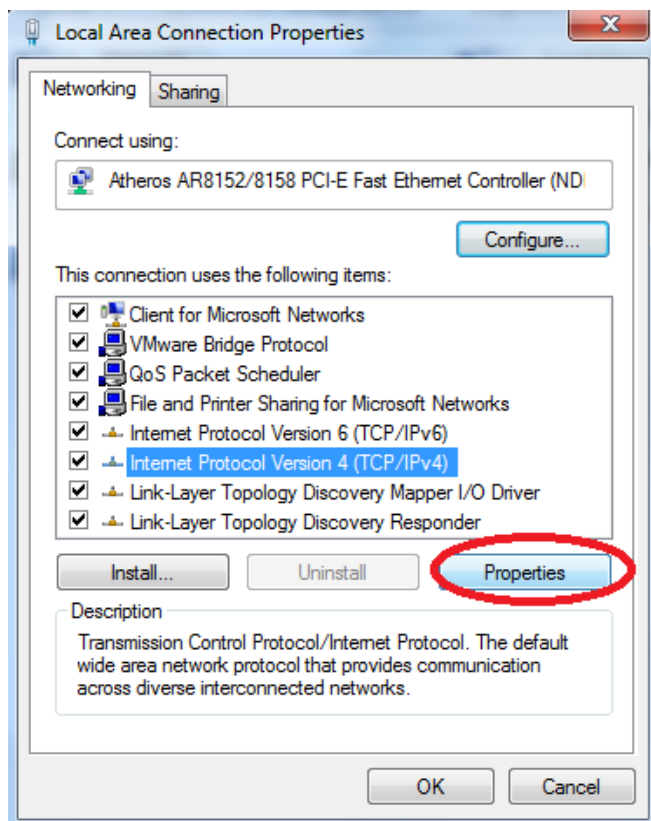
Navigate to Control Panel -> Network and Internet -> View network and status tasks -> Change adapter settings

Then just select the local area connection with right click and select Properties (Fig. 6.11):



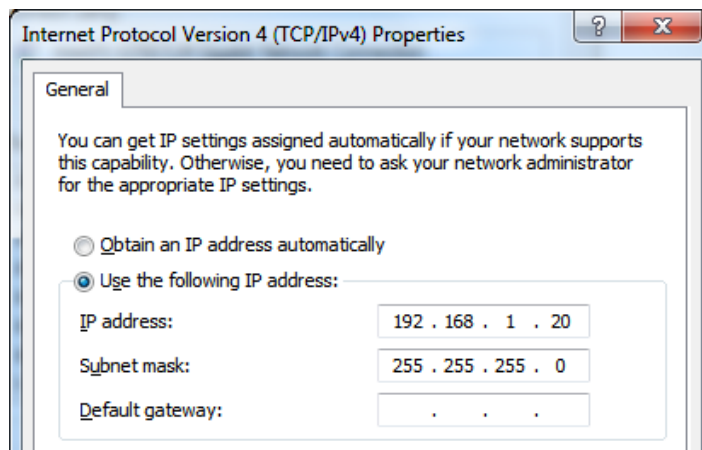
**Figure 6.11.** LAN card properties

The next step is to modify the IPv4 properties (Fig. 6.12).



**Figure 6.12.** IPv4 properties section

Set the IP address of your PC to be in the same network as **smartDEN IP-Maxi-XX** (Fig. 6.13).



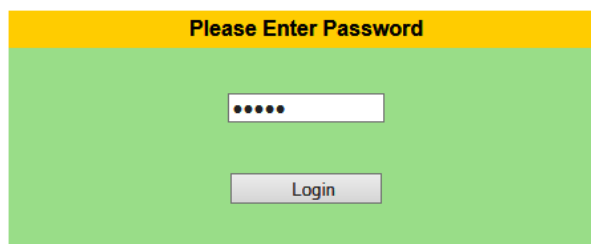
**Figure 6.13.** Set the IP address

Finally, in the address bar of your Web-browser enter the IP address of the **smartDEN IP-Maxi-XX** and press Enter, or select 'Go' (Fig. 6.14).



**Figure 6.14.** Open the device in a browser

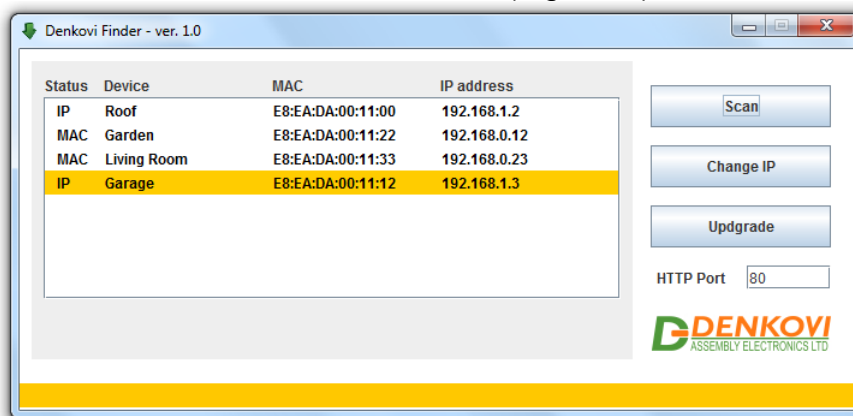
If the network settings are O'K, the login page should appear (Fig. 6.15).



**Figure 6.16.** Login page



**smartDEN IP-Maxi-XX** modules connected locally can be easily scanned and found via the Denkovi Finder tool as well (Fig. 6.17).



**Figure 6.17.** Denkovi Finder utility

## 7. Default settings

### 7.1. Table with default settings

The **smartDEN IP-Maxi-XX** module is shipped with default (factory) settings shown in Table 6.1. The default settings can be reloaded, if necessary (see [point 7.2](#)).

**Table 7.1.** Default settings

Settings group	Parameter (according to Web pages)	Value
<b>Common Parameters</b>		
<b>General Settings</b>	Password	admin
	Temperature Scale	Celsius
	Analog Inputs Filter, sec	0
	Relays Filter, ms	0
	Save Outputs	Disabled
	Monitoring Timeout, sec	3
	Max. Monitoring Errors	5
<b>Network Settings</b>	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
<b>Date/Time Settings</b>	Date (dd/mm/yyyy)	Current
	Day of Week	Current
	Time (hh:mm)	Current
	Time Zone	GMT
	Auto Synchronization	Enabled
	Time Server	pool.ntp.org
	Server Port	123
	Synchronization Period, min	30
<b>HTTP/XML/JSON Settings</b>	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
	Multiple Access	Enabled

<b>Digital Inputs</b>	Description	DIN<n>, where <n> = 1..8
	Counter	0
	Filter (ms)	0
	SNMP Trap <sup>(1)</sup> / MQTT <sup>(2)</sup>	Disabled
	SNMP Trap Value <sup>1)</sup> / Edge <sup>(2)</sup>	(0) Off
<b>Analog Inputs</b>	Description (In1 to In4)	AIN<n>, where <n> = 1..4
	Description (In5 to In8)	TIN<n>, where <n> = 1..4
	Min (In1 to In4)	0.0
	Max (In1 to In4)	10.0
	Min (In5 to In8)	-55
	Max (In5 to In8)	155
	Label (In1 to In4)	Volt
	Label (In5 to In8)	degC
	Trap Low Threshold	0
	Trap High Threshold	0
	SNMP Trap <sup>(1)</sup> / MQTT <sup>(2)</sup>	Disabled
<b>Relays</b>	Description	REL<n>, where <n> = 1..8
	Working Mode	Multiple
	DI No	0
	DI Mode	Normal
	AI+ No	0
	AI- No	0
	AI Threshold 1	0
	AI Threshold 2	0
	Pulse, ms (x100)	0
	Disable Week Schedule	No
	Use Filter	No
	MQTT <sup>(2)</sup>	Disabled
<b>Analog Outputs</b>	Description	AOUT<n>, where <n> = 1..2
	Units	0
	MQTT <sup>(2)</sup>	Disabled
<b>SNMP Agent<sup>(1)</sup></b>	Enable SNMP	Enabled
	SNMP Port	161
	Read-only Community1	public
	Read-only Community2	read
	Read-write Community1	private
	Read-write Community2	write
<b>SNMP Traps</b>	Enable	Disabled

	Trap Receiver IP Address	0.0.0.0
	Trap Receiver Port	162
	Trap Community	
	Trap Sending	Level Triggered
<b>MQTT Settings</b> <sup>(2)</sup>	Enable	Disabled
	MQTT Server	iot.eclipse.org
	Server Port	1883
	Username	
	Password	
	Publish Mode	Periodically
	Publish Period, sec	10
<b>Modbus TCP</b> <sup>(3)</sup>	Enable Modbus-TCP	Yes
	Modbus-TCP Port	502
	Idle Timeout, min	5

(1) smartDEN IP-Maxi only

(2) smartDEN IP-Maxi-MQ only

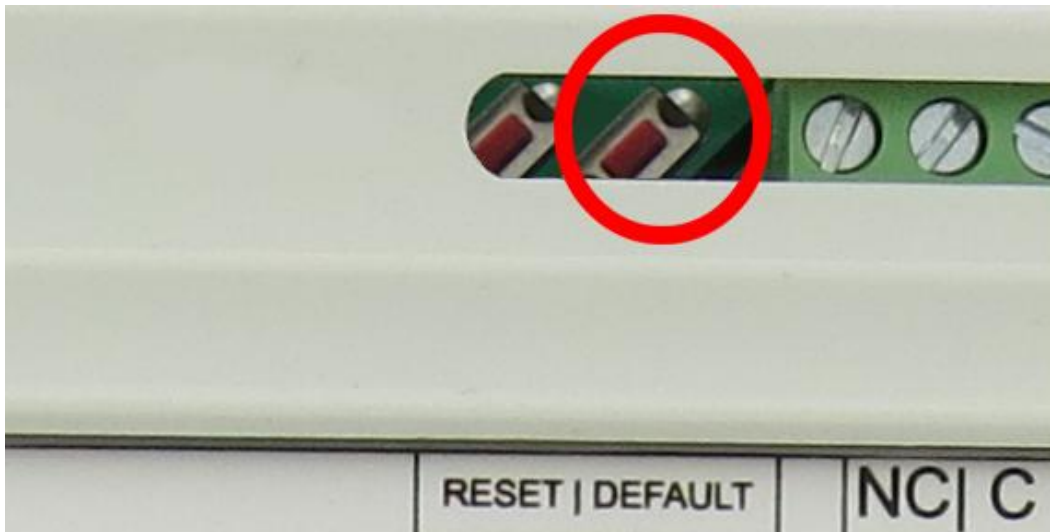
(3) smartDEN IP-Maxi-MT only

## 7.2. Steps for loading the default settings

When necessary, the factory (default settings) may be applied so the module parameters will be returned back to those pointed out in [point 7.1](#) of the current document.

To return the settings to their factory default values next steps take place:

1. Turn Off the power supply of the device;
2. Press and hold the DEFAULT button (Fig. 7.1);
3. Turn On the power supply of the device;
4. Wait until STATUS LED indicator become On (approximately after 10 sec);
5. Release the DEFAULT button;
6. The device is restarted and configured with the default settings.



**Figure 7.1.** Loading the default settings

## 8. Web access

The screenshot displays the smartDEN IP-Maxi web interface. At the top, there is a yellow header bar containing the smartDEN logo, the product name 'smartDEN IP-Maxi', the company name 'Denkovi Assembly Electronics LTD' with the website 'www.denkovi.com', and a status box on the right showing 'Device Name: SMARTDEN\_IPMAXI', 'DHCP Status: Disabled', 'System Date: 28/02/2018', and 'System Time: 15:27'. On the left side, there is a green sidebar menu with options: General Settings, Network Settings, Date/Time Settings, HTTP/XML/JSON, SNMP Agent, SNMP Traps, Digital Inputs, Analog Inputs, Relays Settings, Analog Outputs, Monitoring & Control, Week Schedule, Logout, and Reboot. The main content area is titled 'General Settings' and contains a table with the following fields:

General Settings	
Device Name	SMARTDEN_IPMAXI
Password	*****
Temperature Scale	Celsius
Analog Inputs Filter, sec	0
Relays Filter, ms	0
Save Relays	<input type="checkbox"/>
Monitoring Timeout, sec	3
Max. Monitoring Errors	5

At the bottom of the settings table, there are two buttons: 'Save' and 'Reload'.

**Figure 8.1.** Web access

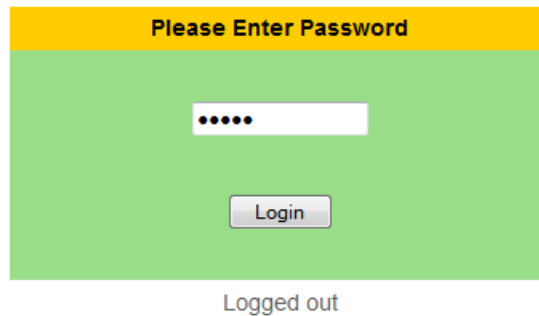
To access the setup pages, start a web browser (Internet Explorer, Chrome, Mozilla Firefox or similar), and enter the **smartDEN IP-Maxi-XX** IP address, for example: <http://192.168.1.100>.



**Figure 8.2.** Open the device in a browser

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

## 8.1. Login



**Figure 8.3.** Login page

Enter the password and click Login button or press Enter (Fig. 8.3). This will bring you to the **smartDEN IP-Maxi-XX** main configuration page, which contains details of the current firmware version/build date and provides a link to the documentation page.

**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-Maxi-XX** for time, specified by **Session Timeout** parameter, the session "times out" and a new login is required.


## 8.2. General settings

General settings page is shown in Fig. 8.6.


General Settings	
Device Name	SMARTDEN_IPMAXI
Password	*****
Temperature Scale	Celsius ▼
Analog Inputs Filter, sec	0
Relays Filter, ms	0
Save Relays	<input type="checkbox"/>
Monitoring Timeout, sec	3
Max. Monitoring Errors	5

**Figure 8.4.** 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/JSON 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. The range is from 0 up to 30 sec. The filter is disabled when its value is set to 0;

 This parameter sets a low pass software filter that removes the short-term fluctuations from the input signal and reduces the effect of occasional spikes. Note that the higher filter constants give a slower response to changes.

- **Relays Filter, ms** – relays filter constant. The range is from 0 up to 9999 milliseconds. Zero value disables the filter;

 In real applications, switching external loads can produce spikes and noise transients that may disturb the Analog Inputs measurement. To avoid the processing of "false" Analog Inputs measurements during these transients the parameter Relays Filter can be set to appropriate value. When a Relay changes its state, during the defined period Analog Input measurements will be ignored. The filter can be enabled or disabled individually for each relay by Use **Filter** option in Relays Settings page.

