

SmartDEN Notifier

Web enabled 32-Inputs Module with MQTT and e-Mail notifications

*User Manual
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1.00	2017/10/30	The initial release

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1. Features

SmartDEN Notifier is an Ethernet input module that can be used in a wide range of remote monitoring, measurement and data-acquisition applications. Thank to its multi-channel design (16 digital, 8 analog and 8 thermistor inputs) this device can perform simultaneously a variety of measurements, for example temperature, humidity, light, pressure, voltage etc. The Web interface allows users to configure the **SmartDEN Notifier**, as well as to monitor current measurements. Along with the current measurements can be downloaded from a remote IP host in XML/JSON format, **SmartDEN Notifier** is capable to send alerts and notifications via MQTT and e-Mail.

A list of **SmartDEN Notifier** features includes:

Inputs:

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

Communication:

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

Web Interface:

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

API for developers communicating with the module via:

- MQTT Protocol;
- HTTP Protocol;

TCP/IP Services:

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

Notifications:

- MQTT notifications (triggered by threshold events and/or periodically);
- Notifications via e-Mail using SMTP (triggered by threshold events);

Power Supply:

- Supply voltage 10..28V DC;
- Additional source out voltage 5V/12V/24V DC is provided to facilitate the sensors power supply;

Physical and Environment:

- Working temperature range: 0 to 70°C;
- DIN rail standard housing;
- 2 mounting fleets for wall fixing.

2. Application examples

With versatile support for multiple digital, analog and temperature sensors, Web interface, TCP/IP services and MQTT/ e-Mail notifications **SmartDEN Notifier** can be used in applications as SCADA, environmental, industrial and various other types of monitoring systems.

The following examples show some basic applications of **SmartDEN Notifier**. The examples are only conceptual and additional equipment/connections can be required in actual implementations.

2.1. Remote sensors monitoring

This mode of the **SmartDEN Notifier** allows monitoring of up to 32 different sensors in real time by a Web-browser (Fig. 2.1). Various kinds of sensors for temperature, humidity, distance, light and so on can be connected to the device.

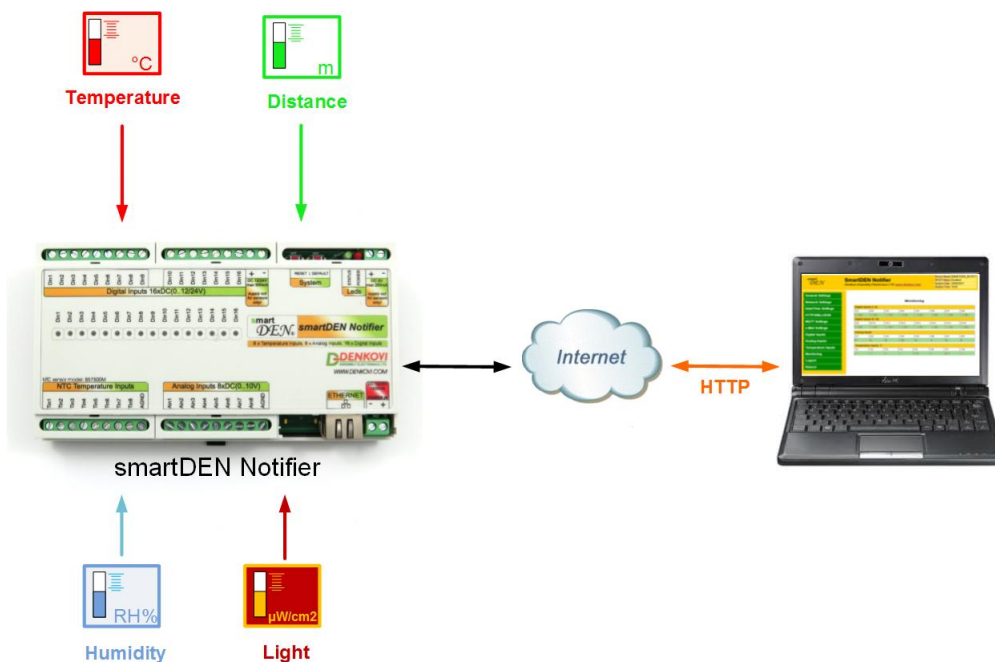


Figure 2.1. Remote sensors monitoring

2.2. Request-response based monitoring

In this mode the **SmartDEN Notifier** acts as a server. A custom HTTP client application can retrieve the current measurements using GET requests to [current_state.xml](#) or [current_state.json](#) files (Fig. 2.2). Examples of client applications include our iOS and Android mobile apps, as well as custom monitoring applications with HTTP/XML/JSON support. Additional level of security for this mode can be set by encrypting the password and/or filtering the client's IP/MAC addresses.

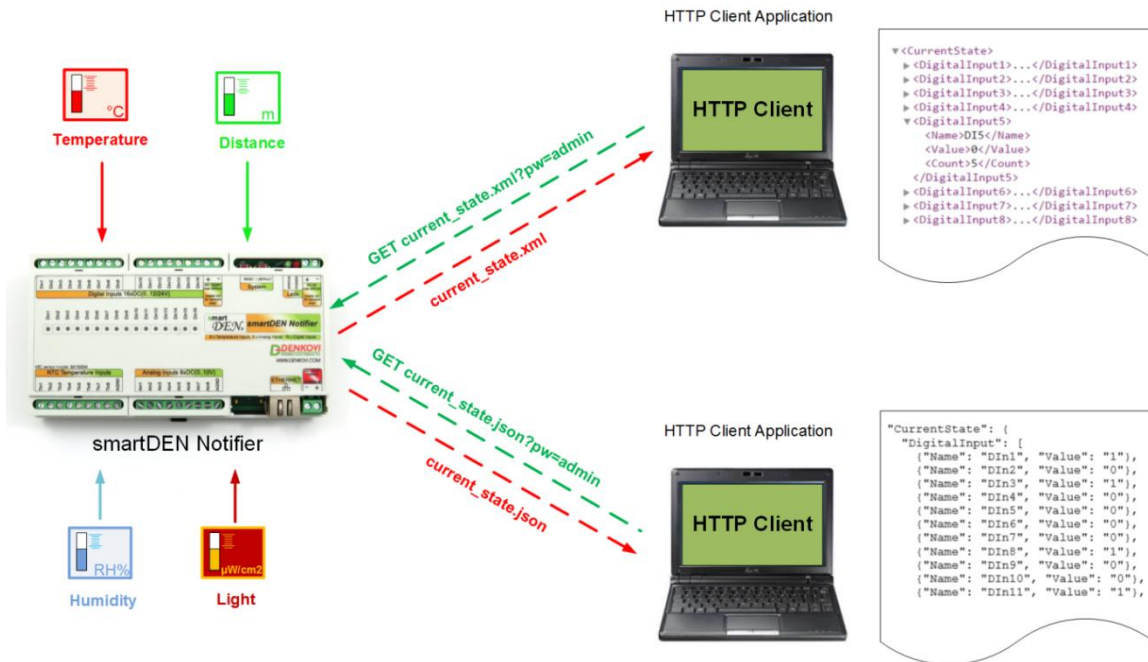


Figure 2.2. HTTP request-response based monitoring

2.3. Publish-subscribe based monitoring

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

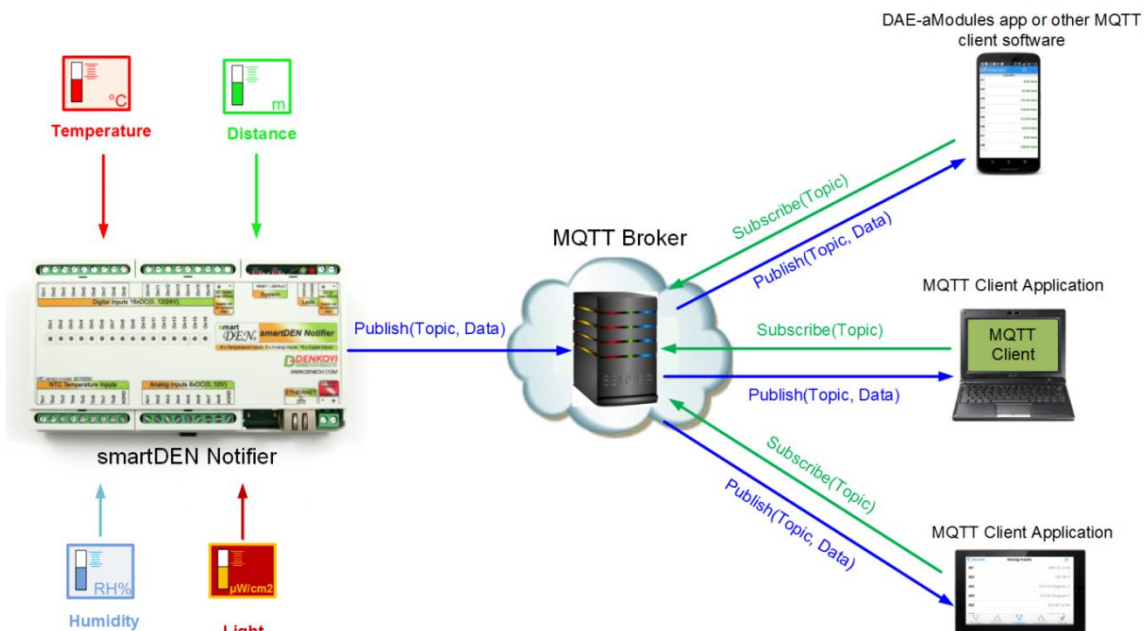


Figure 2.3. MQTT publish-subscribe monitoring

In a typical MQTT scenario (Fig. 2.3), the monitored data are published by **SmartDEN Notifier** under designated topic. In turn, the MQTT broker distributes the messages to the MQTT client applications subscribed to the topic. Two topic types can be used – plain (non-encrypted) and encrypted. While the plain topics are supposed to be used with general MQTT clients, the encrypted ones are designed for communication with the Android [DAE-aModules](#) application or customized MQTT libraries.

2.4. e-Mail notifications

SmartDEN Notifier can be configured to send e-Mail messages using **SMTP** (Simple Mail Transfer Protocol) when specified events are triggered (Fig. 2.4). The event can be a change of digital inputs state or crossing of analog value/temperature over or below the predefined threshold values.

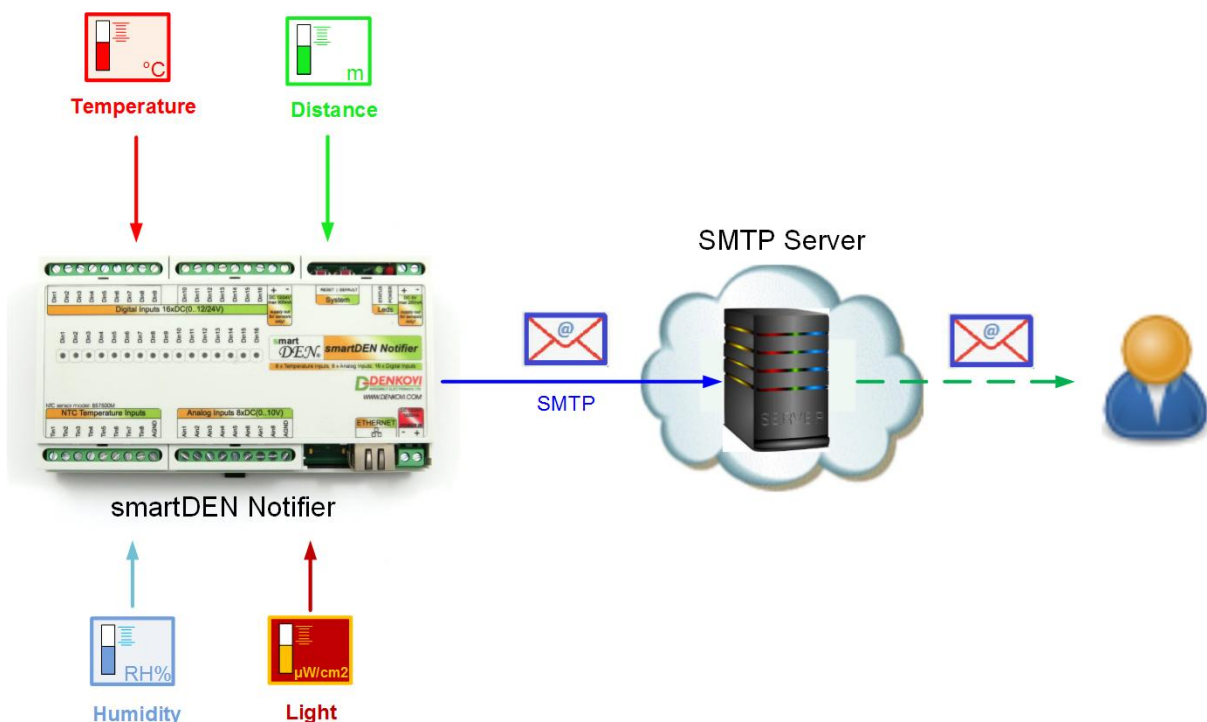


Figure 2.4. e-Mail notifications

2.5. Events counter

SmartDEN Notifier provides 16 x 16-bit counters (from 0 up to 65535) attached to the digital inputs that can be used to count various not fast events - for example detect when a person enters in a shop through the door (Fig. 2.5). Upon detecting the specified edge/level condition **SmartDEN Notifier** increments the corresponding counter. With suitable software and database one could easily organize a simple monitoring and statistic system.