- **Save Outputs** - when checked, each time a Relay or Analog Output value is changed, it will be saved in non-volatile memory (EEPROM), so after reboot/restart it will be restored;
-  This option should be used with care in dynamic systems because of restriction in maximum write cycles of the EEPROM (usually 100 000 write/erase cycles).
- **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.

### 8.3. Network settings

The page shown in Fig. 8.5 lets you configure the network settings of **smartDEN IP-Maxi-XX** module.

Network Settings	
MAC Address	E8:EA:DA:00:00:20
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
<input type="button" value="Save"/> <input type="button" value="Reload"/>	

**Figure 8.5.** Network settings

- **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-Maxi-XX** must be rebooted before obtaining an IP address;
- **IP address** - this is the IP address of the **smartDEN IP-Maxi-XX**. It has 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 SNTP servers for automatic time synchronization;
- **Subnet Mask** - this is the subnet mask for the network on which the **smartDEN IP-Maxi-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.

## 8.4. Date/Time Settings

This page lets you adjust the date/time and set the SNTP (Simple Network Time Protocol) server for auto synchronization (Fig. 8.6).

Date/Time Settings	
Date (dd/mm/yyyy)	<input type="text" value="28/02/2018"/>
Day of Week	<input type="text" value="Wed"/>
Time (hh:mm)	<input type="text" value="17:15"/>
Time Zone	<input type="text" value="(GMT)"/> ▼
Auto Synchronization	<input checked="" type="checkbox"/>
Time Server	<input type="text" value="pool.ntp.org"/>
Server Port	<input type="text" value="123"/>
Synchronization Period, min	<input type="text" value="30"/>
<input type="button" value="Save"/> <input type="button" value="Reload"/>	

**Figure 8.6.** Date/Time settings

- **Date (dd/mm/yyyy)** - the current date in specified format;
- **Time (hh:mm)** - the current time in 24-hour format;
- **Time Zone** - select the time zone for your geographic location;
- **Auto Synchronization** - this option enables or disables automatic synchronization with the SNTP server with period specified by Synchronization Period;
- **Time Sever** - the SNTP server, used for synchronizing the time automatically;
- **Server Port** - the SNTP server port;
- **Synchronization Period, min** - the period in which automatic synchronization will take place, if enabled;
- **Save button** - once you have changed the settings as needed, click this button. These settings apply immediately and do not require a reboot.

## 8.5. HTTP/XML/JSON

These settings let you configure the HTTP and XML/JSON access parameters of smartDEN IP-Maxi-XX (Fig. 8.7).

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="30"/>
XML/JSON Access	
Enable Access	<input checked="" type="checkbox"/>
Encrypt Password	<input type="checkbox"/>
Multiple Access	<input checked="" type="checkbox"/>
<input type="button" value="Save"/> <input type="button" value="Reload"/>	

**Figure 8.7.** HTTP/XML/JSON settings







- **HTTP Port** - port on which the integrated 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 the HTTP/XML/JSON sessions in minutes;
- **Enable Access** - this option enables or disables the XML/JSON access;
- **Encrypt Password** - when the XML/JSON access is enabled, this option adds additional security level by encrypting the login password;
- **Multiple Access** - this option enables simultaneous XML/JSON access from several HTTP clients;
- **Save button** - once you have changed the settings as required, click this button.

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

**Note:** When Encrypt Password mode is enabled, the Multiple Access option is not taken into account, so at any given moment, only one user can be logged-in.

**Note:** When **Multiple Access** mode is enabled, any XML/JSON request will always reset the current HTTP session.

**Note:** When **Multiple Access** mode is disabled, whether **Encrypt Password** is enabled or not, it is possible to access the module via XML/JSON only after login for the specified session timeout.

-  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.

## 8.6. Digital Inputs

Digital Inputs settings page is shown in Fig. 8.8.

**Digital Inputs Settings**

Digital Input	Description	Counter	Filter (ms)	SNMP Trap	SNMP Trap Value	Edge	MQTT
Input 1	DIN1	0	0	<input checked="" type="checkbox"/>	2 (Both) ▾	2 (Both) ▾	<input checked="" type="checkbox"/>
Input 2	DIN2	0	0	<input checked="" type="checkbox"/>	2 (Both) ▾	2 (Both) ▾	<input checked="" type="checkbox"/>
Input 3	DIN3	0	0	<input checked="" type="checkbox"/>	2 (Both) ▾	2 (Both) ▾	<input checked="" type="checkbox"/>
Input 4	DIN4	0	0	<input checked="" type="checkbox"/>	2 (Both) ▾	0 (Off) ▾	<input type="checkbox"/>
Input 5	DIN5	0	0	<input checked="" type="checkbox"/>	2 (Both) ▾	0 (Off) ▾	<input type="checkbox"/>
Input 6	DIN6	0	0	<input checked="" type="checkbox"/>	2 (Both) ▾	0 (Off) ▾	<input type="checkbox"/>
Input 7	DIN7	0	0	<input checked="" type="checkbox"/>	2 (Both) ▾	0 (Off) ▾	<input type="checkbox"/>
Input 8	DIN8	0	0	<input checked="" type="checkbox"/>	2 (Both) ▾	0 (Off) ▾	<input type="checkbox"/>

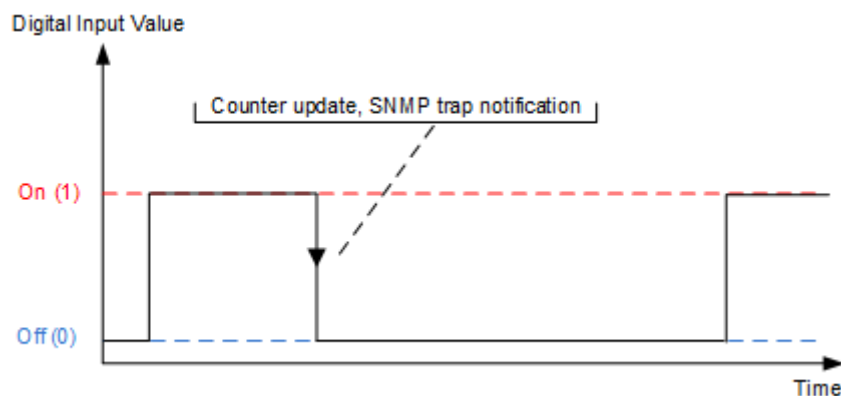
**Figure 8.8.** Digital Inputs settings

- **Description** - identification string of the input (max. 7 chars);

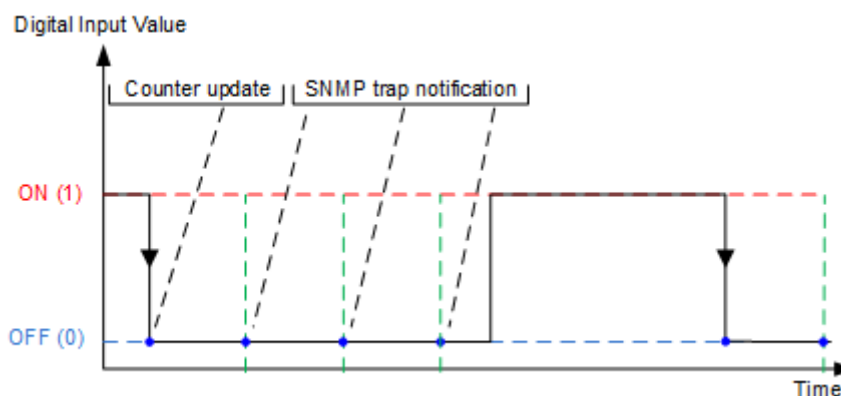


This description will appear in XML/JSON files, as well as in the Monitoring & Control page.

- **Counter** – the value of 32-bit counter attached to the input. The **Counter** is incremented on rising (On), falling (Off), or both edges depending on the **SNMP Trap Value (for smartDEN IP-Maxi)** or **Edge (for smartDEN IP-Maxi-MQ)**. The **Counter** is cyclic and its value can be set or cleared by the user. The range for this parameters is from 0 up to  $2^{32}-1$  (4294967295);
- **Filter (ms)** - the input may be adjusted to work with a digital filter. It is valid for counting, SNMP trap notifications, as well as input visualization. The range for this parameter is from 0 up to 200 milliseconds. The filter is disabled when its value is set to 0;
- **SNMP Trap (for smartDEN IP-Maxi only)** - determines if the Digital Input sends trap notifications or not;
- **SNMP Trap Value (for smartDEN IP-Maxi only)** - this parameter determines the condition to increment the counter and to send a SNMP trap notification:
  - **0 (Off)** – the **Counter** is incremented on the falling edge (1 -> 0). With **Trap Sending**="Edge Triggered" the falling edge triggers a trap message (Fig. 8.9). With **Trap Sending**="Level Triggered" the trap message is sent while the Digital Input is low (0) in intervals of 5 seconds (Fig. 8.10).

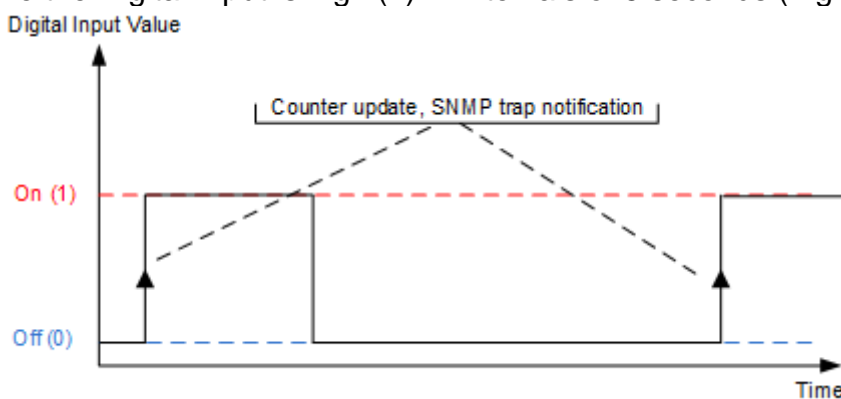


**Figure 8.9. SNMP Trap Value="0 (Off)", Trap Sending="Edge Triggered"**

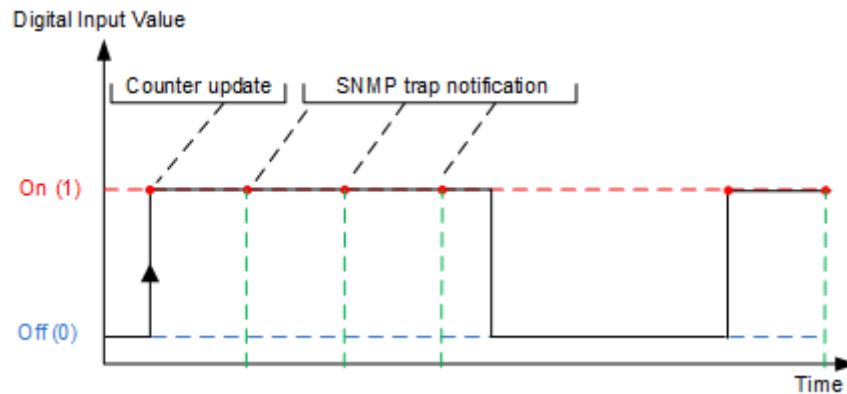


**Figure 8.10. SNMP Trap Value="0 (Off)", Trap Sending="Level Triggered"**

- 1 (On) – the **Counter** is incremented on the rising edge (0 → 1). With **Trap Sending="Edge Triggered"** the rising edge triggers a trap message (Fig. 8.11). With and **Trap Sending="Level Triggered"** the trap message is sent while the Digital Input is high (1) in intervals of 5 seconds (Fig. 8.12).

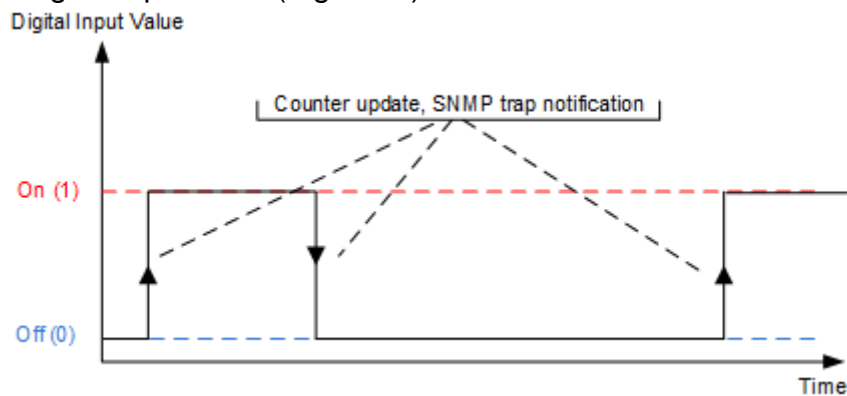


**Figure 8.11. SNMP Trap Value="1 (On)", Trap Sending="Edge Triggered"**

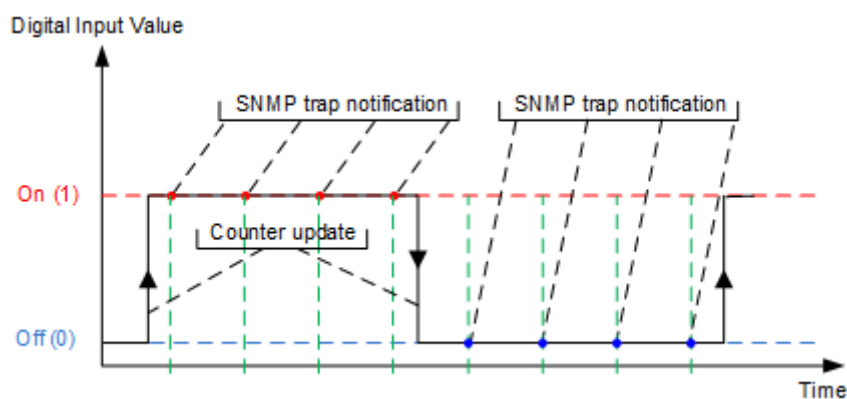


**Figure 8.12. SNMP Trap Value="1 (On)", Trap Sending="Level Triggered"**

- 2 (Both) – **Counter** update takes place on each Digital Input state change (both falling and rising edges). With **Trap Sending**="Edge Triggered" both edges trigger a trap message (Fig. 8.13). With **Trap Sending**="Level Triggered" the trap message is sent in intervals of 5 seconds regardless of the Digital Input state (Fig. 8.14).



**Figure 8.13. SNMP Trap Value="2 (Both)", Trap Sending="Edge Triggered"**

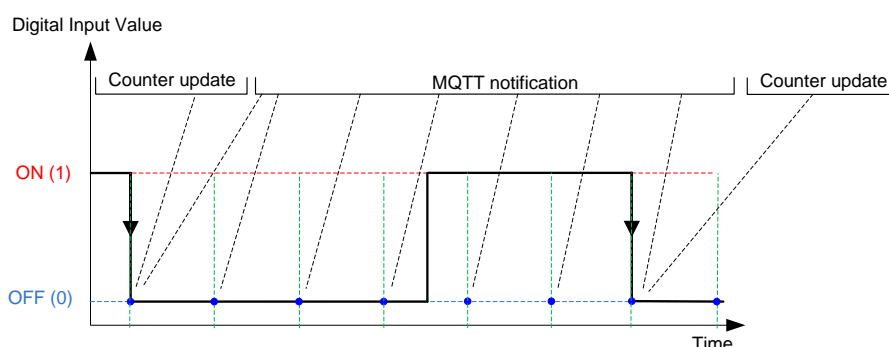


**Figure 8.14. SNMP Trap Value="2 (Both)", Trap Sending="Level Triggered"**

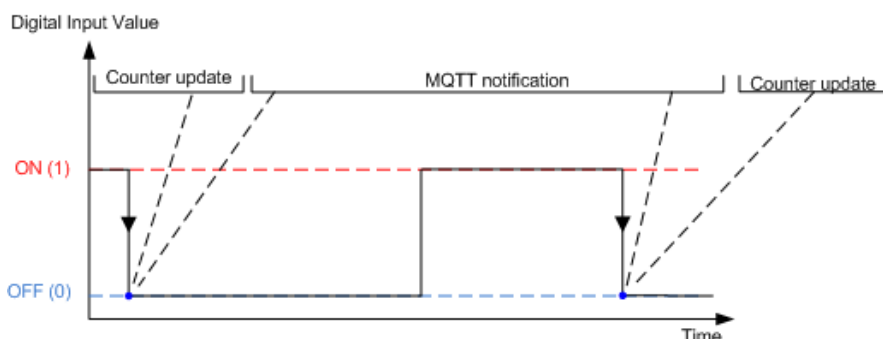
- **MQTT (for smartDEN IP-Maxi-MQ only)** - enables this Digital Input to publish its status via MQTT protocol. The publish topic and publish mechanism depends on selected **Encrypt Topic** parameter (encrypted/non-encrypted)

mode), on the **Publish Mode** parameter and one the selected Digital Input settings;

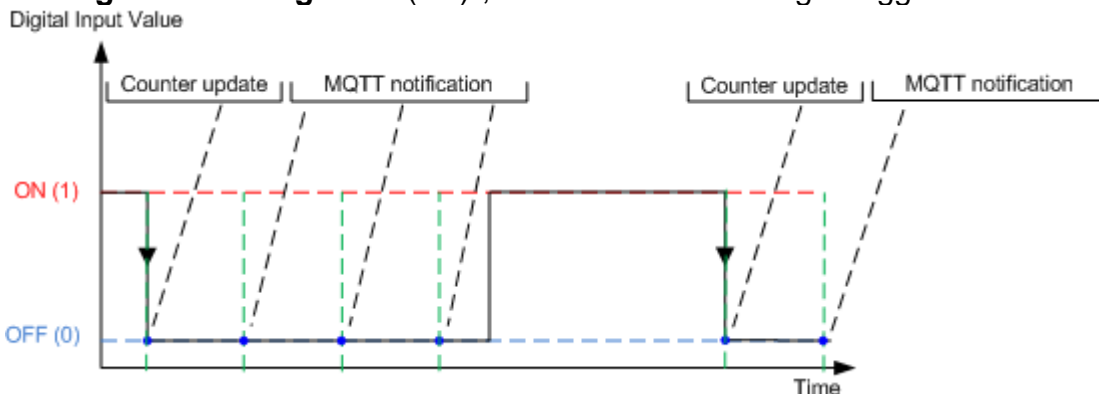
- **Edge (for smartDEN IP-Maxi-MQ only)** - this parameter determines the condition to increment the counter and to send a MQTT notification:
  - **0 (Off)** – the **Counter** is incremented on the falling edge (1 -> 0). With **Publish Mode**="Periodically" the MQTT notifications are sent periodically over the specified period via **Publish Period** parameter (Fig. 8.15). With **Publish Mode** ="Edge Triggered" a single MQTT notification is sent when the Digital Input becomes low (0) (Fig. 8.16). With **Publish Mode** = "Edge Triggered + Periodically" MQTT notifications are sent when the Digital Input is low (0) periodically over the specified period by **Publish Period** parameter (Fig. 8.17);



**Figure 8.15. Edge = "0 (Off)", Publish Mode = "Periodically"**

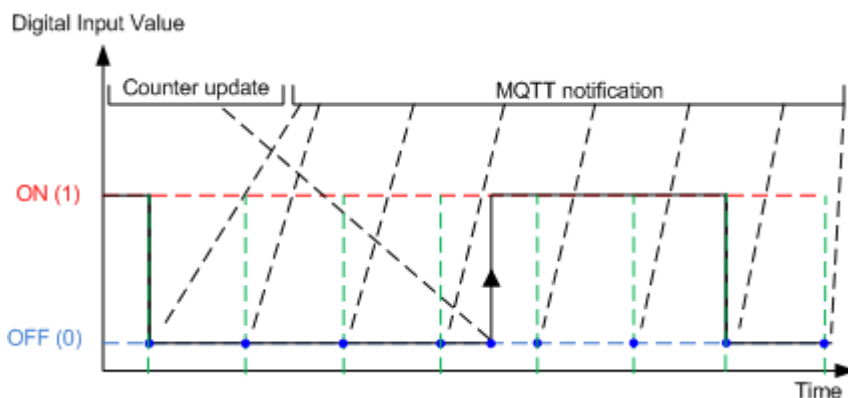


**Figure 8.16. Edge = "0 (Off)", Publish Mode = "Edge Triggered"**

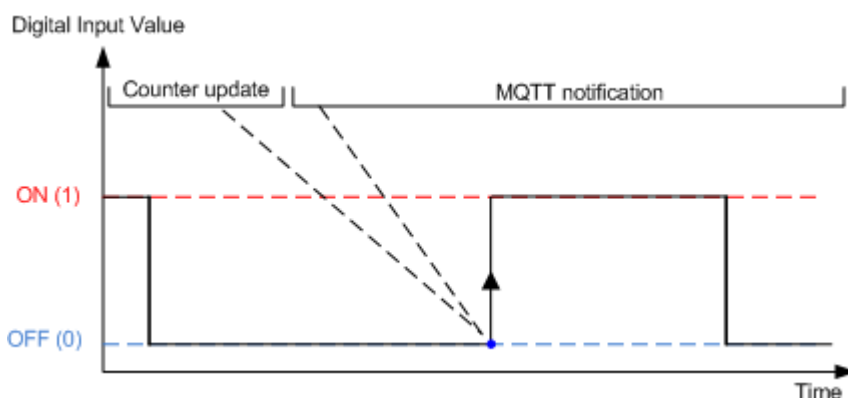


**Figure 8.17. Edge = "0 (Off)", Publish Mode = "Edge Triggered + Periodically"**

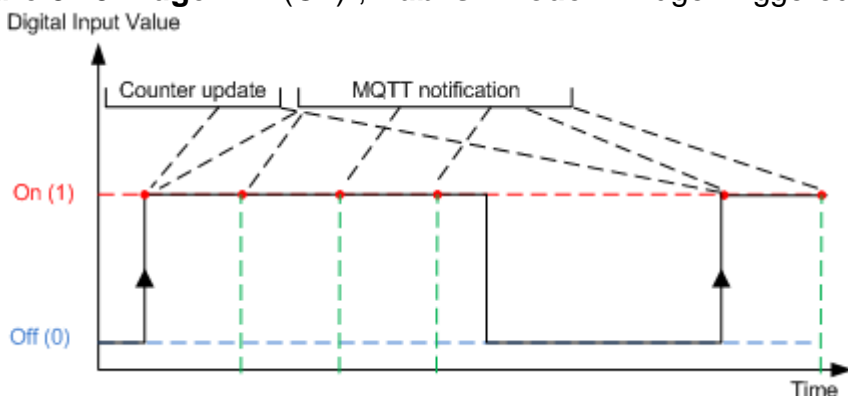
- 1 (On) – the **Counter** is incremented on the rising edge (0 -> 1). With **Publish Mode**="Periodically" the MQTT notifications are sent periodically over the specified period via **Publish Period** parameter (Fig. 8.18). With **Publish Mode** ="Edge Triggered" a single MQTT notification is sent while the Digital Input is high (1) (Fig. 8.19). With **Publish Mode** ="Edge Triggered + Periodically" MQTT notifications are sent when the Digital Input is high (1) periodically over the specified period by **Publish Period** parameter (Fig. 8.20);



**Figure 8.18. Edge = "1 (On)", Publish Mode = "Periodically"**



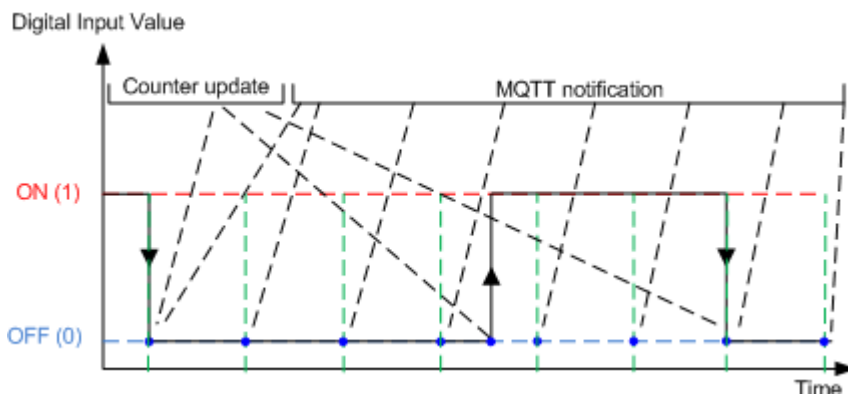
**Figure 8.19. Edge = "1 (On)", Publish Mode = "Edge Triggered"**



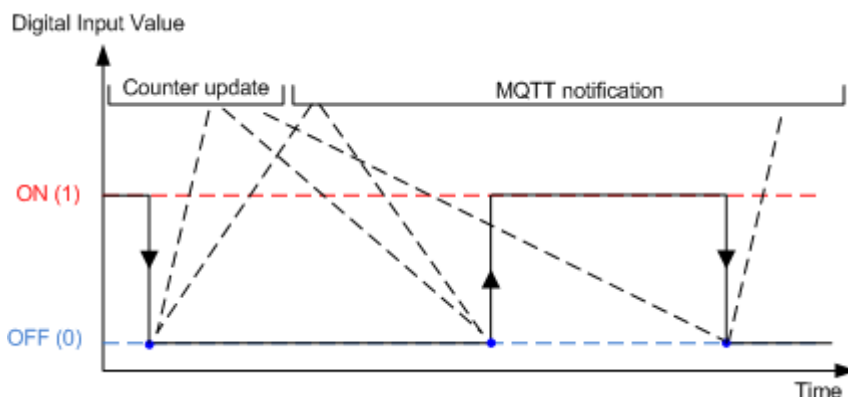
**Figure 8.20. Edge = "1 (On)", Publish Mode = "Edge Triggered + Periodically"**

- 2 (Both) – the **Counter** is incremented on the rising/falling edge (0 -> 1 and 1 -> 0). With **Publish Mode**="Periodically" the MQTT notifications are sent

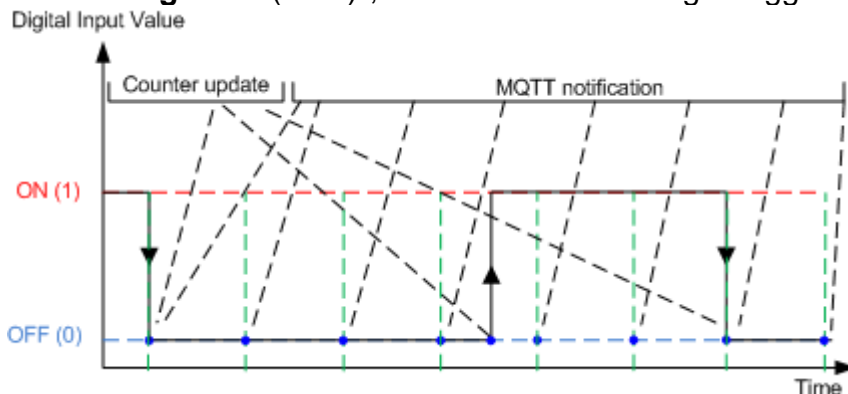
periodically over the specified period via **Publish Period** parameter (Fig. 8.21). With **Publish Mode** = "Edge Triggered" a single MQTT notification is sent while the Digital Input is low (0) or high (1) (Fig. 8.22). With **Publish Mode** = "Edge Triggered + Periodically" MQTT notifications are sent when the Digital Input is low (0) or high (1) and periodically over the specified period by **Publish Period** parameter (Fig. 8.23);



**Figure 8.21. Edge = "2 (Both)", Publish Mode = "Periodically"**



**Figure 8.22. Edge = "2 (Both)", Publish Mode = "Edge Triggered"**



**Figure 8.23. Edge = "2 (Both)", Publish Mode = "Edge Triggered + Periodically"**

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

**Inputs/Counters 1, 2 and 3**

These counters are implemented in software but not in hardware. Due to this there are some considerations which must be taken in mind when working with them:

- When the **Filter** is disabled (set to 0) and no requests are sent to the controller (no HTTP, SNMP, logged out from web server) but just counting pulses, it is possible to achieve frequency about 10 Hz or this is 50 ms On and 50 ms Off. This is the recommend state for counting pulses;
- When the **Filter** is disabled (set to 0) but there is active web session and the monitoring page is opened, then it is possible to count pulses with frequency about 1 Hz or this is 500 ms On and 500 ms Off;
- When the Filter is enabled the actual frequency depends also on the filter constant.
- At the moment the module is saving the configuration in the EEPROM some count pulses may be missed due to the blocking time which may be several seconds.

**Inputs/Counters 4, 5, 6 and 7**

- When the **Filter** is disabled (set to 0) it is possible to count pulses with frequency up to 50 Hz. Note that it is not appropriate at high frequencies to configure these inputs to send traps or to control Relays.
- When the Filter is enabled, these inputs work in the same mode as Inputs/Counters 1, 2 and 3.