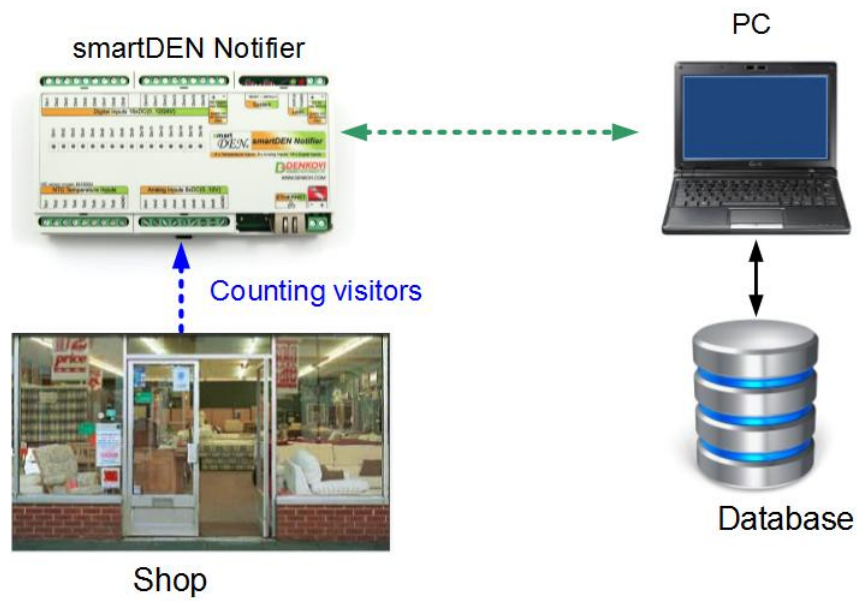


Figure 2.5. Counting visitors in a shop

3. Technical parameters

Table 3.1. Physical parameters

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

Table 3.2. System parameters

Parameter	Value
Power supply voltage, V DC	10... 28 ± 5%
Maximum current consumption, mA	1500
Protection against reverse polarity	Yes
Hardware Real Time Clock (RTC)	Yes
Default settings restore button	Yes
Reset button	Yes

Table 3.3. Digital inputs

Parameter	Value
Digital inputs number	16
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
Sample period, ms	Min: 25*
	Max: 300**
Protection against reverse polarity	Yes

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

**Intensive communication (HTTP, SMTP, MQTT) with the module

Table 3.4. Counters

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

*See point [7.8](#)

Table 3.5. Analog inputs

Parameter	Value
Analog inputs number	8
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, K Ω	1330
Sample period, ms	Min: 25*
	Max: 300**
Protection against reverse polarity	Yes

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

**Intensive communication (HTTP, SMTP, MQTT) with the module

Table 3.6. Temperature inputs

Parameter	Value
NTC inputs number	8
Sensor type	B57500M
Units	Celsius/Fahrenheit
Sensor working temperature range	-55°C/-67°F to +155°C/311°F
Accuracy	±0.5°C / 0.9°F
Sample period, ms	Min: 25*
	Max: 300**

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

**Intensive communication (HTTP, SMTP, MQTT) with the module

Table 3.7. System/network/protocols

Parameter	Value
Hardware Real Time Clock (RTC)	Yes
Network parameters	IP/Mask/Default gateway
MAC lock (protection)	Yes
DHCP	Yes
DNS	Yes
ICMP	Yes
MQTT	Yes (v.3.1.1)
SMTP	Yes
Web server for configuration/access	Yes
Secure HTTP/XML/JSON access	Yes

4. Connectors, ports and led indicators

A picture with the **SmartDEN Notifier** connectors, ports and led indicators is shown in Fig. 4.1.

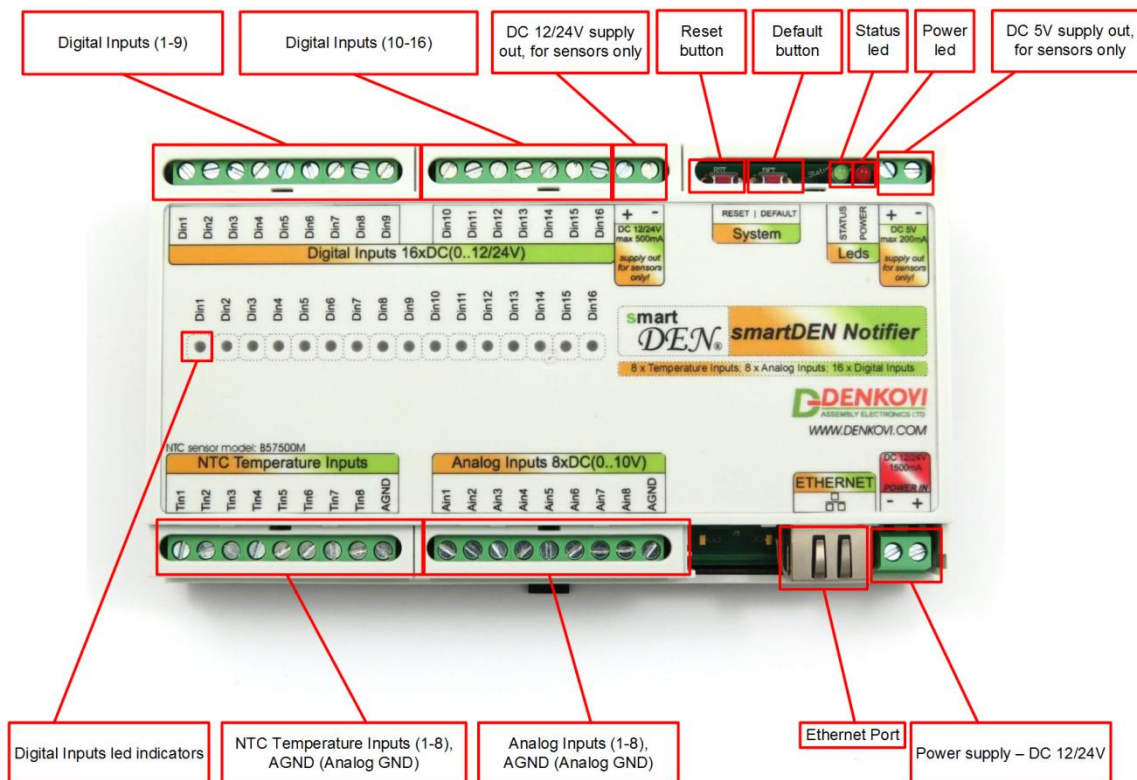


Figure 4.1. Device overview

Picture 4.2 shows examples of sensors with their connection to **SmartDEN Notifier**.

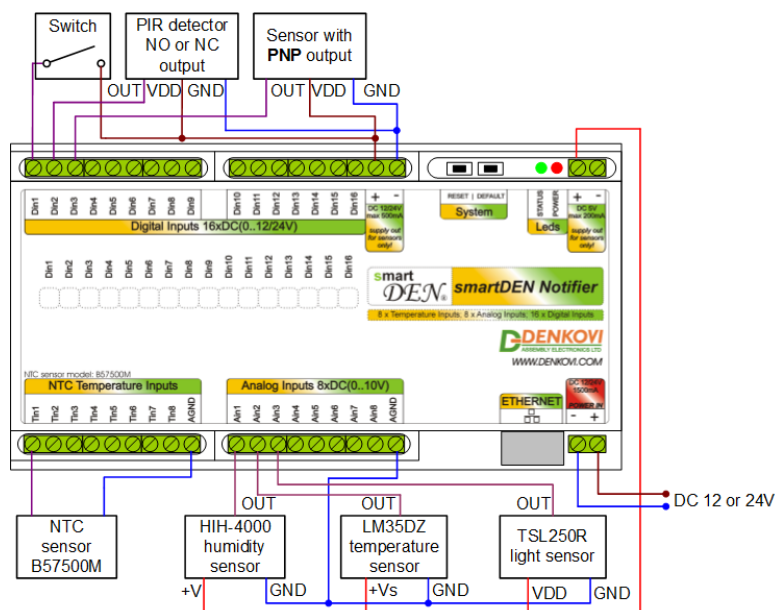


Figure 4.2. Sensors connections

5. Installation

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

5.1. Box mounting

SmartDEN Notifier can be mounted to a standard (35 mm by 7.55 mm) DIN rail (Fig. 5.1). 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 5.1. Mounting the device to DIN rail

5.2. Power supply

SmartDEN Notifier must be powered with voltage either **12 V DC** or **24 V DC** stabilized and filtered. After power on, the power led must be on and **STATUS indicator** must start blinking in 5 seconds which means the module is running normally (Fig. 5.2).



Figure 5.2. SmartDEN Notifier power supply

- ⚠ Please keep the polarity and the power supply voltage range!
- ⚠ **SmartDEN Notifier** 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.

5.3. Connecting inputs

Fig. 5.3 shows the typical connection of dry contact sensors, switches, buttons, door sensors etc. to the digital inputs.

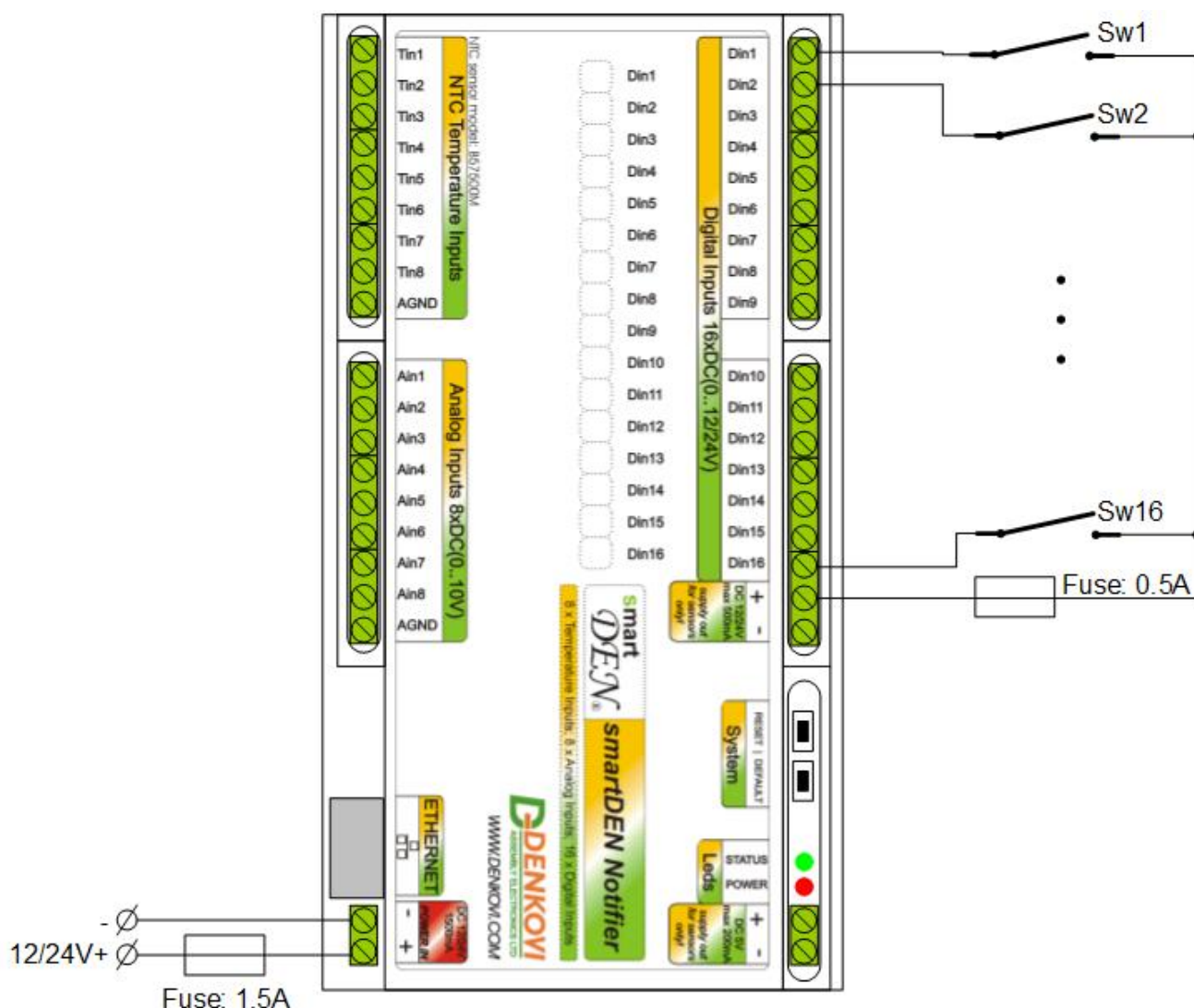


Figure 5.3. Connecting SPST NO output (dry contact) sensors, switches, buttons, door sensors and so on to the digital inputs

When connecting sensors with PNP output they can be powered from the additional internal 12/24 V DC power source (Fig. 5.4).