**Input/Counter 8**

- When the **Filter** is disabled (set to 0) Digital Input 8 works with frequency up to 1 KHz. In this mode the Counter is incremented on the rising edge regardless of **SNMP Trap Value**. Note that it is not appropriate at high frequencies to configure this input to send traps or to control Relays.
- When the **Filter** is enabled, Digital Input 8 works in the same mode as Inputs/Counters 1, 2 and 3.

## 8.7. Analog Inputs

Analog Inputs settings page is shown in Fig. 8.24. Input 1 to Input 4 are used to measure voltage in range 0-10VDC. Input 5 to Input 8 are used to measure temperature from 10K NTC sensors B57500M (with range temperature range -55°C/-67°F to +155°C/311°F).

**Analog/Temperature Inputs Settings**

For smartDEN IP-Maxi-  
MQ only

For smartDEN IP-Maxi only

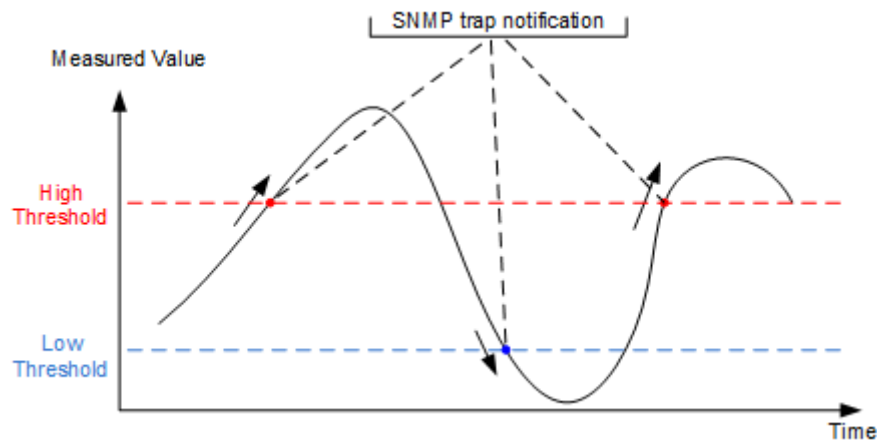
Analog Input	Description	Min	Max	Label	Trap Low Threshold	Trap High Threshold	MQTT	SNMP Trap
Input 1 (Ain1)	AIN1	0.0	9999.9	mV	0	0	<input type="checkbox"/>	<input type="checkbox"/>
Input 2 (Ain2)	AIN2	0.0	9999.9	mV	0	0	<input type="checkbox"/>	<input type="checkbox"/>
Input 3 (Ain3)	AIN3	0.0	9999.9	mV	0	0	<input type="checkbox"/>	<input type="checkbox"/>
Input 4 (Ain4)	AIN4	0.0	9999.9	mV	0	0	<input type="checkbox"/>	<input type="checkbox"/>
Input 5 (Tin1)	TIN1	-55.0	155.0	degC	0	0	<input type="checkbox"/>	<input type="checkbox"/>
Input 6 (Tin2)	TIN2	-55.0	155.0	degC	0	0	<input type="checkbox"/>	<input type="checkbox"/>
Input 7 (Tin3)	TIN3	-55.0	155.0	degC	0	0	<input type="checkbox"/>	<input type="checkbox"/>
Input 8 (Tin4)	TIN4	-55.0	155.0	degC	0	0	<input type="checkbox"/>	<input type="checkbox"/>

Save Reload

**Figure 8.24.** Analog Inputs settings

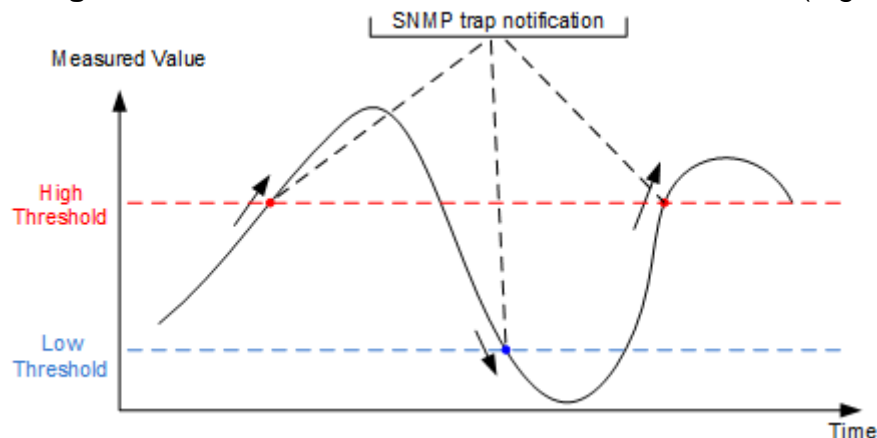
- **Description** - identification string of the input (max. 7 chars);  
💡 This description will appear in XML/JSON files, as well as in the Monitoring & Control page.
- **Min** - the measured value used for scaling corresponding to Analog Input value = 0:
  - For Input 1 to Input 4 range is from -9999.9 to +9999.9;
  - For Input 5 to Input 8 range is from -70.0 to +300.0 degF or -55.0 to +150.0 degC;
- **Max** - the measured value used for scaling corresponding to Analog Input value = 1023:
  - For Input 1 to Input 4 range is from -9999.9 to +9999.9;
  - For Input 5 to Input 8 range is from -70.0 to +300.0 degF or -55.0 to +150.0 degC;
- **Label** - the label for the measured value, for example: mA, Kg, Volt ...(max. 4 chars), available for editing only for Input 1 to Input 4. For inputs 5 to 8, it is fixed (degC or degF);
- **Low Threshold** - the low threshold for the measured value. It is used for notifications only (SNMP Trap or MQTT):
  - For Input 1 to Input 4 range is from -9999.9 to +9999.9;
  - For Input 5 to Input 8 range is from -70.0 to +300.0 degF or -55.0 to +150.0 degC;
- **High Threshold** - the high threshold for the measured value. It is used for notifications only (SNMP Trap or MQTT):
  - For Input 1 to Input 4 range is from -9999.9 to +9999.9;

- For Input 5 to Input 8 range is from -70.0 to +300.0 degF or -55.0 to +150.0 degC;
- **SNMP Trap (for smartDEN IP-Maxi only)** - determines if the Analog/Temperature Input will send SNMP trap notifications or not;
  - If **Traps Sending** parameter from web page SNMP Traps Settings is set to "Level Triggered" and the Analog Input measured value is less or equal than **Low Threshold** or greater or equal than **High Threshold** traps is sent in intervals of 5 seconds (Fig. 8.25);



**Figure 8.25.** Sending traps 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 (Fig. 8.26).

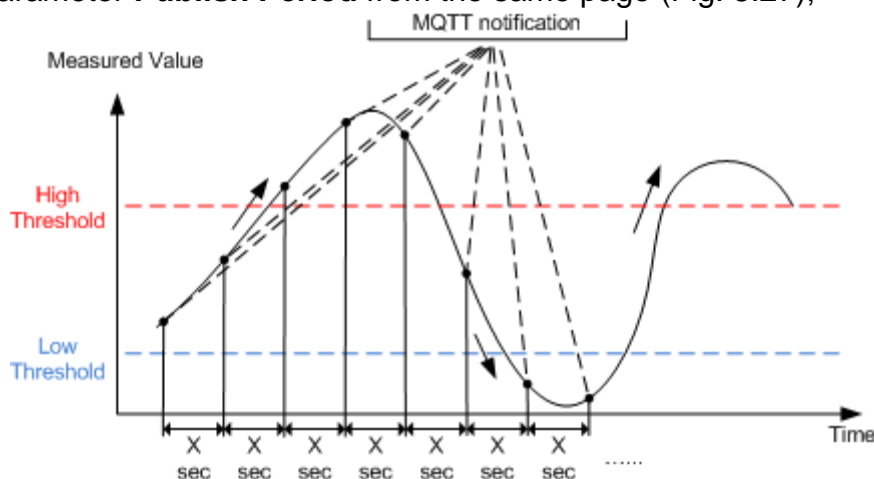


**Figure 8.26.** Sending traps with Traps Sending=Edge Triggered

In addition, Analog Input trap notifications will be sent in the following cases:

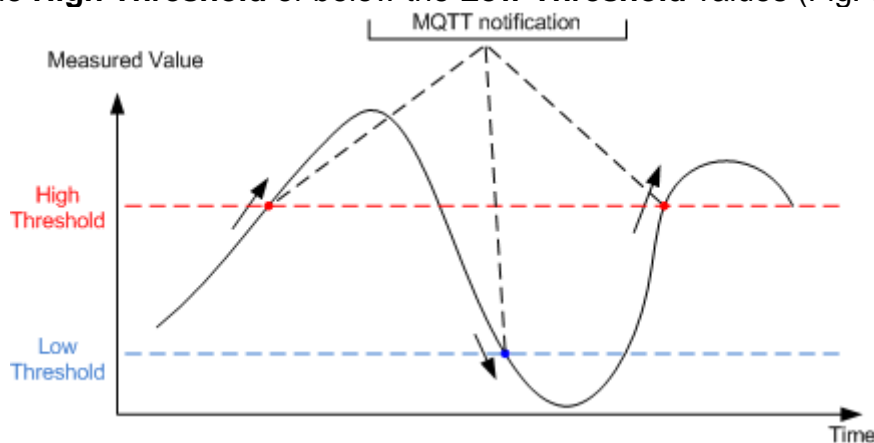
- When the parameter **Low Threshold** is changed and the Analog Input measured value is less or equal than the new value of **Low Threshold**;
- When the parameter **High Threshold** is changed and the Analog Input measured value is greater or equal than the new value of **High Threshold**.

- **MQTT (for smartDEN IP-Maxi-MQ only)** - enables this Analog Input to publish its status via MQTT protocol. The publish topic and publish mechanism depends on selected **Encrypt Topic** parameter (encrypted/non-encrypted mode), on the **Publish Mode** parameter and one the selected Analog Input settings;
  - If **Publish Mode** parameter from web page MQTT Settings is set to "Periodically" notifications are sent in intervals determined by the parameter **Publish Period** from the same page (Fig. 8.27);



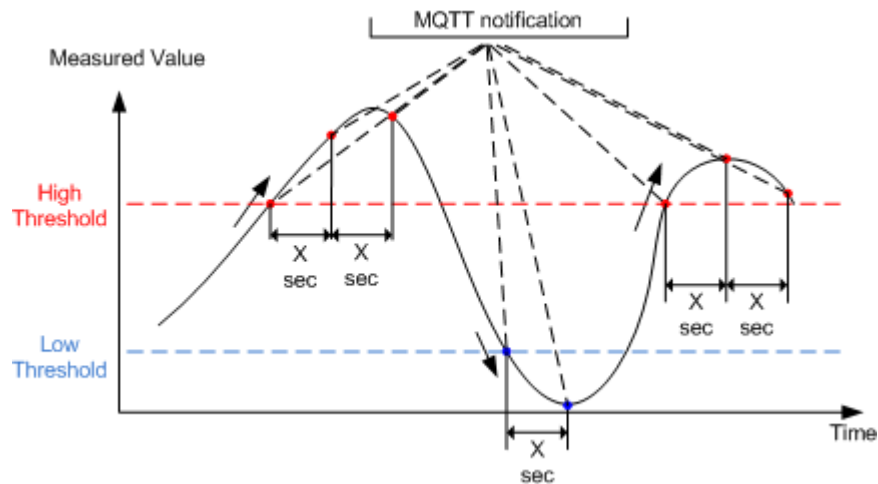
**Figure 8.27.** Sending MQTT notifications with Publish Mode=Periodically and Publish Period = X sec

- If **Publish Mode** parameter from web page MQTT Settings is set to "Edge Triggered" a single notification is sent when measured value crosses over the **High Threshold** or below the **Low Threshold** values (Fig. 8.28);



**Figure 8.28.** Sending traps with Publish Mode=Edge Triggered

- If **Publish Mode** parameter from web page MQTT Settings is set to "Edge Triggered + Periodically" a single notification is sent when measured value crosses over the **High Threshold** or below the **Low Threshold** values. Notifications are also sent in intervals determined by the parameter **Publish Period** from the same page when the measured (scaled) value is higher than **High Threshold** and lower than **Low Threshold** (Fig. 8.29).



**Figure 8.29.** Sending traps with Publish Mode=Edge Triggered + Periodically

In addition, for the "Edge Triggered" and "Edge Triggered + Periodically" publish modes MQTT notifications are sent in the following cases:

- 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**.



The measured value for the Analog Inputs (0-10V) is calculated in the following way:

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

## 8.8. Relays Settings

Relays settings page is shown below.

**Relays Settings**

For smartDEN IP-Maxi-MQ only

Relay	Description	Working Mode	DI No	DI Mode	AI No	AI No	AI Threshold 1	AI Threshold 2	Pulse, ms (x100)	Disable Week Schedule	Use Filter	MQTT
Relay 1	abc	Multiple	0	Normal	0	0	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Relay 2	REL2	Multiple	0	Normal	0	0	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Relay 3	REL3	Multiple	0	Normal	0	0	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Relay 4	REL4	Multiple	0	Normal	0	0	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relay 5	REL5	Multiple	0	Normal	0	0	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relay 6	REL6	Multiple	0	Normal	0	0	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relay 7	REL7	Multiple	0	Normal	0	0	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relay 8	DIH_CON	Multiple	0	Normal	0	0	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Save Reload

This is configuration page only, for monitoring please go to [Monitoring & Control page](#)

**Figure 8.30. Relays settings**

- **Description** - identification string of the relay (max 7 chars);



This description will appear in XML/JSON files, as well as in the Monitoring & Control page.

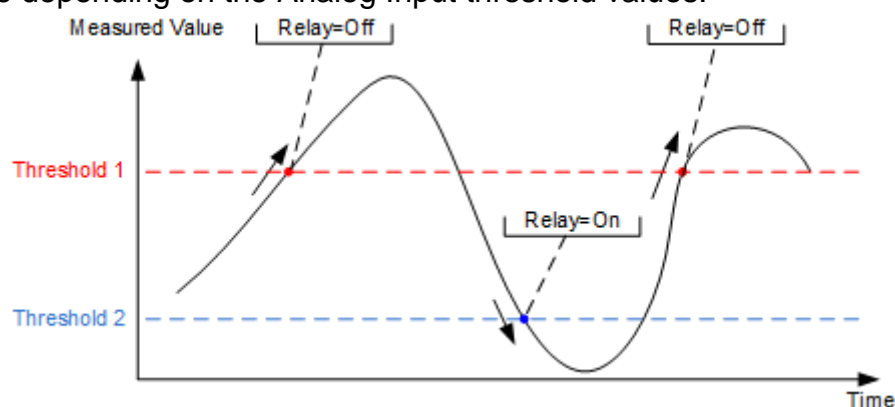
- **Working Mode** - determines the way the Relay is controlled:
  - *Regulator* - in this mode the Relay can be controlled only by an Analog Input. This mode is designed for cases where the input value depends on the output reaction (like thermo-regulator for example). In this mode the parameters DI No, DI Mode and Pulse are not taken in mind. Also in this mode it is not possible to control the Relay via the protocol, Web browser or HTTP/XML/JSON protocol.
  - *Multiple* - in this mode the Relay can be controlled by Analog Inputs, Digital Inputs, Week Schedule or manually (via Web browser, the protocol, HTTP/XML/JSON). This mode is designed for cases where the input event does not depend on the output reaction (for example controlling lamp depending on the sunlight);
- **DI No** – if set to non-zero (1 to 8) this is the number of the Digital Input which is "attached" to the Relay.