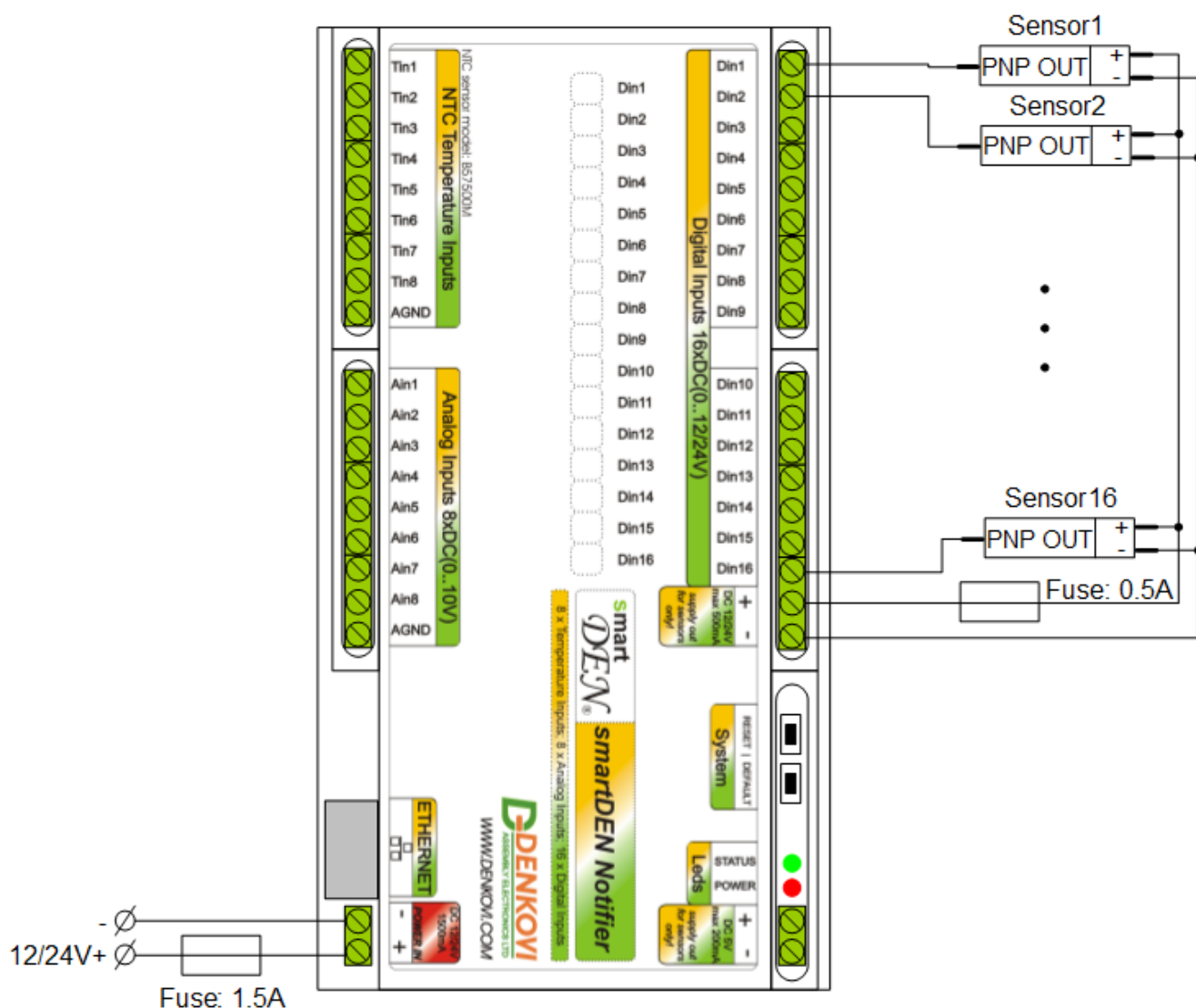


Figure 5.4. Connecting PNP output digital sensors requiring supply voltage 12/24 V DC to the digital inputs

Sensors with 0-20 mA output can be connected to the analog inputs as shown in Fig. 5.5.

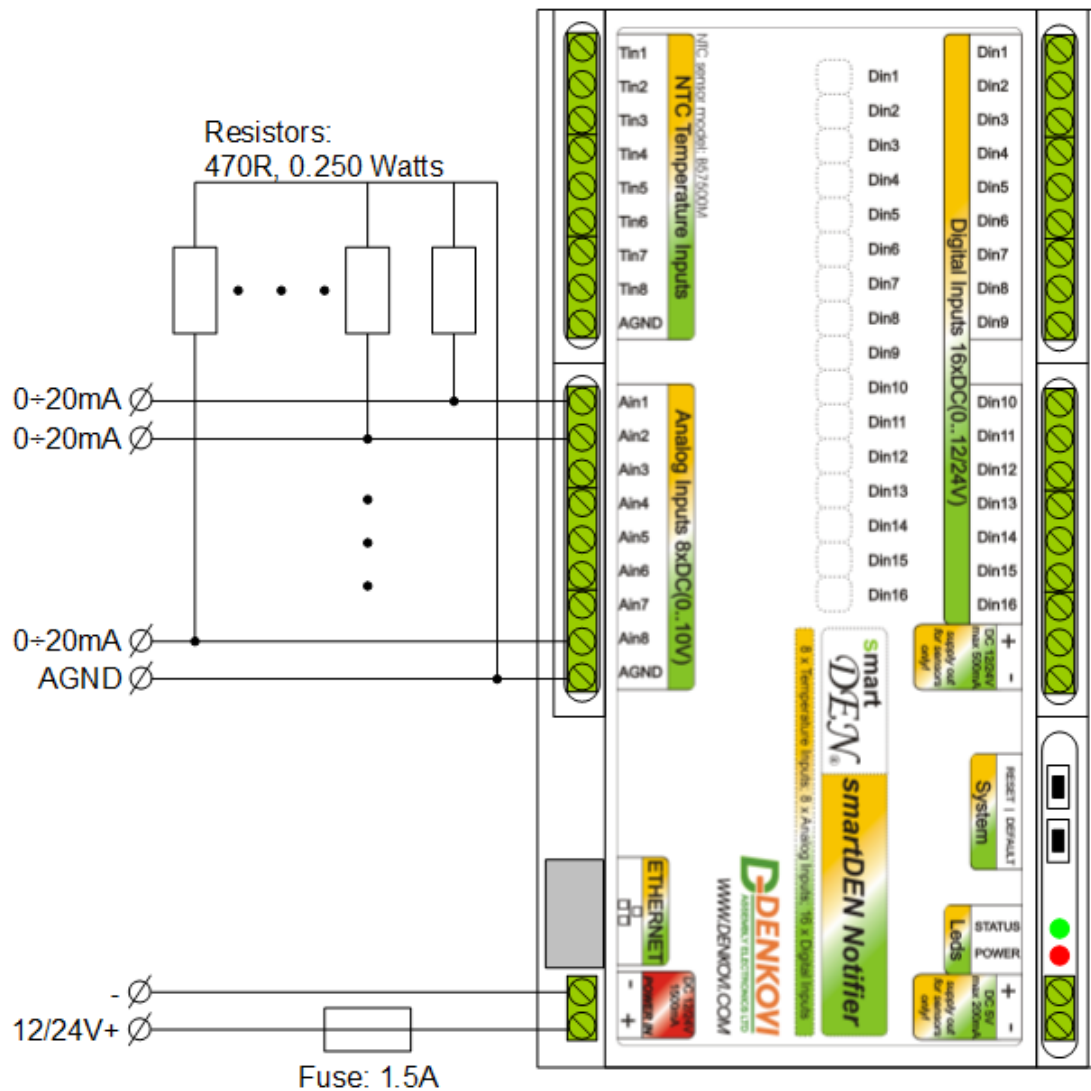


Figure 5.5. Connecting 0-20 mA output analog sensors to the analog inputs

Fig. 5.6 shows the connection of analog sensors with output from 0 up to 10 V DC to the analog inputs. Note that these sensors can be powered by the internal 5 V DC power source.

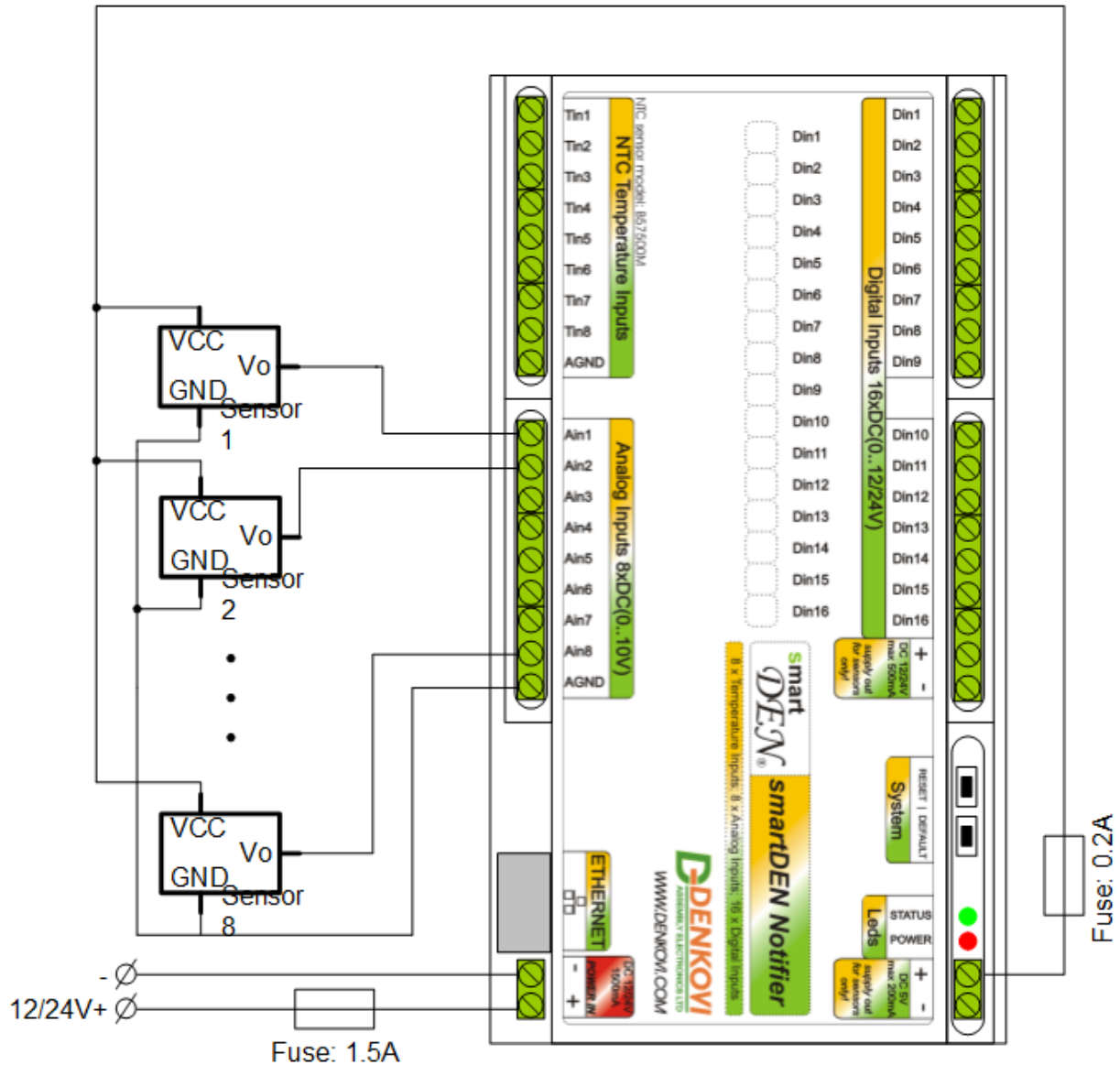


Figure 5.6. Connecting analog sensors with output from 0 up to 10 V DC to the analog inputs requiring power supply voltage 5 V DC

When connecting sensors with output from 0 up to 10 V DC to the analog inputs, they can be powered from the internal 12/24 V DC power source (Fig. 5.7).

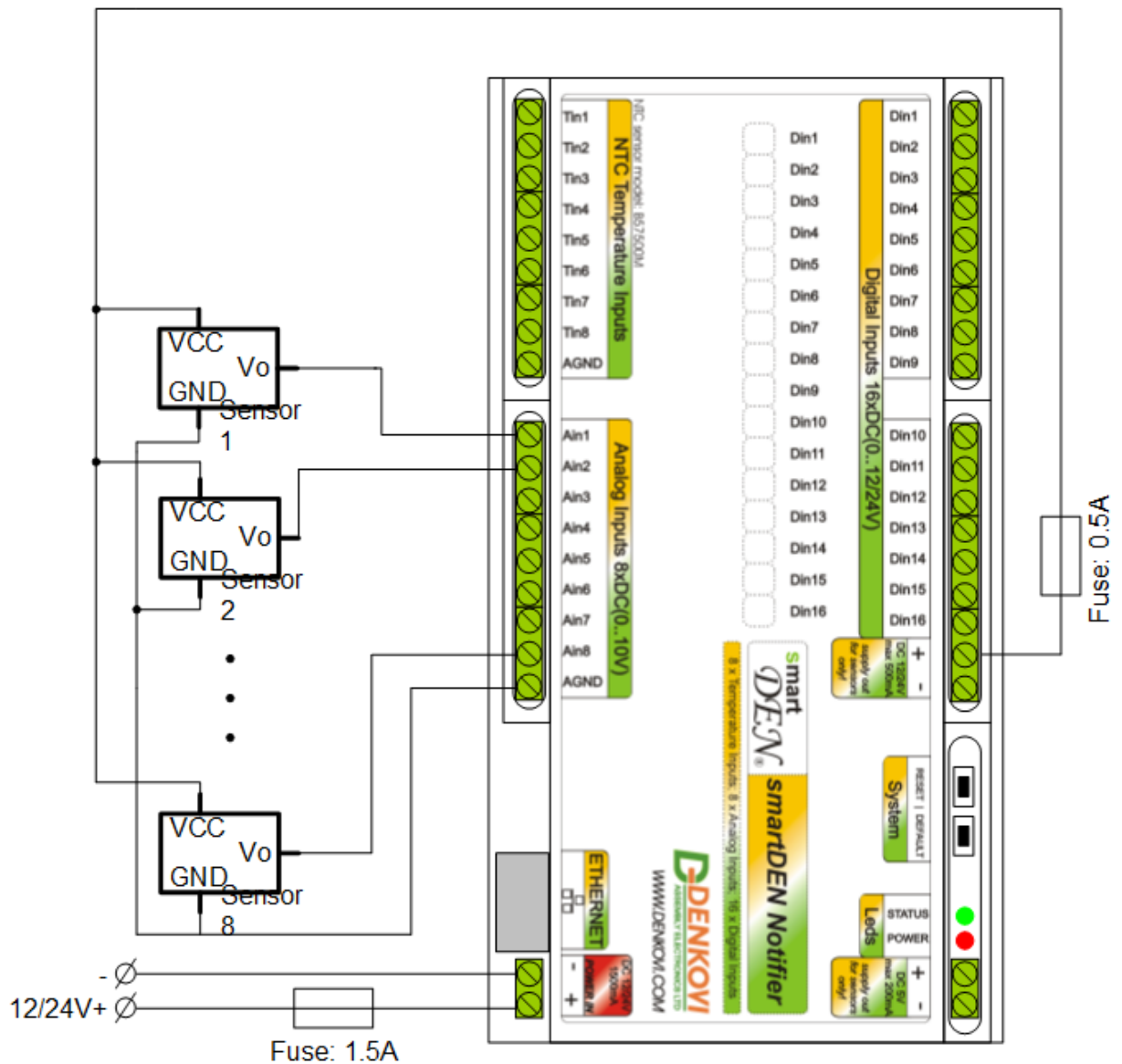


Figure 5.7. Connecting analog sensors with output from 0 up to 10 V DC to the analog inputs requiring power supply voltage 12/24 V DC

Up to 8 NTC thermistors type B57500M can be connected to the temperature inputs (Fig. 5.8).

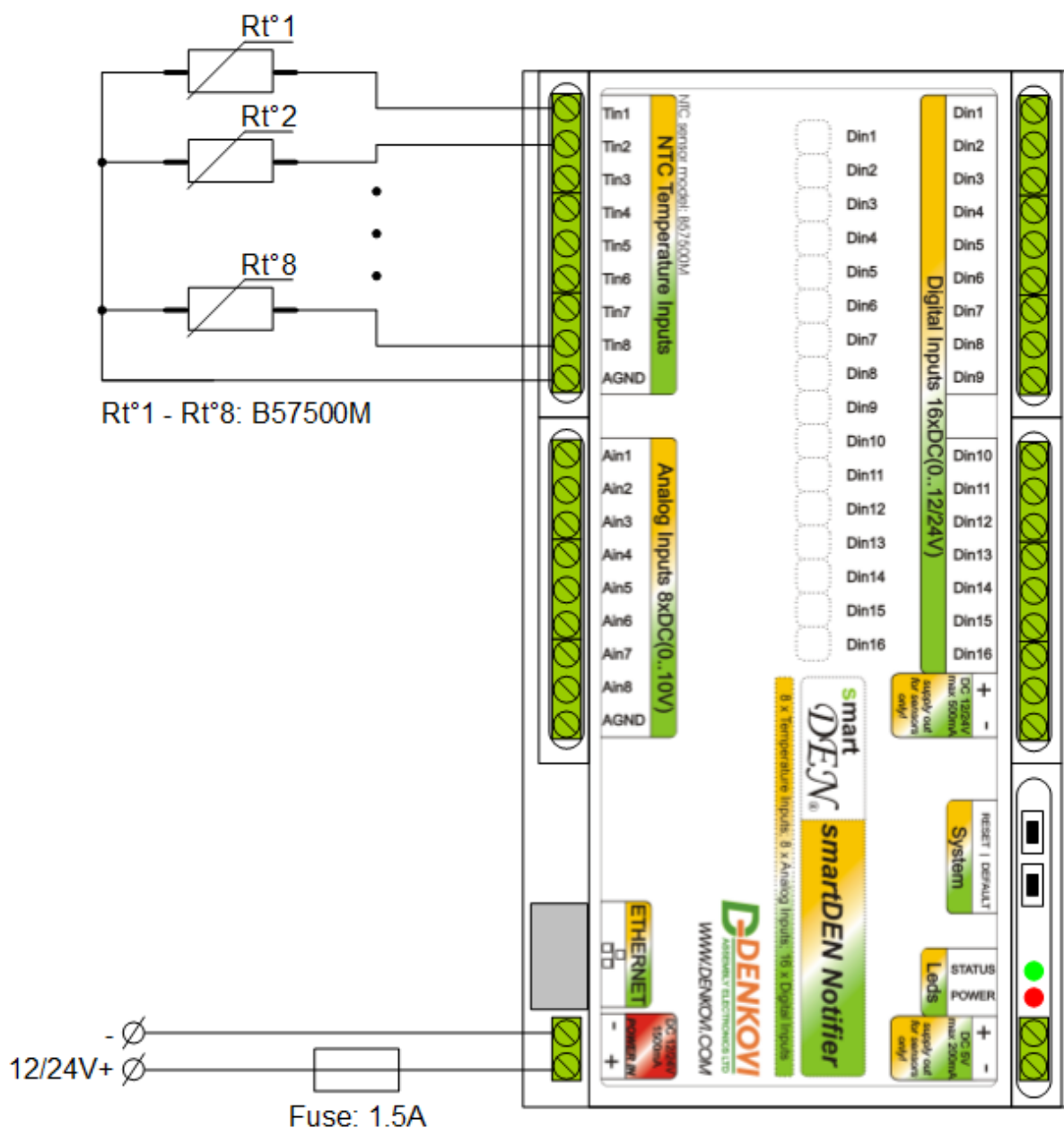


Figure 5.8. Connecting NTC sensors type B57500M to the temperature inputs

5.4. Network connection

SmartDEN Notifier supports AUTO-MDIX so either "crossover" or "straight-through" network cable can be used.



Figure 5.9. Direct connection of **SmartDEN Notifier** to a computer



Figure 5.10. Connecting **SmartDEN Notifier** to a wireless router

5.5. Communication setup

SmartDEN Notifier is shipped with the following default parameters:

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

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

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



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

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

Then just select the local area connection with right click and select [Properties](#) (Fig. 5.11):

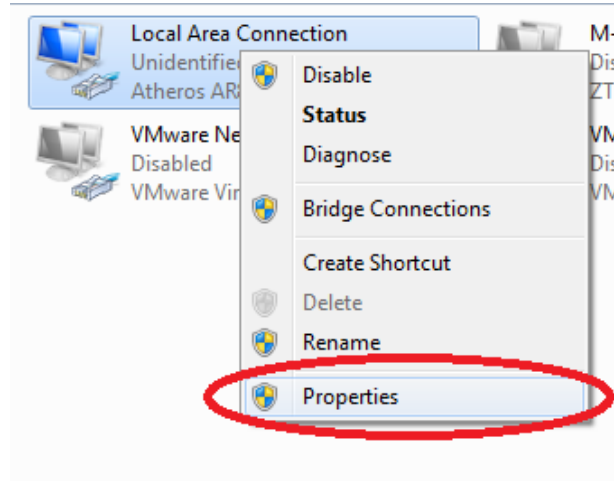


Figure 5.11. LAN card properties

The next step is to modify the IPv4 properties (Fig. 5.12).

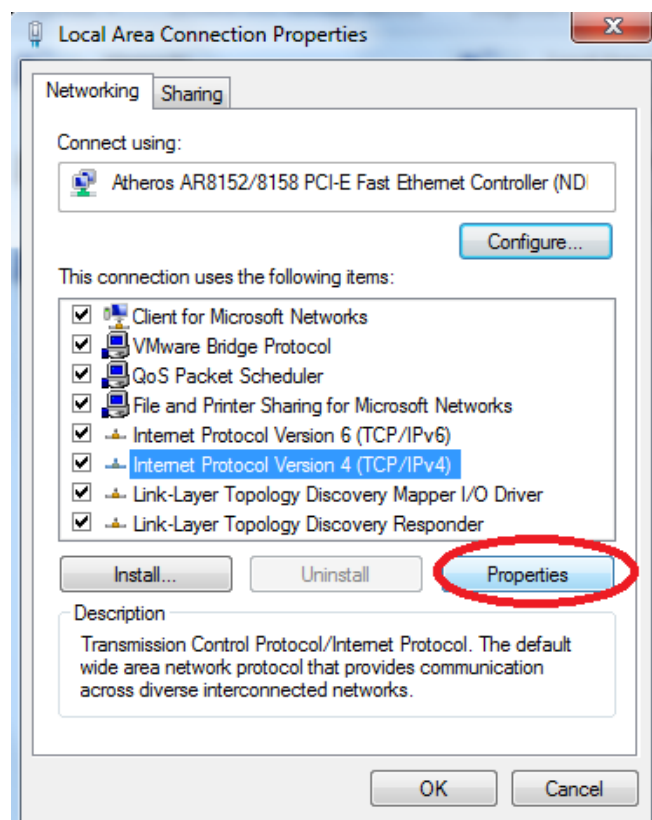


Figure 5.12. IPv4 properties section

Set the IP address of your PC to be in the same network as **SmartDEN Notifier** (Fig. 5.13).

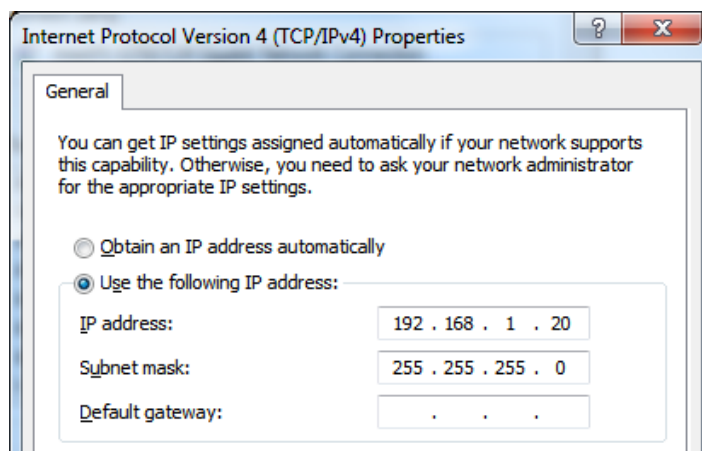


Figure 5.13. Set the IP address

Finally, in the address bar of your Web-browser enter the IP address of the **SmartDEN Notifier** and press Enter, or select 'Go' (Fig. 5.14).



Figure 5.14. Open the device in a browser

If the network settings are O'K, the login page should appear (Fig. 5.15).

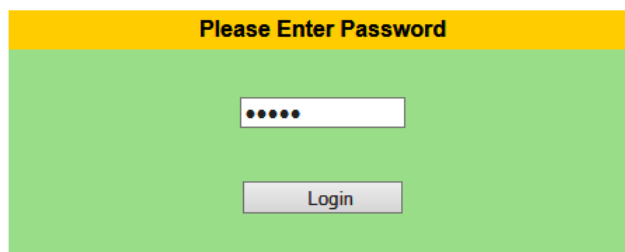


Figure 5.15. Login page



SmartDEN Notifier modules connected locally can be easily scanned and found via the [Denkovi Finder](#) tool as well (Fig. 5.16).

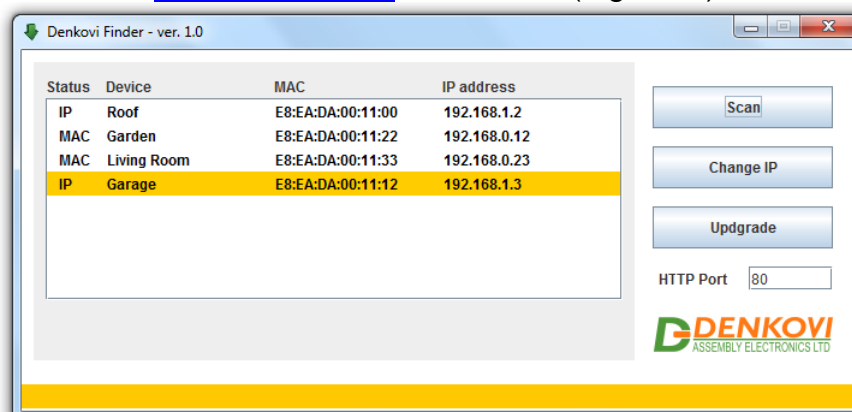


Figure 5.16. [Denkovi Finder](#) utility

6. Default settings

6.1. Table with default settings

The **SmartDEN Notifier** module is shipped with default (factory) settings shown in Table 6.1. The default settings can be reloaded, if necessary (see [point 6.2](#)).

Table 6.1. Default settings

Settings group	Parameter (according to Web pages)	Value
General Settings	Device Name	SMARTDEN_NOTIFY
	Password	admin
	Temperature Scale	Celsius
	Monitoring Timeout, sec	3
	Max. Monitoring Errors	5
Network Settings	DHCP	Disabled
	IP Address	192.168.1.100
	Gateway	192.168.1.1
	Subnet Mask	255.255.255.0
	Primary DNS	192.168.1.1
	Secondary DNS	0.0.0.0
Date/Time Settings	Date (dd/mm/yyyy)	Current
	Day of Week	Current
	Time (hh:mm)	Current
	Time Zone	GMT
HTTP/XML/JSON Settings	HTTP Port	80
	Access IP Address	192.168.1.0
	Access Mask	0.0.0.0
	Access MAC Address	00:00:00:00:00:00
	Session Timeout, min	3
	Enable Access	Enabled
	Encrypt Password	Disabled
	Multiple Access	Enabled
MQTT Settings	Enable	Disabled
	MQTT Server	iot.eclipse.org
	Server Port	1883
	Username	
	Password	
	Publish Mode	Periodically

	Publish Period, sec	10
	Encrypt Topic	Disabled
e-Mail Settings	Enable	Disabled
	SMTP Server	smtp.srvden.com
	Server Port	587
	Username	*****
	Password	*****
	Mail To	test@srvden.com
Digital Inputs	Description	DI<n>, where <n> = 1..16
	Counter	0
	Filter (ms)	0
	Edge	0 (Off)
	MQTT	Disabled
	e-Mail	Disabled
Analog Inputs	Description	AI<n>, where <n> = 1..8
	Min	0.0
	Max	10.0
	Label	Volt
	Low Threshold	0
	High Threshold	0
	MQTT	Disabled
	e-Mail	Disabled
Temperature Inputs	Description	TI<n>, where <n> = 1..8
	Tolerance, %	0
	Low Threshold	0
	High Threshold	0
	MQTT	Disabled
	e-Mail	Disabled

6.2. 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 [6.1](#) 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. 6.1);
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.