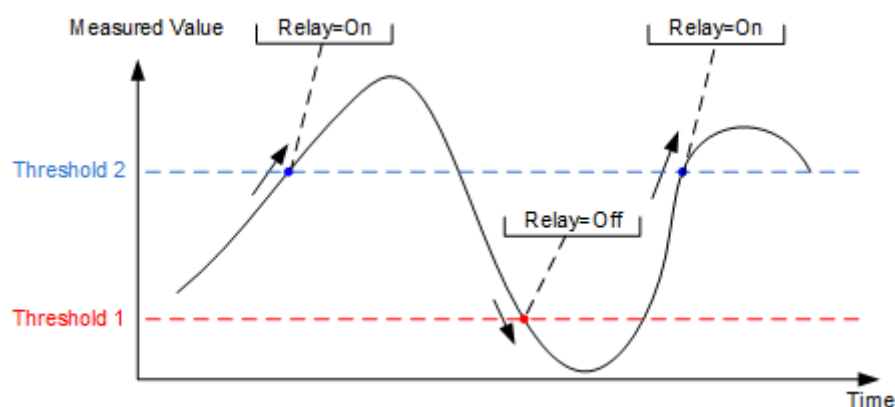
The Relay can be controlled by a Digital Input only in Multiple mode.

- **DI Mode** – one of eight level/edge control modes can be selected:
  - *Normal* - the Relay state is On when the Digital Input state is 1 (On) and Off when the Digital Input state is 0 (Off);
  - *Inverse* - the Relay state is On when the Digital Input state is 0 (Off) and Off when the Digital Input state is 1 (On);
  - *Toggle(DI=0)* - a falling edge (1 -> 0) of the Digital Input toggles the Relay state between On and Off;
  - *Toggle(DI=1)* - a rising edge (0 -> 1) of the Digital Input toggles the Relay state between On and Off;
  - *Normal(DI=0)* - a falling edge (1 -> 0) of the Digital Input switches the Relay Off;
  - *Normal(DI=1)* - a rising edge (0 -> 1) of the Digital Input switches the Relay On;
  - *Inverse(DI=0)* - a falling edge (1 -> 0) of the Digital Input switches the Relay On;

- *Inverse(DI=1)* - a rising edge (0 -> 1) of the Digital Input switches the Relay Off.
- **AI+ No** - the number of the Analog Input (1 to 8) which is "attached" to this Relay. If AI- No is set to zero, this is the single-ended input, otherwise – the (+) lead of the differential input.
- **AI- No** – if set to non-zero (1 to 8), this is the (-) lead of the differential input;
- 💡 If **AI+ No** is non-zero and **AI- No** is zero, the Relay is controlled by the **AI+ No** measured value.
- 💡 If both **AI+ No** and **AI- No** are non-zero, the Relay is controlled by the difference of **AI+ No** and **AI- No** measured values.
- 💡 If **AI+ No** is zero, the Relay is not controlled by the Analog Input (in this case the **AI- No** is not relevant).
- **AI Threshold 1** - the first level for controlling the Relay (range: from -9999 to +9999);
- **AI Threshold 2** - the second level for controlling the Relay (range: from -9999 to +9999);
- 💡 The Relay can be controlled in "normal" (Fig. 8.31) or "inverse" (Fig. 8.32) mode depending on the Analog Input threshold values.



**Figure 8.31.** Normal mode: AI Threshold 1 > AI Threshold 2



**Figure 8.32.** Inverse mode: AI Threshold 1 < AI Threshold 2

- **Pulse, ms (x100)** – if set to non-zero, the Relay operates in pulse mode. The pulse duration is set in tenths of second (for example value of 20 means 2 seconds). The range is from 0 and 65535 (0 disables the pulse mode). When enabled, each time the Relay is switched On, it will generate a single pulse with specified duration.



The Relay can generate pulses only if it's Working Mode=Multiple.



The Relay can be switched On/Off by “attached” Digital or Analog Input, by the protocol or HTTP/XML/JSON command, Week Schedule, and manually from Web Monitoring & Control page.





At any time the pulse is active the Relay can be switched back Off by “attached” Digital or Analog Input, the protocol or HTTP/XML/JSON command, Week Schedule, and manually from Web Monitoring & Control page.

- **Disable Week Schedule** - enables/disables globally the week schedule control for this Relay. This means the Relay may be in the schedule, but if this flag is checked, then it won't be activated by the schedule;
- **MQTT (for smartDEN IP-Maxi-MQ only)** - enables this Relay Output to publish its status via MQTT protocol. The publish topic and publish mechanism depends on selected **Encrypt Topic** parameter (encrypted/non-encrypted mode), on the **Publish Mode** parameter and one the selected Relay Output settings;

## 8.9. Analog Outputs

**Analog Outputs** For smartDEN IP-Maxi-MQ only

Analog Output	Description	Units (0..1023)	MQTT
Output 1	<input type="text" value="Out1"/>	<input type="text" value="574"/> 	<input checked="" type="checkbox"/>
Output 2	<input type="text" value="Out2"/>	<input type="text" value="564"/> 	<input checked="" type="checkbox"/>

This is configuration page only, for monitoring please go to [Monitoring & Control page](#)

**Figure 8.33.** Analog Outputs page

- **Description** - identification string (max 7 chars);  
💡 This description will appear in XML/JSON files, as well as in the [Monitoring & Control](#) page.
- **Units (0..1023)** – Analog Output value (0 to 1023 corresponds to a linear scale of 0V DC to 10V DC).
- **MQTT (for smartDEN IP-Maxi-MQ only)** - enables this Analog Output to publish its status via MQTT protocol. The publish topic and publish mechanism depends on selected **Encrypt Topic** parameter (encrypted/non-encrypted mode), on the **Publish Mode** parameter and one the selected Analog Output settings;

## 8.10. Monitoring & Control

This page is used to monitor the states of the Digital and Analog Inputs as well as to switch On/Off the Relays and set the values of Analog Outputs (Fig. 8.34).



A relay can be switched On/Off from the Monitoring & Control page only if it's **Working Mode="Multiple"**.

Relays							
REL1	REL2	REL3	REL4	REL5	REL6	REL7	REL8
On ▾	Off ▾	Off ▾	Off ▾	Off ▾	Off ▾	On ▾	Off ▾
Toggle	Toggle	Toggle	Toggle	Toggle	Toggle	Toggle	Toggle

Digital Inputs							
DIN1	DIN2	DIN3	DIN4	DIN5	DIN6	DIN7	DIN8
0 (Off)	0 (Off)	0 (Off)	0 (Off)	1 (On)	1 (On)	0 (Off)	1 (On)
0	0	0	0	0	0	0	1

Analog Inputs							
AIN1	AIN2	AIN3	AIN4	AIN5	AIN6	AIN7	AIN8
0	0	478	0	837	837	837	300
0.0 Volt	0.0 mA	478.0 mV	0.0 Kg	837.0 % Ph	---	---	20.3 degC



Analog Outputs	
AOUT1	AOUT2
488  488 Set	797  797 Set

Figure 8.34. Monitoring & Control page

## 8.11. Week Schedule

This page configures the Week Schedule table for switching Relays On/Off at specific times. You can add up to 30 items to the list. The top table of this page allows you to define a new item, while the bottom table shows the already defined list (Fig. 8.35).

New Item (Remaining Items: 27)

Relays								State	Hour (hh:mm)	WeekDays							Start Date (dd/mm/yyyy)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Off ▾	00:00	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	13/02/2018
1	2	3	4	5	6	7	8			Sun	Mon	Tue	Wed	Thu	Fri	Sat	
<input type="button" value="Add"/> <input type="button" value="Reload"/>																	

Existing Items (Start Date: 13/02/2018)

No	Relays	State	Hour	WeekDays	
1	3	On	10:00	Sun, Mon	<input type="checkbox"/>
2	3,4	On	00:10	Tue, Fri	<input type="checkbox"/>
3	2	Off	12:30	Wed, Sat	<input type="checkbox"/>
<input type="button" value="Delete Selected"/> <input type="button" value="Update Start Date"/>					

Relays Description

1: REL1	2: REL2	3: REL3	4: REL4	5: REL5	6: REL6	7: REL7	8: REL8
---------	---------	---------	---------	---------	---------	---------	---------

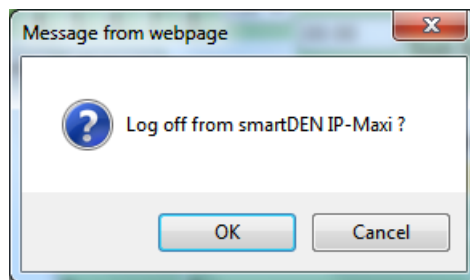
Figure 8.35. Week Schedule page

- **Relays** - select a group of Relays that should be switched;
- **State** - define the state (On/Off) for the selected group of relays;
- **Hour** - time the group of relays will be switched at;
- **WeekDays** - select the days the defined switching should take place;
- **Start Date (dd/mm/yyyy)** - the start date for the Week Schedule.

Once you have defined a new item, click Add. This item will be added as a new row in a Week Schedule table.

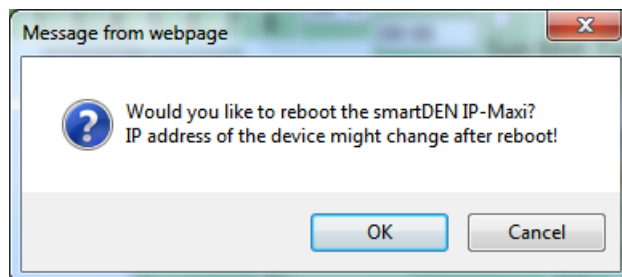
- 💡 This feature allows you to turn specific Relays On/Off upon certain date and time or weekday without the need of LAN connection between the computer and the module.
- 💡 A Relay can be included in Week Schedule only if it's **Working Mode="Multiple"**.
- 💡 To delete an item, select it in **Existing Items table** and click the Delete Selected button.
- 💡 To set a new start date, click **Update Start Date button**.
- 💡 The module has back-up supply source for the RTC in order to keep the current date/time for several days during power off.

## 8.12. Logout



**Figure 8.36.** Log off

### 8.13. Reboot



**Figure 8.37.** Reboot

## 8.14. SNMP Agent (for smartDEN IP-Maxi only)

These settings let you configure the SNMPv2c (Simple Network Management Protocol) access parameters to the **smartDEN IP-Maxi-XX** (Fig. 8.38).

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 8.38.** SNMP agent configuration

- **Enable SNMP** - this option enables or disables SNMP access;
- **SNMP Port** - UDP port number the SNMP agent receives requests on (default port is 161);
- **Read-only Community1/2** - community strings for client's authentication, used in read operations;
- **Read-write Community1/2** - community strings 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.

## 8.15. SNMP Traps (for smartDEN IP-Maxi only)

smartDEN IP-Maxi-XX can be configured to send SNMPv2 trap notifications triggered by Digital/Analog Input conditions (Fig. 8.39).

SNMP Trap Settings	
Enable Trap	<input checked="" type="checkbox"/>
Trap Receiver IP Address	192.168.1.2
Trap Receiver Port	162
Trap Community	password
Trap Sending	<div>Level Triggered</div> <div>Edge Triggered</div>
<div>Save</div> <div>Reload</div>	

Figure 8.39. SNMP Trap settings

- **Enable Trap** - enables or disables sending of 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 string;
- **Trap Sending** - determines if the traps will be sent by level or by edge conditions.

💡 With the **Level Triggered** option the trap message will be sent every 5 seconds when the trap condition is met. This mode is preferred in cases where the UDP trap messages are not guaranteed to be received by the trap server.

💡 With the **Edge Triggered** option the trap message will be sent upon input event only once.

💡 If the traps are enabled, so called "cold trap" message indicating **smartDEN IP-Maxi-XX** is started will be send on power-on or reboot.

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

## 8.16. MQTT Settings (for smartDEN IP-Maxi-MQ only)

These settings let you configure the MQTT communication of **smartDEN IP-Maxi-MQ**.

MQTT Settings	
Enable	<input checked="" type="checkbox"/>
MQTT Server	<input type="text" value="192.168.2.122"/>
Server Port	<input type="text" value="1883"/>
Username	<input type="text" value="admin"/>
Password	<input type="text" value="admin"/>
Publish Mode	<input type="text" value="Periodically"/>
Publish Period, sec	<input type="text" value="5"/>
Encrypt Topic	<input type="checkbox"/>
Non-encrypted Topic	<input type="text" value="SmartDEN_MQTTMaxi/E8EADA006654/#"/>
Encrypted Read Topic	<input type="text" value="485b03c0a0b818e247808cd0dd8c5afe"/>
Encrypted Write Topic	<input type="text" value="f2b90d5543f7073d859d5f10ecb3ce30"/>
Encrypted Notify Topic	<input type="text" value="626acd27d59bc496e7cd2698f5dee1bf"/>
Status	<input type="text" value="Disconnected"/>

**Figure 8.16.** MQTT settings

- **Enable** – enable/disable the MQTT protocol;
- **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), used for encrypted mode only;
- **Password** – password, if used (max. 10 chars), used for encrypted mode only;
- **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 IP-Maxi-MQ**;
- **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](https://iot.eclipse.org), [test.mosquitto.org](https://test.mosquitto.org), [mqtt.fluux.io...](https://mqtt.fluux.io)



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.

## 8.17. Modbus-TCP Settings (for smartDEN IP-Maxi-MT only)

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

### Modbus-TCP Settings

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

**Figure 8.15.** 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.

## 9. HTTP XML/JSON operation

This operation mode allows custom applications to control the **smartDEN IP-Maxi-XX** without using a Web-browser. The custom application acts as a HTTP client, sending HTTP GET requests to the **smartDEN IP-Maxi-XX** (Fig. 9.1). As a reply the **smartDEN IP-Maxi-XX** returns data as either JSON or XML file for parsing and/or processing by the custom application.