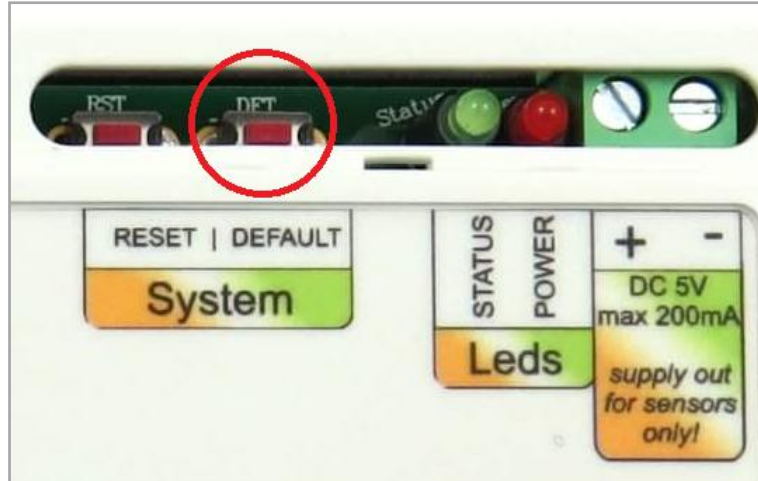
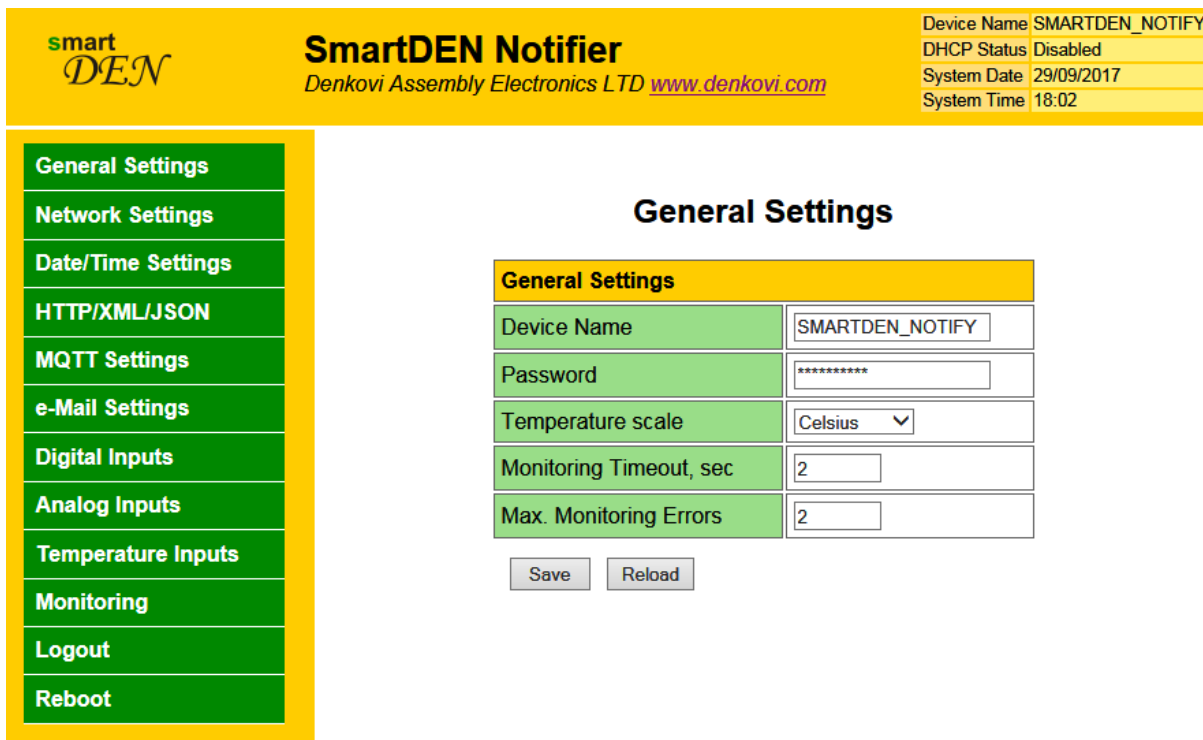


Figure 6.1. Loading the default settings

7. Web access



The screenshot shows the SmartDEN Notifier web interface. At the top, there is a yellow header bar with the 'smart DEN' logo on the left, the title 'SmartDEN Notifier' in the center, and a status table on the right. Below the header, on the left, is a green sidebar menu with various settings options. The main content area is titled 'General Settings' and contains a form with several fields: Device Name (SMARTDEN_NOTIFY), Password (masked with asterisks), Temperature scale (Celsius), Monitoring Timeout, sec (2), and Max. Monitoring Errors (2). At the bottom of the form are 'Save' and 'Reload' buttons.

Device Name	SMARTDEN_NOTIFY
DHCP Status	Disabled
System Date	29/09/2017
System Time	18:02

General Settings

General Settings	
Device Name	SMARTDEN_NOTIFY
Password	*****
Temperature scale	Celsius
Monitoring Timeout, sec	2
Max. Monitoring Errors	2

Save Reload

Figure 7.1. Web access

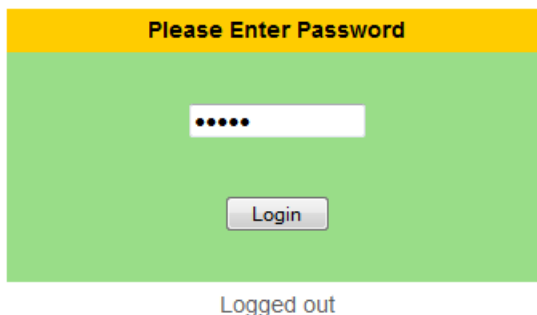
To access the setup pages, start a web browser (Internet Explorer, Mozilla Firefox or similar), and enter the **SmartDEN Notifier** IP address, for example: <http://192.168.1.100>.



Figure 7.2. Open the device in a browser

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

7.1. Login



The screenshot shows the login page of the SmartDEN Notifier. It has a yellow header bar with the text 'Please Enter Password'. Below this is a green background with a white password input field containing four asterisks. At the bottom of the green area is a 'Login' button. Below the green area, the text 'Logged out' is visible.

Figure 7.3. Login page

Enter the password and click "Login" button or press Enter (Fig. 7.3). This will bring you to the **SmartDEN Notifier** main configuration page, which contains details

of the current firmware version/build date and provides a link to the documentation page (Fig. 7.4).

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.

smartDEN Notifier Info	
smartDEN Notifier Version	v1.25
Build Date	Sep 28 2017 00:08:00
Documentation	User Manual

Figure 7.4. Version/Build Date info

7.2. Menu

The main menu (Fig. 7.5) consists of the following items, located in the left window frame:

General Settings
Network Settings
Date/Time Settings
HTTP/XML/JSON
MQTT Settings
e-Mail Settings
Digital Inputs
Analog Inputs
Temperature Inputs
Monitoring
Logout
Reboot

Figure 7.5. Navigation menu


7.3. General settings

General settings page is shown in Fig. 7.6.

General Settings	
Device Name	SMARTDEN_NOTIFY
Password	*****
Temperature Scale	Celsius ▼
Monitoring Timeout, sec	3
Max. Monitoring Errors	5

Figure 7.6. General settings

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

 When typed, the password in this screen is not hidden. Only in this case, when the password is being changed, it is transmitted across the network "in the open". Therefore, set passwords in a secure environment where you can make sure that no one is "eavesdropping". Subsequent transmissions of the password to "login" onto the device are encrypted and "safe".
- **Temperature Scale** – Celsius / Fahrenheit;
- **Monitoring Timeout, sec** - the connection timeout for the Web-browser;
- **Max. Monitoring Errors** – the number of successive timeouts before the connection error is reported by the Web-browser;
- **Save button** - once you have changed the settings as required, click this button.

7.4. Network settings

The page shown in Fig. 7.7 lets you configure the network settings of **SmartDEN Notifier** module:

- **Enable DHCP** - this option allows DHCP to be enabled or disabled. If DHCP is set to Enabled, the Network page must be saved and **SmartDEN Notifier** must be rebooted before obtaining an IP address;
- **IP address** - this is the IP address of the **SmartDEN IP-32IN**. It needs to be manually assigned only if DHCP is disabled. With DHCP enabled, this field displays the currently assigned address;
- **Gateway** - this specifies the IP address of the gateway router. It is used for accessing public MQTT and e-Mail servers;
- **Subnet Mask** - this is the subnet mask for the network on which the **SmartDEN Notifier** 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.

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

Figure 7.7. Network settings

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

7.5. HTTP/XML/JSON

These settings let you configure the HTTP and XML/JSON access parameters of SmartDEN Notifier (Fig. 7.8):

- **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 to the SmartDEN Notifier;
- **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.

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 7.8. HTTP/XML/JSON access

Note: If there is no traffic between the Web-browser/HTTP client and the **SmartDEN Notifier** 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.

7.6. MQTT Settings

These settings let you configure the MQTT notification mode of **SmartDEN Notifier** (Fig. 7.9).

MQTT Settings	
Enable	<input checked="" type="checkbox"/>
MQTT Server	iot.eclipse.org
Server Port	1883
Username	
Password	
Publish Mode	Periodically
Publish Period, sec	
Encrypt Topic	<input checked="" type="checkbox"/>
Non-encrypted Topic	SmartDEN_Notifier/E8EADA00245B/#
Encrypted Read Topic	f15be6b5e6b1675f17f1160b70e1cdb9
Encrypted Write Topic	2416b01600cc5b2755e0ca82f39836ec
Encrypted Notify Topic	c555b50f7324b0a2cb219f1847c708f1
Status	Disconnected

Save Reload

Figure 7.9. MQTT settings

- **Enable** – enable/disable the MQTT notifications;
- **MQTT Server** - the MQTT server (broker) IP address or domain name (max. 22 chars);
- **Server Port** – the MQTT server listening port (the default port is 1883);
- **Username** – username, if used (max. 10 chars);
- **Password** – password, if used (max. 10 chars);
- **Publish Mode:**
 - **Periodically** – notifications are send periodically (the period is defined by the **Publish Period** value);
 - **Edge Triggered** – notifications are triggered by events (change of digital inputs state or crossing of analog value/temperature over or below the predefined threshold values);
 - **Edge Triggered + Periodically** - combination of the above two modes. In that mode notifications are send just like the mode **Edge Triggered** but periodically (the period is defined by the **Publish Period** value);
- **Publish Period, sec** – the time interval between two successive notifications (from 5 to 250 seconds);
- **Encrypt Topic** – when enabled, the MQTT topic is encrypted;
- **Non-encrypted Topic** – plain (non-encrypted) topic the clients can subscribe to receive notifications from **SmartDEN Notifier**;

- **Encrypted Read Topic, Encrypted Write Topic, Encrypted Notify Topic** - encrypted topics for communication with the Android [DAE-aModules](#) application or customized MQTT libraries.
- **Save button** - once you have changed the settings as required, click this button.



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



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



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



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



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

7.7. e-Mail Settings

This page let you configure the e-Mail notification mode of **SmartDEN Notifier** (Fig. 7.10).

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

Figure 7.10. e-Mail settings

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

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


7.8. Digital Inputs

Digital Inputs settings page is shown in Fig. 7.11.

Digital Input	Description	Counter	Filter (ms)	Edge	MQTT	e-Mail
Input 1	DIn1	8	50	0 (Off) ▼	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 2	DIn2	12	0	1 (On) ▼	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 3	DIn3	110	0	0 (Off) ▼	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 4	DIn4	65	0	2 (Both) ▼	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 5	DIn5	0	0	0 (Off) ▼	<input type="checkbox"/>	<input type="checkbox"/>
Input 6	DIn6	0	0	0 (Off) ▼	<input type="checkbox"/>	<input type="checkbox"/>
Input 7	DIn7	0	0	1 (On) ▼	<input type="checkbox"/>	<input type="checkbox"/>
Input 8	DIn8	0	0	0 (Off) ▼	<input type="checkbox"/>	<input type="checkbox"/>
Input 9	DIn9	0	0	0 (Off) ▼	<input type="checkbox"/>	<input type="checkbox"/>
Input 10	DIn10	0	0	0 (Off) ▼	<input type="checkbox"/>	<input type="checkbox"/>
Input 11	DIn11	0	0	1 (On) ▼	<input type="checkbox"/>	<input type="checkbox"/>
Input 12	DIn12	0	0	0 (Off) ▼	<input type="checkbox"/>	<input type="checkbox"/>
Input 13	DIn13	0	0	0 (Off) ▼	<input type="checkbox"/>	<input type="checkbox"/>
Input 14	DIn14	0	0	0 (Off) ▼	<input type="checkbox"/>	<input type="checkbox"/>
Input 15	DIn15	0	0	0 (Off) ▼	<input type="checkbox"/>	<input type="checkbox"/>
Input 16	DIn16	0	0	0 (Off) ▼	<input type="checkbox"/>	<input type="checkbox"/>

Save Reload

Figure 7.11. Digital Inputs settings

- **Description** - digital input identification string (max. 7 chars);
 This description will appear in XML/JSON files, MQTT and e-Mail notifications, as well as in the **Monitoring** page.
- **Counter** – the value of 16-bit counter attached to the input. The counter is incremented on rising (On), falling (Off), or both edges depending on the **Edge** parameter. 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 65535;
- **Filter (ms)** - the input may be adjusted to work with a digital filter. It is valid for counting, MQTT and e-Mail notifications, as well as input visualization. The range for this parameter (in milliseconds) is from 0 up to 200 ms. The filter is disabled when its value is set to 0;
- **Edge** - this parameter determines when the counter is incremented and MQTT and e-Mail notifications are sent:
 - **0 (Off)** – The counter is incremented on the falling edge (1 -> 0). With MQTT enabled and **MQTT Publish Mode=Edge Triggered** the falling edge triggers a notification message. The e-Mail (if enabled) is sent on falling edge (Fig. 7.12).

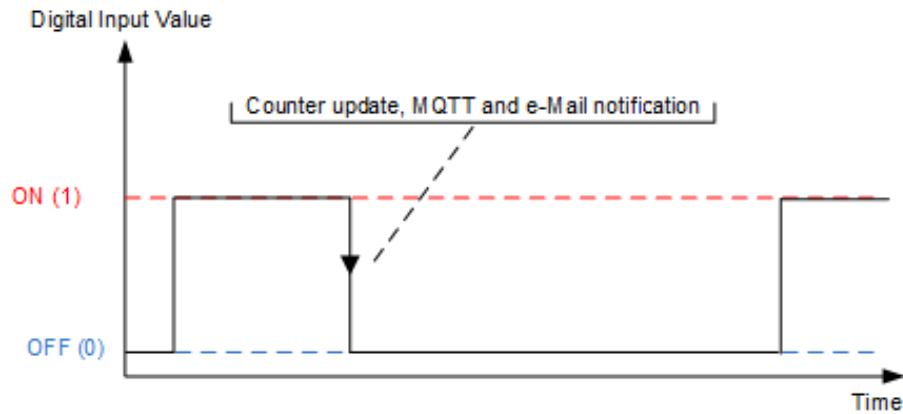


Figure 7.12. Counter update and notifications when **Edge** is set to "0 (Off)"

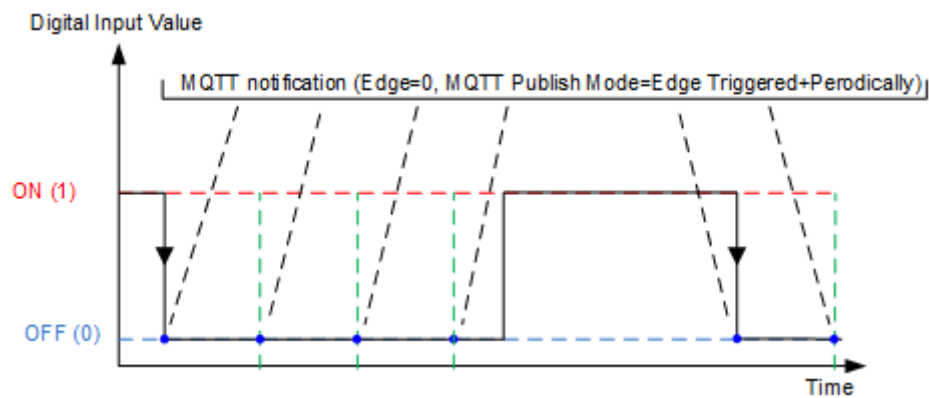


Figure 7.12.1. MQTT Publish Mode = "Edge Triggered+Preiodically" and Edge=0

- **1 (On)** – The counter is incremented on the rising edge (0 -> 1). With MQTT enabled and **MQTT Publish Mode=Edge Triggered** the rising edge triggers a notification message. The e-Mail (if enabled) is sent on rising edge (Fig. 7.13).

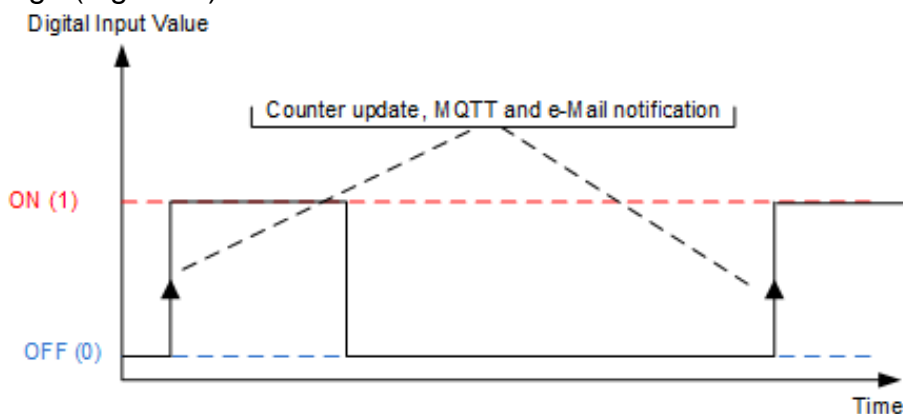


Figure 7.13. Counter update and notifications when **Edge** is set to "1 (On)"

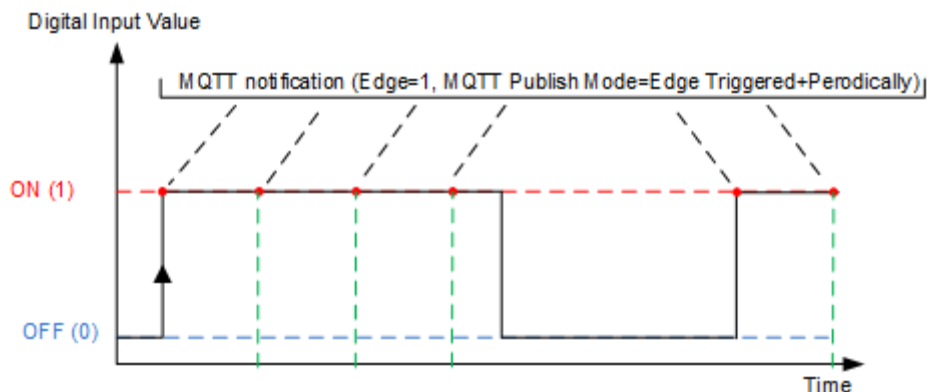


Figure 7.13.1. MQTT Publish Mode = "Edge Triggered+Preiodically" and Edge=1

- **2 (Both)** – Counter update and notifications take place on every digital input state change (both falling and rising edges) (Fig. 7.14).

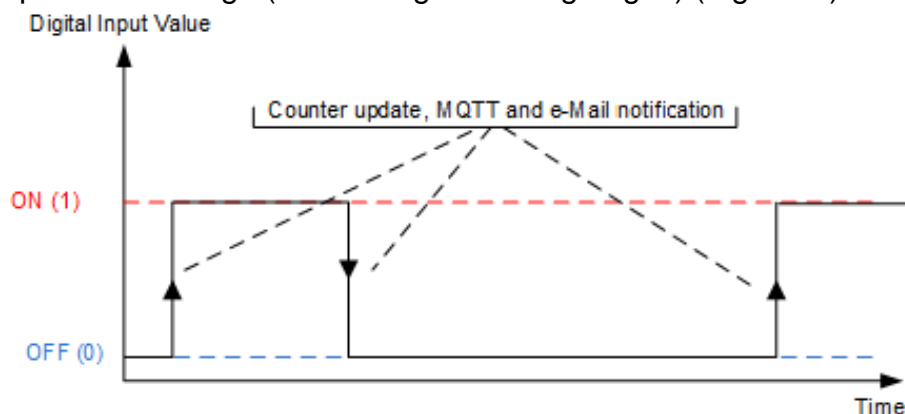


Figure 7.14. Counter update and notifications when **Edge** is set to "2 (Both)"

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



The 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, MQTT and e-Mail, 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;
- At the moment the module is saving the configuration in the EEPROM it is not possible to count pulses due to the blocking time which may be several seconds.

7.9. Analog Inputs

Analog Inputs settings page is shown in Fig. 7.15.

Analog Input	Description	Min	Max	Label	Low Threshold	High Threshold	MQTT	e-Mail
Input 1	<input type="text" value="Aln1"/>	<input type="text" value="0.0"/>	<input type="text" value="5.0"/>	<input type="text" value="Volt"/>	<input type="text" value="1"/>	<input type="text" value="3"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 2	<input type="text" value="Aln2"/>	<input type="text" value="0.0"/>	<input type="text" value="9000.0"/>	<input type="text" value="mA"/>	<input type="text" value="100"/>	<input type="text" value="9999"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 3	<input type="text" value="Aln3"/>	<input type="text" value="-9000.0"/>	<input type="text" value="5000.0"/>	<input type="text" value="mV"/>	<input type="text" value="-7000"/>	<input type="text" value="4000"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 4	<input type="text" value="Aln4"/>	<input type="text" value="0.0"/>	<input type="text" value="10.0"/>	<input type="text" value="Volt"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="checkbox"/>	<input type="checkbox"/>
Input 5	<input type="text" value="Aln5"/>	<input type="text" value="0.0"/>	<input type="text" value="10.0"/>	<input type="text" value="Volt"/>	<input type="text" value="0"/>	<input type="text" value="4"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 6	<input type="text" value="Aln6"/>	<input type="text" value="0.0"/>	<input type="text" value="40.0"/>	<input type="text" value="Kg"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="checkbox"/>	<input type="checkbox"/>
Input 7	<input type="text" value="Aln7"/>	<input type="text" value="0.0"/>	<input type="text" value="10.0"/>	<input type="text" value="Volt"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="checkbox"/>	<input type="checkbox"/>
Input 8	<input type="text" value="Aln8"/>	<input type="text" value="0.0"/>	<input type="text" value="10.0"/>	<input type="text" value="Volt"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 7.15. Analog Inputs Settings

- **Description** - analog input identification string (max 7 chars);
💡 This description will appear in XML/JSON files, MQTT and e-Mail notifications, as well as in the **Monitoring** page.
- **Min** - the measured value used for scaling corresponding to analog input value = 0 (range: from -9999.9 to 9999.9);
- **Max** - the measured value used for scaling corresponding to analog input value = 1023 (range: from -9999.9 to +9999.9);
- **Label** - the label for the measured value, for example: mA, Kg, Volt ...(max. 4 chars);
- **Low Threshold** - the low threshold for the measured value (range: from -9999 to **High Threshold**);
- **High Threshold** - the high threshold for the measured value (range: from **Low Threshold** to 9999);
- **MQTT** - determines if the analog input will send MQTT notification or not;
- **e-Mail** - determines if the analog input will send e-Mail message or not;
- **Save button** - once you have changed the settings as required, click this button.

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

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

With MQTT enabled and **MQTT Publish Mode=Edge Triggered** a notification message is sent when measured value crosses over the **High Threshold** or below the **Low Threshold** values (Fig. 7.16). The same crossing conditions trigger sending of an e-Mail.

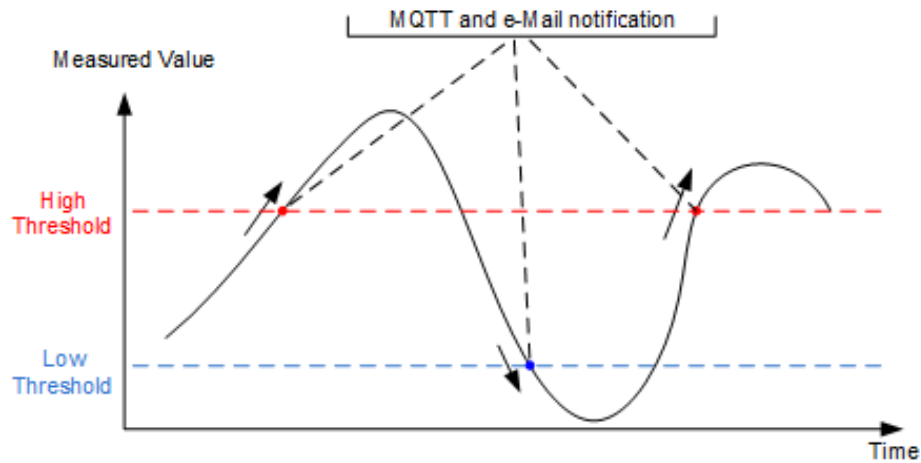


Figure 7.16. Sending analog input notifications

In addition, analog input 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**.

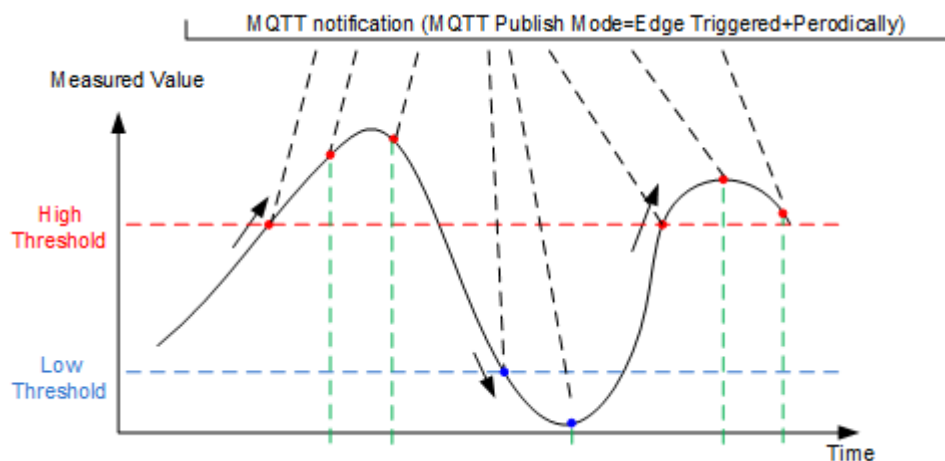


Figure 7.16.1 Sending analog input notifications during Publish Mode = "Edge Triggered+Periodically"

7.10. Temperature Inputs

Temperature inputs settings page is shown in Fig. 7.17.

Temp. Input	Description	Tolerance, %	Low Threshold, °C	High Threshold, °C	MQTT	e-Mail
Input 1	TIn1	-3	5	12	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 2	TIn2	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>
Input 3	TIn3	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>
Input 4	TIn4	1	20	36	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 5	TIn5	0	-5	2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 6	TIn6	0	100	120	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 7	TIn7	0	28	32	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Input 8	TIn8	0	0	0	<input type="checkbox"/>	<input type="checkbox"/>

Figure 7.17. Temperature inputs

- **Description** - temperature input identification string (max 7 chars);
💡 This description will appear in XML/JSON files, MQTT and e-Mail notifications, as well as in the **Monitoring** page.
- **Tolerance, %** - the tolerance for the temperature input - from -5% to +5%; This can be set in case of significant difference in the sensor value, otherwise must be left with value of 0;
- **Low Threshold** - the low threshold for this input (range: from -55°C/-67°F up to **High Threshold**);
- **High Threshold** - the high threshold for this input (range: from **Low Threshold** up to +155°C/ 311°F);
- **MQTT** - determines if the temperature input will send MQTT notification or not;
- **e-Mail** - determines if the temperature input will send e-Mail message or not;
- **Save button** - click this button to save the settings.

With MQTT enabled and **MQTT Publish Mode=Edge Triggered** a notification message is sent when temperature value crosses over the **High Threshold** or below the **Low Threshold** values (Fig. 7.18). The same crossing conditions trigger sending of an e-Mail.