**Figure 9.1. smartDEN IP-Maxi-XX working as a HTTP server**

To receive the current state of the **smartDEN IP-Maxi-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.xml)

[http://192.168.1.100/current\\_state.json](http://192.168.1.100/current_state.json)

The custom application can also control the **smartDEN IP-Maxi-XX** by sending parameters (name/value pairs) with the HTTP/XML/JSON GET request, for example:

[http://192.168.1.100/current\\_state.xml?Relay1=1&Pulse2=10&Count3=0](http://192.168.1.100/current_state.xml?Relay1=1&Pulse2=10&Count3=0)

[http://192.168.1.100/current\\_state.json?Relay1=1&Pulse2=10&Count3=0](http://192.168.1.100/current_state.json?Relay1=1&Pulse2=10&Count3=0)

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

### 9.1. 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](http://192.168.1.100/current_state.xml)

##### Reply (login required):

```
<CurrentState>  
<LoginKey>65156</LoginKey>  
</CurrentState>
```

[http://192.168.1.100/current\\_state.json](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](http://192.168.1.100/current_state.xml?pw=28237099263eabfd88626124a822c64c)

or

[http://192.168.1.100/current\\_state.json?pw=28237099263eabfd88626124a822c64c](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.

## 9.2. 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.xml?pw=admin)

[http://192.168.1.100/current\\_state.json?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-Maxi-XX** for time, specified by **Session Timeout** parameter, the session "times out" and a new login is required.

### 9.3. Getting the current state

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

[http://192.168.1.100/current\\_state.xml](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](http://192.168.1.100/current_state.json)

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

## 9.4. Multiple XML Access

In this mode the password should be passed as non-encrypted parameter with each request:

[http://192.168.1.100/current\\_state.xml?pw=admin&Relay1=1](http://192.168.1.100/current_state.xml?pw=admin&Relay1=1)

[http://192.168.1.100/current\\_state.json?pw=admin&Relay1=0](http://192.168.1.100/current_state.json?pw=admin&Relay1=0)



**Multiple XML/JSON Access** is not allowed when **Encrypt Password** option is enabled.

## 9.5. Parameters

After a login the custom application can also control the **smartDEN IP-Maxi-XX** by sending parameters (name/value pairs) with the HTTP GET request.

Valid parameters and values are shown in the bellow tables.

**Table 9.1.** HTTP parameters

Name	Value	Description
Relay <i>i</i>	0	Switch the relay <i>i</i> off ( <i>i</i> =1..8)
	1	Switch the relay <i>i</i> on ( <i>i</i> =1..8)
	2	Toggle the relay <i>i</i> state ( <i>i</i> =1..8)
SetAll	0...65535	Set all the relays with single command
Pulse <i>i</i>	1...65535	Generate pulse to an output ( <i>i</i> =1...8)
Count <i>i</i>	0.. 4294967295	Set Counter value for Digital Input ( <i>i</i> =1..8)
AnalogOutput <i>i</i>	0..1023	Set Analog Output units ( <i>i</i> =1...2)
Date <sup>(1)</sup>	dd/mm/yyyy	Set date
Time <sup>(1)</sup>	hh:mm	Set time
pw	password	Required at login

<sup>(1)</sup> smartDEN IP-Maxi-MQ and smartDEN IP-Maxi-MT only




The overall length of name/value pairs is limited to 100. If this limit is exceeded, the request fails with the "**414 Request-URI Too Long: Buffer overflow**" status code.

## 10. Integration Protocols

### 10.1. SNMP (for smartDEN IP-Maxi only)

#### 10.1.1. SNMP Agent

smartDEN IP-Maxi supports SNMPv1 protocol – snmpget and snmpset. 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.

#### 10.1.2. Product

**Table 10.1. Product**

OID	Description	Access	Syntax
x.8.1.1.0	Device Name	R/W	DisplayString (SIZE(0..14))
x.8.1.2.0	Firmware version	R	DisplayString
x.8.1.3.0	Firmware build date	R	DisplayString

#### 10.1.3. Setup

**Table 10.2. Digital Inputs**

Start OID	End OID	Description	Access	Syntax
x. 8.2.1.1.2.0	x. 8.2.1.1.2.7	Digital Input Description	R/W	DisplayString (SIZE(0..7))
x. 8.2.1.1.3.0	x. 8.2.1.1.3.7	Digital Input Counter	R/W	Counter32 (0..4294967295)
x. 8.2.1.1.4.0	x. 8.2.1.1.4.7	Digital Input Filter, ms	R/W	Integer (0..200)
x. 8.2.1.1.5.0	x. 8.2.1.1.5.7	Digital Input Trap Enable Flag	R/W	Integer { No(0), Yes(1) }
x. 8.2.1.1.6.0	x. 8.2.1.1.6.7	Digital Input Trap Value	R/W	Integer { Off(0), On(1), Both(2) }
x. 8.2.1.1.7.0	x. 8.2.1.1.7.7	Digital Input State	R	Integer { Off(0), On(1) }

**Table 10.3. Analog Inputs**

Start OID	End OID	Description	Access	Syntax
x. 8.2.2.1.2.0	x. 8.2.2.1.2.7	Analog Input Description	R/W	DisplayString (SIZE(0..7))
x. 8.2.2.1.3.0	x. 8.2.2.1.3.7	Analog Input Trap LowThreshold	R/W	Integer (-9999..9999)
x. 8.2.2.1.4.0	x. 8.2.2.1.4.7	Analog Input Trap HighThreshold	R/W	Integer (-9999..9999)

<b>x. 8.2.2.1.5.0</b>	<b>x. 8.2.2.1.5.7</b>	Analog Input Trap Enable Flag	R/W	Integer { No(0), Yes(1) }
<b>x. 8.2.2.1.6.0</b>	<b>x. 8.2.2.1.6.7</b>	Analog Input ADC Value	R	Integer (0..1023)
<b>x. 8.2.2.1.7.0</b>	<b>x. 8.2.2.1.7.7</b>	Analog Input Min Value	R/W	DisplayString (SIZE(0..7))
<b>x. 8.2.2.1.8.0</b>	<b>x. 8.2.2.1.8.7</b>	Analog Input Max Value	R/W	DisplayString (SIZE(0..7))
<b>x. 8.2.2.1.9.0</b>	<b>x. 8.2.2.1.9.7</b>	Analog Input Label	R/W	DisplayString (SIZE(0..3))
<b>x. 8.2.2.1.10.0</b>	<b>x. 8.2.2.1.10.7</b>	Analog Input Measured Value	R	DisplayString

**Table 10.4. Relays**

Start OID	End OID	Description	Access	Syntax
<b>x. 8.2.3.1.2.0</b>	<b>x. 8.2.3.1.2.7</b>	Relay Description	R/W	DisplayString (SIZE(0..7))
<b>x. 8.2.3.1.3.0</b>	<b>x. 8.2.3.1.3.7</b>	Relay Working Mode	R/W	Integer {Multiple(0),Regulator(1)}
<b>x. 8.2.3.1.4.0</b>	<b>x. 8.2.3.1.4.7</b>	Relay ← Digital Input No	R/W	Integer (0..8)
<b>x. 8.2.3.1.5.0</b>	<b>x. 8.2.3.1.5.7</b>	Relay ← Digital Input Mode	R/W	Integer (0..7)
<b>x. 8.2.3.1.6.0</b>	<b>x. 8.2.3.1.6.7</b>	Relay ← Analog Input (+) No	R/W	Integer (0..8)
<b>x. 8.2.3.1.7.0</b>	<b>x. 8.2.3.1.7.7</b>	Relay ← Analog Input (-) No	R/W	Integer (0..8)
<b>x. 8.2.3.1.8.0</b>	<b>x. 8.2.3.1.8.7</b>	Relay ← Analog Threshold 1	R/W	Integer (-9999..9999)
<b>x. 8.2.3.1.9.0</b>	<b>x. 8.2.3.1.9.7</b>	Relay ← Analog Threshold 2	R/W	Integer (-9999..9999)
<b>x. 8.2.3.1.10.0</b>	<b>x. 8.2.3.1.10.7</b>	Relay Disable Week Schedule	R/W	Integer { No(0), Yes(1) }
<b>x. 8.2.3.1.11.0</b>	<b>x. 8.2.3.1.11.7</b>	Relay Set Pulse Period	R/W	Integer32 (0..65535)
<b>x. 8.2.3.1.12.0</b>	<b>x. 8.2.3.1.12.7</b>	Relay Start Pulse	R/W	Integer32 (0..65535)
<b>x. 8.2.3.1.13.0</b>	<b>x. 8.2.3.1.13.7</b>	Relay State	R/W	Integer {Off(0), On(1), Toggle(2)}
<b>x. 8.2.3.1.14.0</b>	<b>x. 8.2.3.1.14.7</b>	Relay Use Filter	R/W	Integer { No(0), Yes(1) }
<b>x. 8.2.3.1.15.0</b>	<b>x. 8.2.3.1.15.7</b>	Relay Filter, ms	R/W	Integer (0..9999)

**Table 10.5. Analog Outputs**

Start OID	End OID	Description	Access	Syntax
<b>x. 8.2.4.1.2.0</b>	<b>x. 8.2.4.1.2.1</b>	Analog Output Description	R/W	DisplayString (SIZE(0..7))
<b>x. 8.2.4.1.3.0</b>	<b>x. 8.2.4.1.3.1</b>	Analog Output Units	R/W	Integer (0..1023)

### 10.1.4. Control

**Table 10.6. Control**

OID	Description	Access	Syntax
<b>x.8.3.1.0</b>	TemperatureScale	R/W	Integer {Celsius(0), Fahrenheit(1) }
<b>x.8.3.2.0</b>	AnalogInputFilter	R/W	Integer (0..30)
<b>x.8.3.3.0</b>	RelayFilter	R/W	Integer (0..9999)
<b>x.8.3.4.0</b>	Digital Inputs State	R	Integer (0..255)
<b>x.8.3.5.0</b>	Relays State	R/W	Integer (0..255)
<b>x.8.3.6.0</b>	System Date (dd/mm/yyyy)	R/W	DisplayString
<b>x.8.3.7.0</b>	System Time (hh:mm)	R/W	DisplayString
<b>x.8.3.8.0</b>	Reboot smartDEN IP-Maxi-XX	R/W	Integer (0..255)
<b>x.8.3.9.0</b>	sysUpTime	R	TimeTicks



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', the code in decimal is 97.

### 10.1.5. Week Schedule

**Table 10.7. Week Schedule Start Date**

OID	Description	Access	Syntax
<b>x.8.5.1.0</b>	Week Schedule Start Date	R/W	DisplayString

**Table 10.8. Week Schedule Rows**

Start OID	End OID	Description	Access	Syntax
<b>x. 8.5.2.1.2.0</b>	<b>x. 8.5.2.1.2.29</b>	Row Enable Flag	R/W	Integer { No(0),Yes(1) }
<b>x. 8.5.2.1.3.0</b>	<b>x. 8.5.2.1.3.29</b>	Relays Code	R/W	Integer (0..255)
<b>x. 8.5.2.1.4.0</b>	<b>x. 8.5.2.1.4.29</b>	Relays State	R/W	Integer { Off(0), On(1) }
<b>x. 8.5.2.1.5.0</b>	<b>x. 8.5.2.1.5.29</b>	Hour (hh:mm)	R/W	DisplayString
<b>x. 8.5.2.1.6.0</b>	<b>x. 8.5.2.1.6.29</b>	Week Days Code	R/W	Integer (0..127)

### 10.1.1. Traps

Configuration parameters related with the SNMP traps are shown in the below **Table 10.9.**

**Table 10.9. Traps**

OID	Description	Access	Syntax
<b>x.8.4.1.0</b>	Trap Enable Flag	R/W	Integer { No(0),Yes(1) }
<b>x.8.4.2.0</b>	Trap Receiver IP Address	R/W	IpAddress
<b>x.8.4.3.0</b>	Trap Receiver Port	R/W	Integer32 (0..65535)
<b>x.8.4.4.0</b>	Community in Sending Trap	R/W	DisplayString (SIZE (0..7))
<b>x.8.4.5.0</b>	Trap Sending Mode	R/W	Integer { Level(0), Edge(1) }
<b>x.8.4.6.0</b>	System UpTime	R	TimeTicks

Each of the inputs can be individually configured to send trap notifications when an event is triggered.

**Table 10.10. SNMP v1 traps**

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.8.2.1.1.7.0 - x.8.2.1.1.7.7	Digital Input State (off-0,on-1)	Digital Input trap
		2	x.8.2.1.1.2.0 - x.8.2.1.1.2.7	Digital Input Description (maxlen=7)	
enterpriseSpecific	2	1	x.8.2.2.1.10.0 - x.8.2.2.1.10.3	Analog Input Measured Value	Analog Input trap
		2	x.8.2.2.1.2.0 - x.8.2.2.1.2.3	Analog Input Description (maxlen=7)	
enterpriseSpecific	2	1	x.8.2.3.1.7.4 - x.8.2.3.1.7.7	Temperature Input Value	Temperature Input trap
		2	x.8.2.3.1.2.4 - x.8.2.3.1.2.7	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-Maxi** is started will be send on power-on or reboot.

## 10.2. Modbus TCP (for smartDEN IP-Maxi-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-Maxi-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-Maxi-MT** module:

**Table 10.11.** Modbus commands

Function	Code	Resources	Access
<b>Read Coil Status</b>	01 (0x01)	Relays 1..8	bit
<b>Write Single Coil</b>	05 (0x05)	Relays 1..8	bit
<b>Write Multiple Coils</b>	15 (0x0F)	Relays 1..8	bit
<b>Read Holding Registers</b>	03 (0x03)	Configuration parameters, Analog outputs, Scaled Analog/Temperature values	16-bit
<b>Write Single Register</b>	06 (0x06)	Generate pulses, Configuration parameters, Analog outputs	16-bit
<b>Write Multiple Registers</b>	16 (0x10)	Generate pulses, Configuration parameters, Analog outputs	16-bit
<b>Read Input Status</b>	02 (0x02)	Digital Inputs 1..8	bit
<b>Read Input Registers</b>	04 (0x04)	Analog/Temperature Inputs 1..8	16-bit

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

**Table 10.12.** Modbus registers

Resources		Start Address	End Address	Value Range	Comm and code
Relays 1..8					
Generate Pulses on Relays (write only)		0x0000	0x0007	1..65535	6, 16
Description <sup>(3) (4)</sup>					3, 16
	Relay 1	0x0100	0x0103	7 ASCII chars max	
	Relay 2	0x0110	0x0113		
	Relay 3	0x0120	0x0123		
	Relay 4	0x0130	0x0133		
	Relay 5	0x0140	0x0143		
	Relay 6	0x0150	0x0153		
	Relay 7	0x0160	0x0163		
	Relay 8	0x0170	0x0173		
Working Mode		0x0200	0x0207	0-Multiple 1-Regulator	3, 6, 16
DI No		0x0300	0x0307	0..8	3, 6, 16
DI Mode		0x0400	0x0407	0-Normal 1-Inverse 2-Toggle(DI=0) 3-Toggle(DI=1) 4-Normal(DI=0) 5-Normal(DI=1) 6-Inverse(DI=0) 7-Inverse(DI=1)	3, 6, 16
AI+ No		0x0500	0x0507	0..8	3, 6, 16
AI- No		0x0600	0x0607	0..8	3, 6, 16
AI Threshold 1 <sup>(2) (3) (4)</sup>					3, 16
Value range: -9999..+9999	AI Threshold 1 (AI 1)	0x0700	0x0702	5 ASCII chars max	
	AI Threshold 1 (AI 2)	0x0710	0x0712		
	AI Threshold 1 (AI 3)	0x0720	0x0722		
	AI Threshold 1 (AI 4)	0x0730	0x0732		
	AI Threshold 1 (AI 5)	0x0740	0x0742		
	AI Threshold 1 (AI 6)	0x0750	0x0752		
	AI Threshold 1 (AI 7)	0x0760	0x0762		
	AI Threshold 1 (AI 8)	0x0770	0x0772		
AI Threshold 2 <sup>(2) (3) (4)</sup>					3, 16
Value range: -9999..+9999	AI Threshold 2 (AI 1)	0x0800	0x0802	5 ASCII chars max	
	AI Threshold 2 (AI 2)	0x0810	0x0812		
	AI Threshold 2 (AI 3)	0x0820	0x0822		
	AI Threshold 2 (AI 4)	0x0830	0x0832		
	AI Threshold 2 (AI 5)	0x0840	0x0842		
	AI Threshold 2 (AI 6)	0x0850	0x0852		
	AI Threshold 2 (AI 7)	0x0860	0x0862		

	AI Threshold 2 (AI 8)	0x0870	0x0872		
Pulse, ms (x100)		0x0900	0x0907	0..65535	3, 6, 16
Disable Week Schedule		0x0A00	0x0A07	0-Enable schedule 1-Disable schedule	3, 6, 16
Use Filter		0x0B00	0x0B07	0-Disable filter 1-Enabel filter	3, 6, 16
Digital Inputs 1..8					
Description <sup>(3)</sup> <sup>(4)</sup>					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		
Counter <sup>(1)</sup>					3, 16
	Counter 1	0x1100	0x1101	0..2 <sup>32</sup> -1 (32 bits)	
	Counter 2	0x1110	0x1111		
	Counter 3	0x1120	0x1121		
	Counter 4	0x1130	0x1131		
	Counter 5	0x1140	0x1141		
	Counter 6	0x1150	0x1151		
	Counter 7	0x1160	0x1161		
	Counter 8	0x1170	0x1171		
Filter (ms)		0x1200	0x1207	0..200	3, 6, 16
Analog/Temperature Inputs 1..8					
Description <sup>(3)</sup> <sup>(4)</sup>					3, 16
	AIN 1	0x2000	0x2003	7 ASCII chars max	
	AIN 2	0x2010	0x2013		
	AIN 3	0x2020	0x2023		
	AIN 4	0x2030	0x2033		
	TIN 1	0x2040	0x2043		
	TIN 2	0x2050	0x2053		
	TIN 3	0x2060	0x2063		
	TIN 4	0x2070	0x2073		
Min (Ain1...Ain4) <sup>(2)</sup> <sup>(3)</sup> <sup>(4)</sup>					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 (Tin1...Tin4) <sup>(2)</sup> , read only					3, 16
Value range: -9999.9...+9999.9	Min (TIN 1)	0x2140	0x2143	7 ASCII chars max	
	Min (TIN 2)	0x2150	0x2153		
	Min (TIN 3)	0x2160	0x2163		

	Min (TIN 4)	0x2170	0x2173		
Max (Ain1...Ain4) <sup>(2)(3)(4)</sup>					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 (Tin1...Tin4) <sup>(2)</sup> , read only					3, 16
Value range: -9999.9..+9999.9	Max (TIN 1)	0x2240	0x2243	7 ASCII chars max	
	Max (TIN 2)	0x2250	0x2253		
	Max (TIN 3)	0x2260	0x2263		
	Max (TIN 4)	0x2270	0x2273		
Label (Ain1...Ain4) <sup>(3)</sup>					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 (Tin1...Tin4), read only					3, 16
	Label (TIN 1)	0x2340	0x2341	4 ASCII chars max	
	Label (TIN 2)	0x2350	0x2351		
	Label (TIN 3)	0x2360	0x2361		
	Label (TIN 4)	0x2370	0x2371		
Ain1...Ain4, Tin1...Tin4 Scaled Value, read only <sup>(2)</sup>					3, 16
	AIN 1	0x2400	0x2406	14 ASCII chars max. It is a string in hexadecimal representation. For example: <b>0000 3233 2e38</b> <b>2064 6567 4300</b> is <b>23.8 degC</b>	
	AIN 2	0x2410	0x2416		
	AIN 3	0x2420	0x2426		
	AIN 4	0x2430	0x2436		
	TIN 1	0x2440	0x2446		
	TIN 2	0x2450	0x2456		
	TIN 3	0x2460	0x2466		
	TIN 4	0x2470	0x2476		
Analog Outputs 1..2					
Description <sup>(3)(4)</sup>					3, 16
	AOUT 1	0x3000	0x3003	7 ASCII chars max	
	AOUT 2	0x3010	0x3013		
Units					3, 6, 16
	AOUT 1	0x3100	0x3100	0..1023	
	AOUT 2	0x3101	0x3101		
Week Schedule					
Week Schedule Start Date (Day)		0x6100	0x6100	1..31	3, 6, 16
Week Schedule Start Date (Month)		0x6101	0x6101	1..12	3, 6, 16
Week Schedule Start Date (Year)		0x6102	0x6102	2000..2099	3, 6, 16
Week Schedule Row Enable Flag		0x6200	0x621D	0..1	3, 6, 16
Week Schedule Row Outputs Code		0x6300	0x631D	0..65535	3, 6, 16
Week Schedule Row Outputs State		0x6400	0x641D	0..1	3, 6, 16
Week Schedule Row Hour		0x6500	0x651D	0..23	3, 6, 16
Week Schedule Row Minute		0x6600	0x661D	0..59	3, 6, 16

Week Schedule Row WeekDays Code	0x6700	0x671D	0..127	3, 6, 16
<b>General Settings</b>				
Save Outputs Option	0x6800	0x6800	0..1	3, 6, 16
System Date (Day)	0x6900	0x6900	1..31	3, 6, 16
System Date (Month)	0x6901	0x6901	1..12	3, 6, 16
System Date (Year)	0x6902	0x6902	2000..2099	3, 6, 16
System Time (Hour)	0x6903	0x6903	0..23	3, 6, 16
System Time (Minutes)	0x6904	0x6904	0..59	3, 6, 16
Firmware Version (read only)	0x6A00	0x6A00		3
Device Name <sup>(3) (4)</sup>	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
Relays Filter, ms	0x6E00	0x6E00	0..9999	3, 6, 16

(1) – Counters are 32-bit wide. Use **Write Multiple Registers/ Read Holding Registers** commands to set/get the high and low words of the counter value.

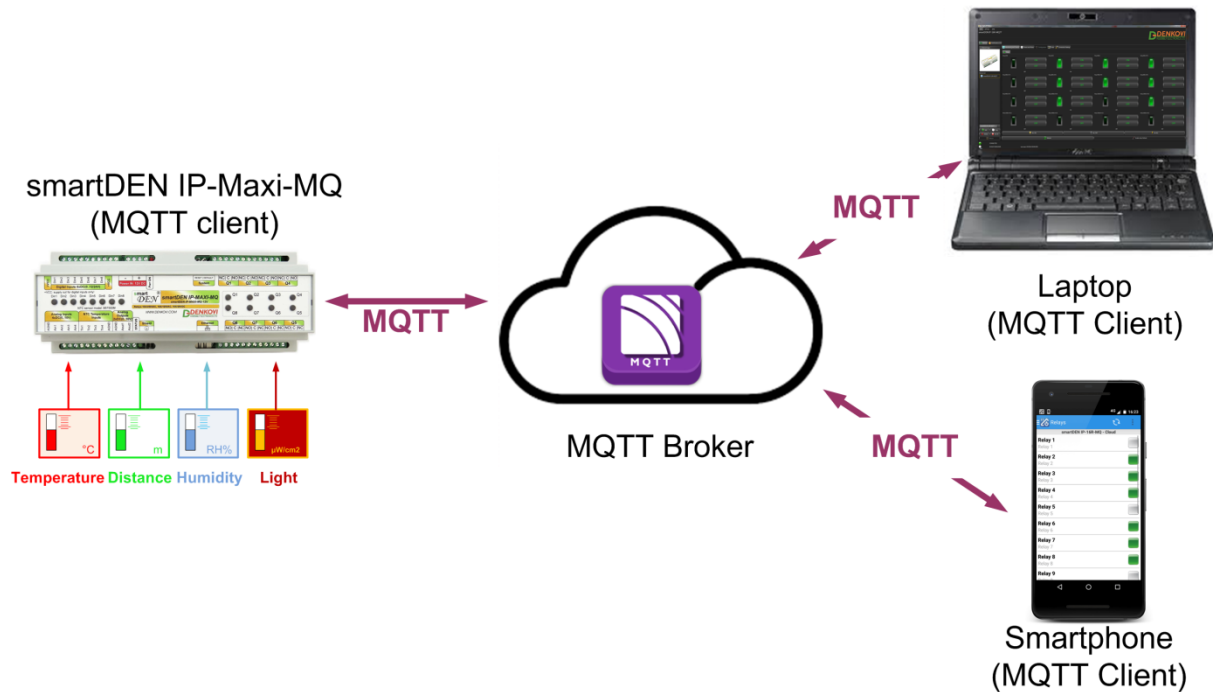
(2) Read operation should start from the first address

(3) Write operation should start from the first address

(4) Allowed symbols – all with ascii code  $\geq 32$  (0x20). Add a zero byte to terminate the string

### 10.3. MQTT (for smartDEN IP-Maxi-MQ only)

The **smartDEN IP-Maxi-MQ** supports MQTT protocol V3.1.1. The module runs a MQTT client that publishes the relays states, and subscribes to messages to switch the relays On/Off.



**Figure 10.1. smartDEN IP-Maxi-MQ working as MQTT client**

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

### 10.3.1. Plain (non-encrypted) mode

In this mode, **smartDEN IP-Maxi-MQ** 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 IP-Maxi-MQ** via MQTT protocol. All topics begin with the following prefix:

SmartDEN\_MQTTMaxi/<**MAC identifier**>/

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

SmartDEN\_MQTTMaxi/**E8EADA123456**/Get/#  
SmartDEN\_MQTTMaxi/**E8EADA123456**/Set/All

#### 10.3.1.1. Topics

The topics are listed in Table 10.31:

- Get topics - the **smartDEN IP-Maxi-MQ** publishes data up-on certain conditions to these topics. Another MQTT client (Laptop, Smartphone) is subscribed to these topics and receives the data. In this case, the parent topic is **Get**. For example:

SmartDEN\_MQTTMaxi/E8EADA123456/**Get**/Status

- Set topics - An MQTT Client (Laptop, Smartphone) publishes to these topics the request. The **smartDEN IP-Maxi-MQ** subscribes to them and receives the request data and takes some actions (for example turn relays) and/or send reply to the Get topics. In this case, the parent topic is **Set**. For example:

SmartDEN\_MQTTMaxi/E8EADA123456/**Set**/GetStatus

**Table 10.10.** MQTT plain (non-encrypted) topics

Parent topic	Topic	Application Message	Description
<b>Generic</b>			
<b>Get</b>	<b>/#</b>		All messages published by the mqtt clients
<b>Get</b>	<b>/Status</b>	Rebooted, Connected, Disconnected	The module status related to the MQTT broker connection
<b>I/O Monitoring and Notifications</b>			
<b>Set</b>	<b>/GetStatus</b>	0,1,2	0 - forces the module to publish at once the I/O states under the respective below Notifications

			<p>topics (excluding the <b>/All</b> topic)</p> <p>1 - all the I/O states are published at once in XML format under the <b>/All</b> topic.</p> <p>2 - all the I/O states are published at once in JSON format under the <b>/All</b> topic.</p> <p>See: <a href="#">Appendix 1. Application reply formats</a></p>
Get	<b>/Ri</b>	On, Off	Notification relay topic, containing the relay ( <b>i=1...8</b> ) state*
Get	<b>/DIi</b>	On, Off	Notification DI topic, containing the digital input ( <b>i=1...8</b> ) state*
Get	<b>/ATIi</b>	0...1023	Notification AI/TI raw topic, containing the analog/temperature input ( <b>i=1...4</b> - analog, <b>i=5...8</b> - temperature) raw value*
Get	<b>/ATISi</b>	String	Notification AI/TI scaled topic, containing the analog/temperature input ( <b>i=1...4</b> - analog, <b>i=5...8</b> - temperature) scaled value*
Get	<b>/AOi</b>	0...1023	Notification AO topic, containing the analog output ( <b>i=1...2</b> ) state (units)*
Get	<b>/All</b>	I/O states in XML or JSON format	All the I/O states in XML or JSON format
<b>Settings</b>			
Set	<b>/SDate</b>	Date in format dd/mm/yyyy	The current system date
Set	<b>/STime</b>	Time in format hh:mm	The current system time
<b>Relays (i=1...8)</b>			
Set	<b>/RSi</b>	0,1,2	Turns relays OFF or ON (0 - OFF, 1 - ON, 2 – TOGGLE)
Set	<b>/RAIi</b>	0 to 255	Turns all the relays at once. The most significant bit of the value specifies the state of relay 8, and the least significant bit – the state of relay 1
Set	<b>/RNI</b>	1 to 65535	Generates a positive (ON) pulse on a single relay. The pulse duration is in ms x 100
Set	<b>/RFi</b>	1 to 65535	Generates a negative (OFF) pulse on a single relay. The pulse duration is in ms x 100
<b>Analog Outputs (i=1...2)</b>			
Set	<b>/AOSi</b>	0...1023	Set the analog output value

\*Please note these messages (notifications) are published by the **smartDEN IP-Maxi-MQ** module only if the "MQTT" option is checked (enabled) in the respective

settings page for the Relays, Digital Inputs, Analog/Temperature Inputs and Analog Outputs. 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);
- upon receiving command with value of 0 under the topic Set/GetStatus.