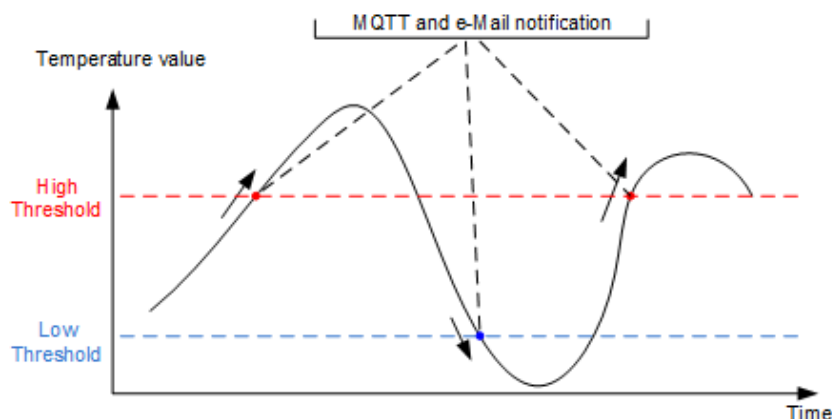


Figure 7.18. Sending Temperature input notifications

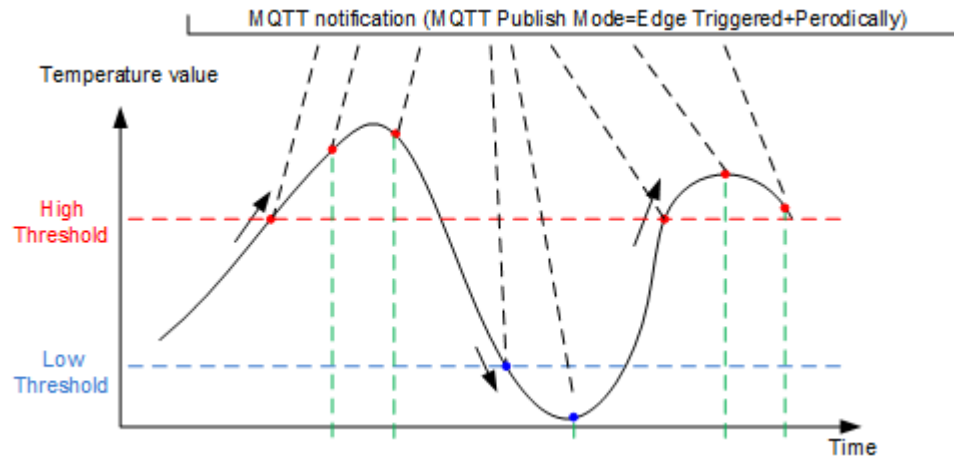


Figure 7.18.1. Sending temperature input notifications during Publish Mode = "Edge Triggered+Periodically"

7.11. Monitoring

This page allows the states of the digital, analog and temperature inputs to be monitored in a single window.

Digital Inputs (1..8)							
DIn1	DIn2	DIn3	DIn4	DIn5	DIn6	DIn7	DIn8
0 (Off)	0 (Off)	0 (Off)	1 (On)	0 (Off)	1 (On)	0 (Off)	0 (Off)
8	12	110	108	0	0	0	0
Digital Inputs (9..16)							
DIn9	DIn10	DIn11	DIn12	DIn13	DIn14	DIn15	DIn16
0 (Off)	1 (On)	0 (Off)	0 (Off)	0 (Off)	0 (Off)	0 (Off)	0 (Off)
0	0	0	0	0	0	0	0
Analog Inputs							
AI1	AI2	AI3	AI4	AI5	AI6	AI7	AI8
0	0	0	0	504	0	0	0
0.0 Volt	0.0 mA	-9000.0 mV	0.0 Volt	49.2 %PH	0.0 Kg	0.0 Volt	0.0 Volt
Temperature Inputs, °C							
TIn1	TIn2	TIn3	TIn4	TIn5	TIn6	TIn7	TIn8
-9.0	--	--	29.1	--	92.4	22.1	--

Figure 7.19. Monitoring page

7.12. Logout

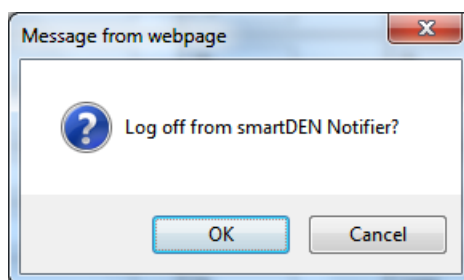


Figure 7.20. Log off

7.13. Reboot

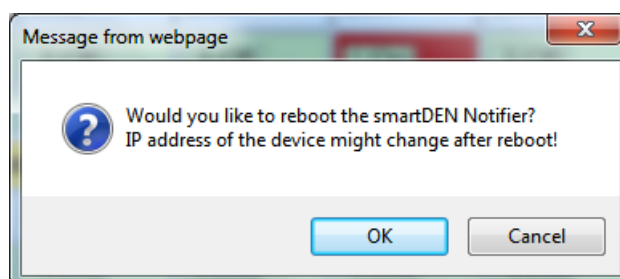


Figure 7.21. Reboot

8. HTTP server

This operation mode allows custom applications to obtain current measurements of **SmartDEN Notifier** without using a Web-browser. The custom application acts as a HTTP client, sending HTTP GET requests to the **SmartDEN Notifier** (Fig. 8.1).

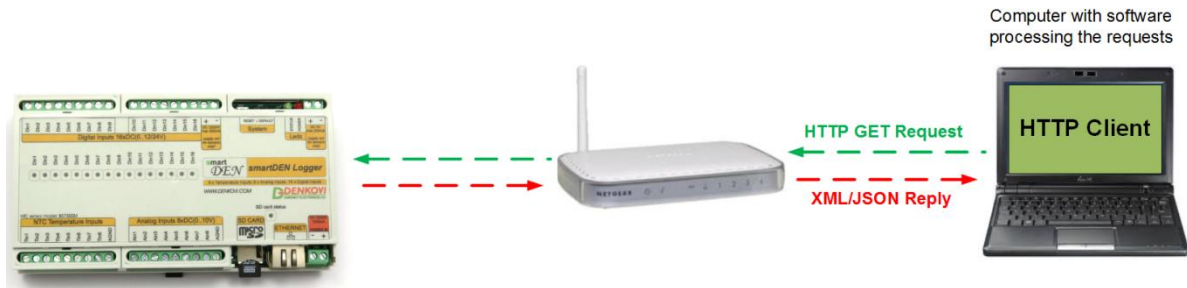


Figure 8.1. SmartDEN Notifier working as a HTTP server

To receive the current state of the **SmartDEN Notifier**, the application requests the page [current_state.xml](http://192.168.1.100/current_state.xml) / [current_state.json](http://192.168.1.100/current_state.json), for example:

http://192.168.1.100/current_state.xml
http://192.168.1.100/current_state.json



In order to use this mode, XML/JSON access should be enabled (see [7.5](#)).

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

8.1. XML access

8.1.1. XML 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](http://192.168.1.100/current_state.xml), 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](http://192.168.1.100/current_state.xml).

Bellow is an example of login process:

Step 1:

Request

http://192.168.1.100/current_state.xml

Reply (login required):

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

Step 2:**Request (password is sent as a parameter)**http://192.168.1.100/current_state.xml?pw=28237099263eabfd88626124a822c64c**Reply (password is O'K, login accepted):**

```
<CurrentState>
  <DigitalInput1>
    <Name>DIn1</Name>
    <Value>1</Value>
  </DigitalInput1>
  ...
</CurrentState>
```



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

8.1.2. XML 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

Getting the **<LoginKey>** in the answer in this mode means 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 Notifier** for time, specified by **Session Timeout** parameter, the session "times out" and a new login is required.

8.1.3. Retrieving current state in XML format

After successful login the custom application can obtain the **SmartDEN Notifier** current state by request to the [current_state.xml](#) page. The reply contains a page in XML format (Fig. 8.2).

```

▼ <CurrentState>
  ▼ <DigitalInput1>
    <Name>DIn1</Name>
    <Value>0</Value>
    <Count>92</Count>
  </DigitalInput1>
  ▶ <DigitalInput2>...</DigitalInput2>
  ▶ <DigitalInput3>...</DigitalInput3>
  ▶ <DigitalInput4>...</DigitalInput4>
  ▶ <DigitalInput5>...</DigitalInput5>
  ▶ <DigitalInput6>...</DigitalInput6>
  ▶ <DigitalInput7>...</DigitalInput7>
  ▶ <DigitalInput8>...</DigitalInput8>
  ▶ <DigitalInput9>...</DigitalInput9>
  ▶ <DigitalInput10>...</DigitalInput10>
  ▶ <DigitalInput11>...</DigitalInput11>
  ▶ <DigitalInput12>...</DigitalInput12>
  ▶ <DigitalInput13>...</DigitalInput13>
  ▶ <DigitalInput14>...</DigitalInput14>
  ▶ <DigitalInput15>...</DigitalInput15>
  ▶ <DigitalInput16>...</DigitalInput16>
  ▼ <AnalogInput1>
    <Name>AIn1</Name>
    <Value>504</Value>
    <Measure>3.9 Volt</Measure>
  </AnalogInput1>
  ▶ <AnalogInput2>...</AnalogInput2>
  ▶ <AnalogInput3>...</AnalogInput3>
  ▶ <AnalogInput4>...</AnalogInput4>
  ▶ <AnalogInput5>...</AnalogInput5>
  ▶ <AnalogInput6>...</AnalogInput6>
  ▶ <AnalogInput7>...</AnalogInput7>
  ▶ <AnalogInput8>...</AnalogInput8>
  ▼ <TemperatureInput1>
    <Name>TIn1</Name>
    <Value>23.4 °C</Value>
  </TemperatureInput1>
  ▶ <TemperatureInput2>...</TemperatureInput2>
  ▶ <TemperatureInput3>...</TemperatureInput3>
  ▶ <TemperatureInput4>...</TemperatureInput4>
  ▶ <TemperatureInput5>...</TemperatureInput5>
  ▶ <TemperatureInput6>...</TemperatureInput6>
  ▶ <TemperatureInput7>...</TemperatureInput7>
  ▶ <TemperatureInput8>...</TemperatureInput8>
  ▼ <Device>
    <Name>SMARTDEN_NOTIFY</Name>
    <MAC>E8:EA:DA:00:00:01</MAC>
  </Device>
</CurrentState>

```

Figure 8.2. XML file with current measurements

8.2. JSON access

8.2.1. JSON login (encrypted password)

The encrypted login sequence is similar to the XML access:

Step 1:

Request

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.json?pw=28237099263eabfd88626124a822c64c

Reply (password is O'K, login accepted):

```
{
  "CurrentState": {
    "DigitalInput": [
      { "Name": "DIn1", "Value": "1" },
      ...
    ]
  }
}
```



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

8.2.2. JSON login (non-encrypted password)

The password should be passed as non-encrypted parameter with the request:

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

Getting the "LoginKey" in the answer 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 Notifier** for time, specified by **Session Timeout** parameter, the session "times out" and a new login is required.

8.2.3. Retrieving current state in JSON format

When logged, the custom application can get current measurements requesting the [current_state.json](#) page. The reply contains a page in JSON format (Fig. 8.3).


```
{
  "CurrentState": {
    "DigitalInput": [
      {"Name": "DI1", "Value": "1"},
      {"Name": "DI2", "Value": "0"},
      {"Name": "DI3", "Value": "0"},
      {"Name": "DI4", "Value": "0"},
      {"Name": "DI5", "Value": "0"},
      {"Name": "DI6", "Value": "0"},
      {"Name": "DI7", "Value": "1"},
      {"Name": "DI8", "Value": "0"},
      {"Name": "DI9", "Value": "0"},
      {"Name": "DI10", "Value": "0"},
      {"Name": "DI11", "Value": "0"},
      {"Name": "DI12", "Value": "1"},
      {"Name": "DI13", "Value": "0"},
      {"Name": "DI14", "Value": "0"},
      {"Name": "DI15", "Value": "0"},
      {"Name": "DI16", "Value": "0"}
    ],
    "AnalogInput": [
      {"Name": "AI1", "Value": "249"},
      {"Name": "AI2", "Value": "190"},
      {"Name": "AI3", "Value": "13"},
      {"Name": "AI4", "Value": "505"},
      {"Name": "AI5", "Value": "1011"},
      {"Name": "AI6", "Value": "35"},
      {"Name": "AI7", "Value": "33"},
      {"Name": "AI8", "Value": "561"}
    ],
    "TemperatureInput": [
      {"Name": "TI1", "Value": "25.1"},
      {"Name": "TI2", "Value": "14.2"},
      {"Name": "TI3", "Value": "25.3"},
      {"Name": "TI4", "Value": "17.3"},
      {"Name": "TI5", "Value": "37.9"},
      {"Name": "TI6", "Value": "18.0"},
      {"Name": "TI7", "Value": "19.1"},
      {"Name": "TI8", "Value": "29.9"}
    ],
    "Device": {
      "Name": "SMARTDEN_NOTIFY",
      "MAC": "E8:EA:DA:00:00:01"
    }
  }
}
```

Figure 8.3. JSON file with current measurements

8.3. Multiple XML/JSON access

With the **Multiple Access** option selected (see [7.5](#)) the password should be passed as a non-encrypted parameter with each request:

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



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

9. MQTT notifications

SmartDEN Notifier supports MQTT protocol version 3.1.1. MQTT notifications can be triggered by threshold events or sent periodically.

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

9.1. Plain (non-encrypted) topics

9.1.1. Status notifications

Status notifications are sent as **PUBLISH Control Packets**. These packets contain two main fields: **Topic Name** and **Application Message**.

The following **Topic Name** format is used for status notifications:

SmartDEN_Notifier/<[MAC identifier](#)>/Status

Here <[MAC identifier](#)> is the MAC string of the module without intermediate colon chars. A sample status **Topic Name** for the module with MAC address "E8:EA:DA:00:00:01" can be:

SmartDEN_Notifier/E8EADA000001/Status

The **Application Message** can be:

- **Rebooted** – the module is rebooted;
- **Connected** - the module is connected to the MQTT server (broker);
- **Disconnected** - the module is disconnected from the MQTT server (broker) or is powered off (send as **Last Will** MQTT message);

9.1.2. Inputs state notifications

Inputs state notifications are sent as **PUBLISH Control Packets** with the following **Topic Name** format:

SmartDEN_Notifier/<[MAC identifier](#)>/<[Input name](#)>

Here <[MAC identifier](#)> is the MAC string of the module without intermediate colon chars, and <[Input name](#)> is can be DI1...DI16, AI1...AI8 and TI1...Ti8. A sample input state **Topic Name** for the module with MAC address "E8:EA:DA:00:00:01" can be:

SmartDEN_Notifier/E8EADA000001/DI1

The [Application Message](#) in this case contains the value of corresponding input.