### 10.3.2. 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.

#### 10.3.2.1. 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 IP-Maxi-MQ** is subscribed to this topic and replies back to Admin Write Topic;
- **Admin Write Topic** - the **smartDEN IP-Maxi-MQ** 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 IP-Maxi-MQ** module upon event - I/O event, module reboot etc.



Notification MQTT messages are published by the **smartDEN IP-Maxi-MQ** module only if the **MQTT** option is checked (enabled) in the respective settings page for the Relays, Digital Inputs, Analog/Temperature Inputs and Analog Outputs.

#### 10.3.2.2. 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 IP-Maxi-MQ** 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 10.32 are with prefix **MQTT\_COMMAND?**

**Table 10.11.** Application messages (commands)

XML Application Message (Command)	JSON Application Message (Command)	Description
GETSTATUS;	GETSTATUS2;	Just get all the I/O states
RSXi= <b>x</b> ;	RSJi= <b>x</b> ;	Turns relay ( <b>i</b> =1...8) ON/OFF. <b>x</b> : 0 - OFF, 1 - ON, 2 – TOGGLE
RALLX= <b>x</b> ;	RALLJ= <b>x</b> ;	Turns all the relays at once. The most significant bit of the value specifies the state of relay 8, and the least significant bit – the state of relay 1. <b>x</b> represents the relays states - from 0 to 255
RNXi= <b>x</b> ;	RNJi= <b>x</b> ;	Generates a positive (ON) pulse on a single

		relay ( <i>i</i> =1...8). The pulse duration <b>x</b> is in ms x 100
RFX <i>i</i> = <b>x</b> ;	RFJ <i>i</i> = <b>x</b> ;	Generates a negative (OFF) pulse on a single relay ( <i>i</i> =1...8). The pulse duration <b>x</b> is in ms x 100
DONAMEX <i>i</i> = <b>x</b> ;	DONAMEJ <i>i</i> = <b>x</b> ;	Sets the relay ( <i>i</i> =1...8) name. The length of <b>x</b> is 1 to 7 symbols
DICX <i>i</i> = <b>x</b> ;	DICJ <i>i</i> = <b>x</b> ;	Sets the digital input ( <i>i</i> =1...8) counter. Possible values: 0...4294967295
DINAMEX <i>i</i> = <b>x</b> ;	DINAMEJ <i>i</i> = <b>x</b> ;	Sets the digital input ( <i>i</i> =1...8) name. The length of <b>x</b> is 1 to 7 symbols
AINAMEX <i>i</i> = <b>x</b> ;	AINAMEJ <i>i</i> = <b>x</b> ;	Sets the analog/temperature input ( <i>i</i> =1...4 - analog, <i>i</i> =5...8 - temperature) name. The length of <b>x</b> is 1 to 7 symbols
AOSX <i>i</i> = <b>x</b> ;	AOSJ <i>i</i> = <b>x</b> ;	Sets the analog output ( <i>i</i> =1...2) state. Possible values: 0...1023
AONAMEX <i>i</i> = <b>x</b> ;	AONAMEJ <i>i</i> = <b>x</b> ;	Sets the analog output ( <i>i</i> =1...2) name. The length of <b>x</b> is 1 to 7 symbols

## 11. Software

### 11.1. DRMv3 Software

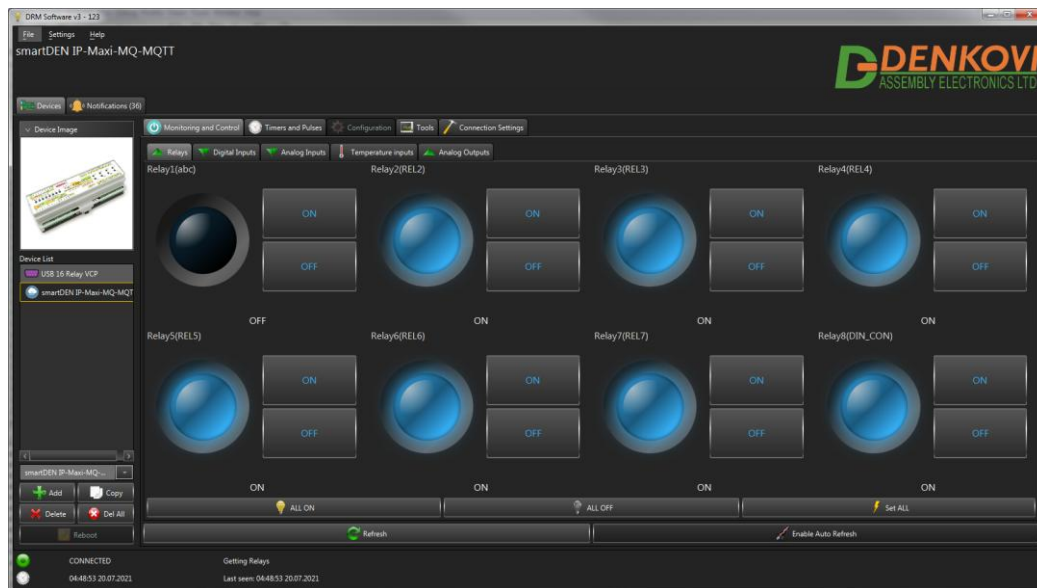


Figure 11.1. smartDEN IP-Maxi-XX and DRMv3

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

#### 11.1.1. smartDEN IP-Maxi

Device from DRMv3 list: **smartDEN IP-Maxi (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 IP-Maxi-MQ

Device from DRMv3 list: **smartDEN IP-Maxi-MQ-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.

Device from DRMv3 list: **smartDEN IP-Maxi-MQ-XML (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 match.

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-Maxi-XX and DAE-aModules android app**

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

### 11.2.1. smartDEN IP-Maxi

Device from DAE-aModules Device Model list: **smartDEN IP-MAXI**

Integration (communication) protocol: SNMP

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

### 11.2.2. smartDEN IP-Maxi-MQ

Device from DAE-aModules Device Model list: **smartDEN IP-Maxi - 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.

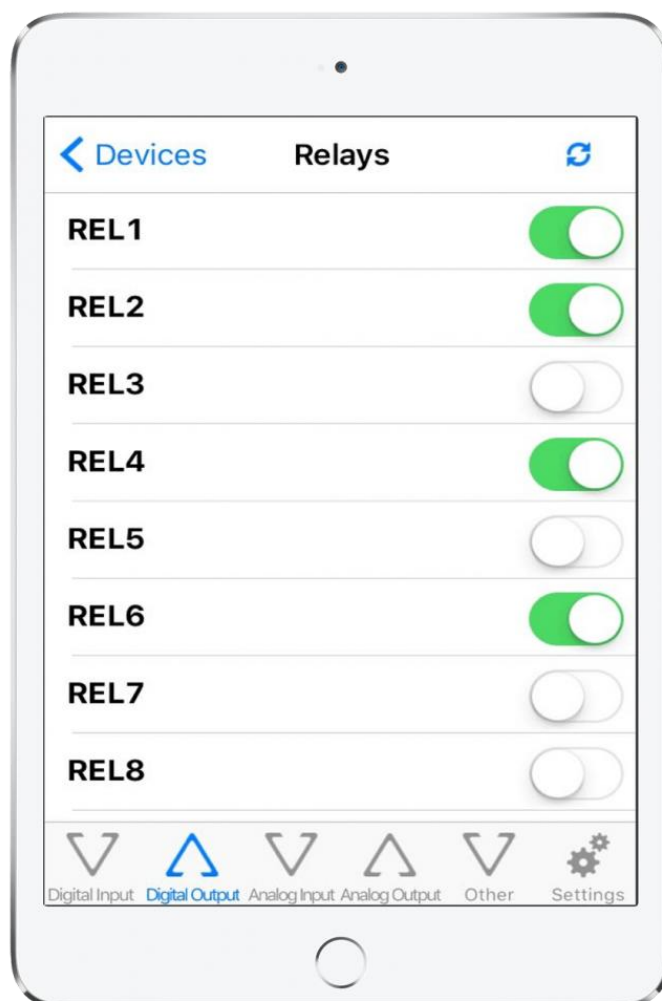
Device from DAE-aModules Device Model list: **smartDEN IP-Maxi - XML**

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 [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-Maxi and DAE-iModules iOS app**

### 11.3.1. smartDEN IP-Maxi

Device from DAE-iModules Device Model list: **smartDEN IP-Maxi**

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-Maxi-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-Maxi-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-Maxi 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-Maxi-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 IP-Maxi-MQ 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>DIN1</Name>
    <Value>0</Value>
    <Count>0</Count>
  </DigitalInput1>
  +<DigitalInput2></DigitalInput2>
  +<DigitalInput3></DigitalInput3>
  +<DigitalInput4></DigitalInput4>
  +<DigitalInput5></DigitalInput5>
  +<DigitalInput6></DigitalInput6>
  +<DigitalInput7></DigitalInput7>
  +<DigitalInput8></DigitalInput8>
  -<AnalogInput1>
    <Name>AIN1</Name>
    <Value>0</Value>
    <Measure>100.0 mV</Measure>
  </AnalogInput1>
  +<AnalogInput2></AnalogInput2>
  +<AnalogInput3></AnalogInput3>
  +<AnalogInput4></AnalogInput4>
  -<AnalogInput5>
    <Name>TIN1</Name>
    <Value>270</Value>
    <Measure>23.8 degC</Measure>
  </AnalogInput5>
  +<AnalogInput6></AnalogInput6>
  +<AnalogInput7></AnalogInput7>
  +<AnalogInput8></AnalogInput8>
  -<Relay1>
    <Name>abc</Name>
    <Value>0</Value>
  </Relay1>
  +<Relay2></Relay2>
  +<Relay3></Relay3>
  +<Relay4></Relay4>
  +<Relay5></Relay5>
  +<Relay6></Relay6>
  +<Relay7></Relay7>
  +<Relay8></Relay8>
  -<AnalogOutput1>
    <Name>1</Name>
    <Value>0</Value>
  </AnalogOutput1>
  +<AnalogOutput2></AnalogOutput2>
  -<Device>
    <Name>SD_IP-MAXI-MQ</Name>
    <MAC>E8:EA:DA:00:57:4E</MAC>
    <sysUpTime>0 days, 5 hours, 51 mins</sysUpTime>
    <Date>19/07/2021</Date>
    <Time>12:11</Time>
  </Device>
</CurrentState>

```

## 13.2. JSON reply

```
{
  "CurrentState": {
    "DigitalInput": [
      {"Name": "DIN1", "Value": "0", "Count": "0"},
      {"Name": "DIN2", "Value": "0", "Count": "0"},
      {"Name": "DIN3", "Value": "0", "Count": "0"},
      {"Name": "DIN4", "Value": "0", "Count": "0"},
      {"Name": "DIN5", "Value": "0", "Count": "0"},
      {"Name": "DIN6", "Value": "0", "Count": "0"},
      {"Name": "DIN7", "Value": "0", "Count": "0"},
      {"Name": "DIN8", "Value": "0", "Count": "0"}
    ],
    "AnalogInput": [
      {"Name": "AIN1", "Value": "0", "Measure": "100.0 mV"},
      {"Name": "AIN2", "Value": "0", "Measure": "0.0 mV"},
      {"Name": "AIN3", "Value": "0", "Measure": "0.0 mV"},
      {"Name": "AIN4", "Value": "0", "Measure": "0.0 mV"},
      {"Name": "TIN1", "Value": "269", "Measure": "24.0 degC"},
      {"Name": "TIN2", "Value": "840", "Measure": "---"},
      {"Name": "TIN3", "Value": "840", "Measure": "---"},
      {"Name": "TIN4", "Value": "840", "Measure": "---"}
    ],
    "Relay": [
      {"Name": "abc", "Value": "0"},
      {"Name": "REL2", "Value": "0"},
      {"Name": "REL3", "Value": "0"},
      {"Name": "REL4", "Value": "0"},
      {"Name": "REL5", "Value": "0"},
      {"Name": "REL6", "Value": "0"},
      {"Name": "REL7", "Value": "0"},
      {"Name": "DIN_CON", "Value": "0"}
    ],
    "AnalogOutput": [
      {"Name": "1", "Value": "0"},
      {"Name": "2", "Value": "0"}
    ],
    "Device": {
      "Name": "SD_IP-MAXI-MQ",
      "MAC": "E8:EA:DA:00:57:4E",
      "sysUpTime": "0 days, 5 hours, 51 mins",
      "Date": "19/07/2021",
      "Time": "12:12"
    }
  }
}
```

## 14. Appendix 2. Mechanical drawing

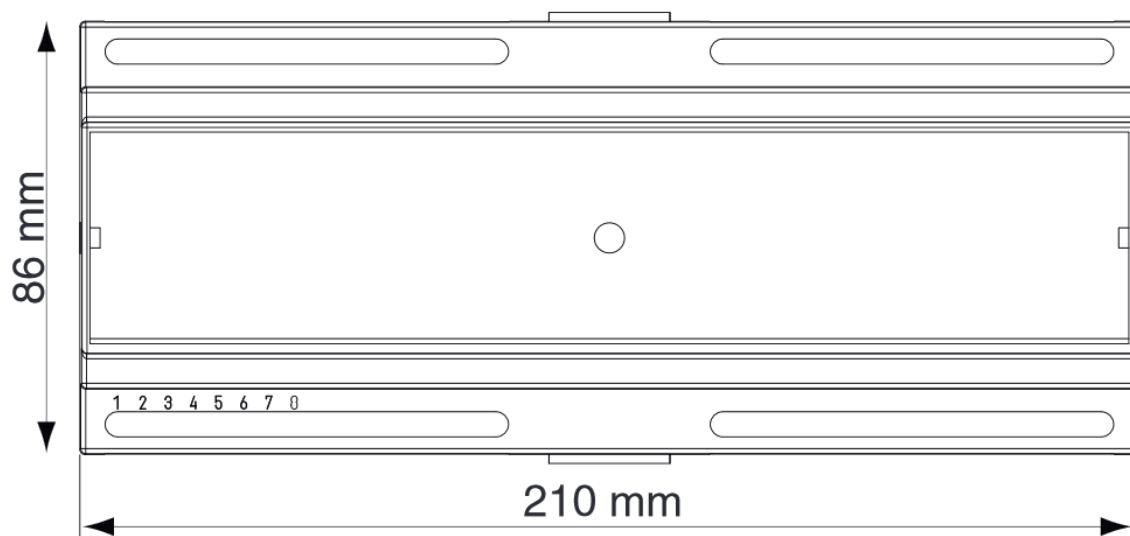


Figure 14.1. Device dimensions

## 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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