To subscribe to all **SmartDEN Notifier** topics at once, the client application can use the multi-level wildcard character '#', for example:

SmartDEN_ Notifier/<[MAC identifier](#)>/#

9.2. Encrypted topics

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.

In order to monitor the **SmartDEN Notifier** by Android device the module should be added to the list of boards, controlled by the [DAE-aModules](#) application (Fig. 9.1). Please note

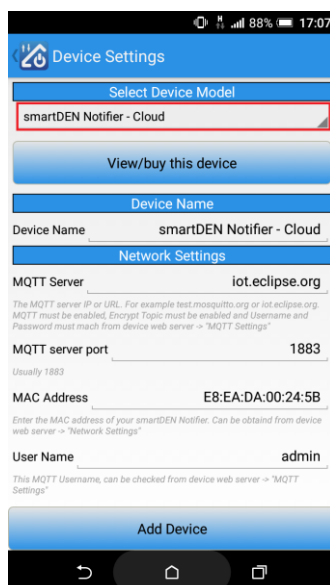


Figure 9.1. Add a new **SmartDEN Notifier** module

Next, the added module must be configured in the **Device Settings** screen of [DAE-aModules](#) (Fig. 9.2).

The screenshot shows the 'Device Settings' screen of the SmartDEN Notifier. The status bar at the top indicates 93% battery and 09:10. The screen is divided into two main sections: 'Device Settings' and 'Network Settings'.

Device Settings:

- Device Name:** smartDEN Notifier - Cloud
- View/buy this device:** A button to purchase the device.

Network Settings:

- MQTT Server:** . Annotation: "The MQTT server (broker) set in 'MQTT Settings' from the web server."
- MQTT server port:** . Annotation: "The MQTT Port set in 'MQTT Settings' from the web server." Below the input, it says "Usually 1883".
- MAC Address:** . Annotation: "The MAC address of the smartDEN Notifier". Below the input, it says "Enter the MAC address of your smartDEN Notifier. Can be obtained from device web server -> 'Network Settings'".
- User Name:** . Annotation: "Must be 'admin'". Below the input, it says "This MQTT Username, can be checked from device web server -> 'MQTT Settings'".
- Password:** . Annotation: "The MQTT Password set in 'MQTT Settings' from the web server." Below the input, it says "This MQTT password, can be checked from device web server -> 'MQTT Settings'".

At the bottom of the 'Network Settings' section is a **Save** button. The bottom of the screen shows the Android navigation bar with back, home, and recent apps icons.

Figure 9.2. SmartDEN Notifier module settings

Last, the notifications from the [DAE-aModules](#) must be allowed in the Android [Notifications management](#) screen (Fig. 9.3).

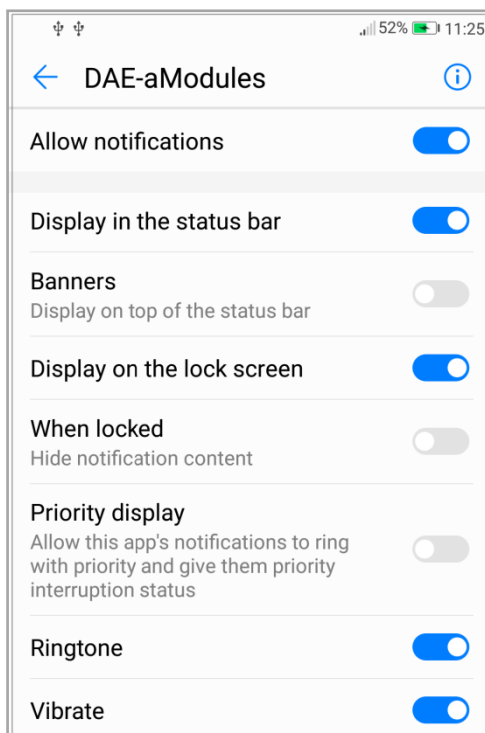


Figure 9.3. Android [Notifications management](#) settings for [DAE-aModules](#)

When configured, the inputs to be monitored can be selected from the navigation menu (Fig. 9.4).

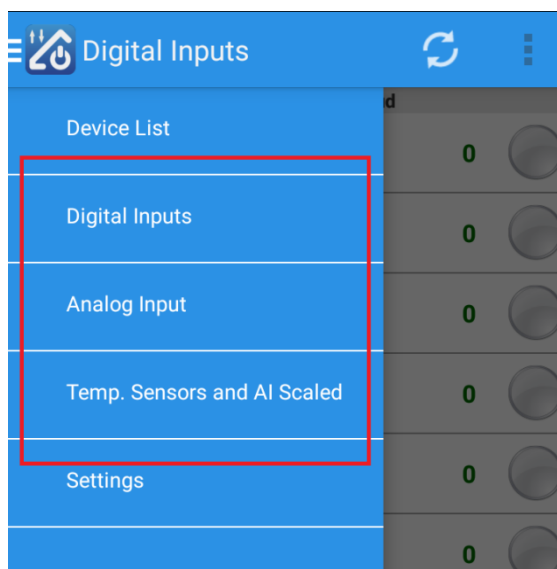


Figure 9.4. Navigation menu

Example monitoring screens for digital, analog and temperature inputs are shown in Fig. 9.5, 9.6 and 9.7.

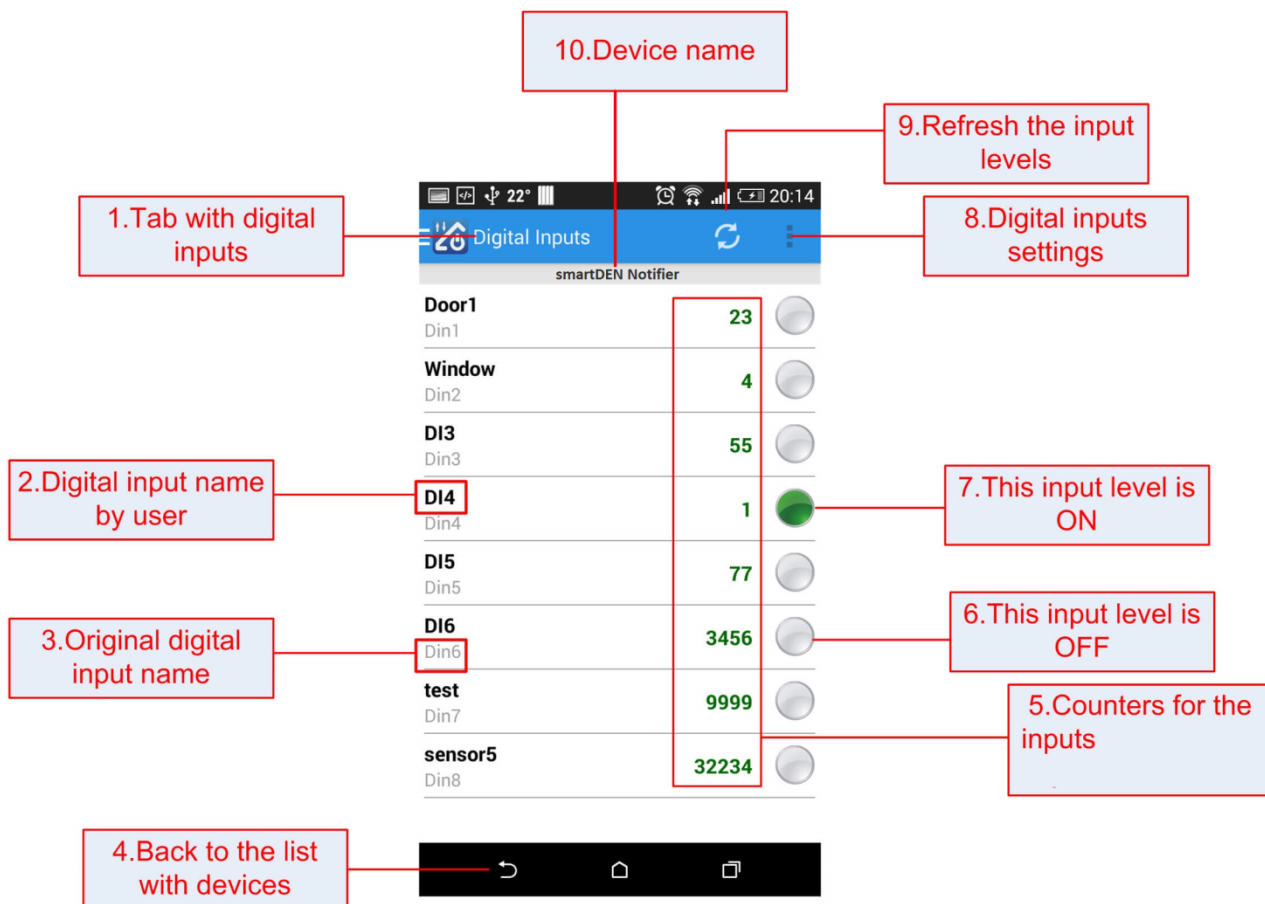


Figure 9.5. Digital inputs monitoring



Figure 9.6. Analog inputs monitoring

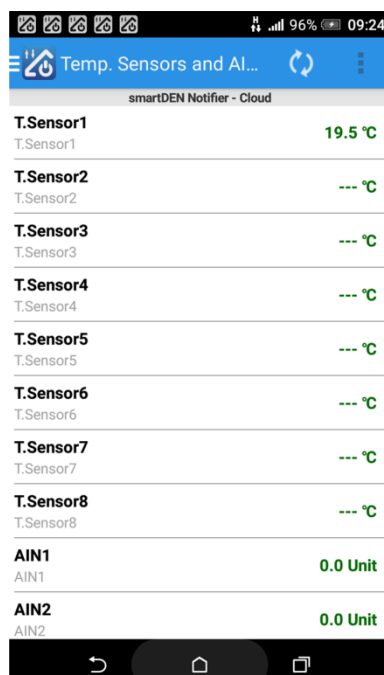


Figure 9.7. Temperature inputs and analog inputs (scaled) monitoring

Examples of status and inputs state notifications, received by **SmartDEN Notifier** are shown in Fig. 9.3 and Fig. 9.4.

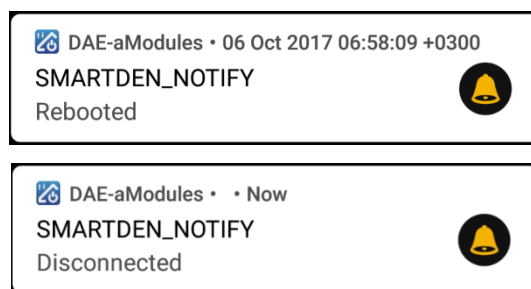


Figure 9.3. Status notifications

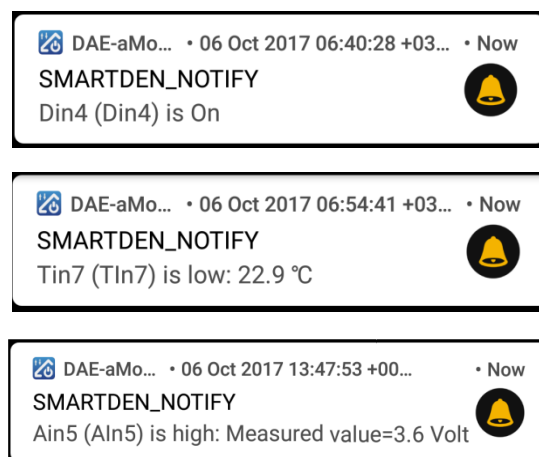


Figure 9.4. Inputs state notifications

10. e-Mail notifications

SmartDEN Notifier sends three types of e-Mail messages:

- “reboot” message - sent when the module is powered on;
- “event” message - triggered by event (for example a digital input state changes or analog/temperature value crosses over or below the predefined threshold values;
- “test” message - sent when a Test button on the e-Mail settings page is clicked.



After sending of an e-Mail, a “silent” period of 10 seconds is included before the next e-Mail transmission.

Messages include three sections:

```

-----
<e-Mail type>
-----
<Inputs state/values>
-----
<IP and MAC addresses of the module>
-----

```

10.1. “Reboot” message

The subject of “reboot” e-Mail messages is:

```
smartDEN Notifier "<Device Name>" Alert
```

where <Device Name> is the name of the module.

A sample “reboot” message is depicted in Fig. 10.1.

```

-----
Boot event
-----
Digital Inputs:
- Din1 (DIn1) is Off, Count=0
- Din2 (DIn2) is Off, Count=0
- Din3 (DIn3) is On, Count=0
- Din4 (DIn4) is On, Count=0
- Din5 (DIn5) is Off, Count=0
- Din6 (DIn6) is Off, Count=0
- Din7 (DIn7) is Off, Count=0
- Din8 (DIn8) is Off, Count=0
- Din9 (DIn9) is Off, Count=0
- Din10 (DIn10) is Off, Count=0
- Din11 (DIn11) is Off, Count=0
- Din12 (DIn12) is On, Count=0
- Din13 (DIn13) is On, Count=0
- Din14 (DIn14) is Off, Count=0
- Din15 (DIn15) is Off, Count=0
- Din16 (DIn16) is Off, Count=0

```

Analog Inputs:

- Ain1 (AIn1): Measured value=0.0 Volt, ADC value=0
- Ain2 (AIn2): Measured value=1237.0 mA, ADC value=139
- Ain3 (AIn3): Measured value=-2310.0 mV, ADC value=493
- Ain4 (AIn4): Measured value=3.2 Volt, ADC value=335
- Ain5 (AIn5): Measured value=65.1 %PH, ADC value=681
- Ain6 (AIn6): Measured value=5.2 Kg, ADC value=133
- Ain7 (AIn7): Measured value=0.0 Volt, ADC value=0
- Ain8 (AIn8): Measured value=0.0 Volt, ADC value=0

Temperature Inputs:

- Tin1 (TIn1): 17.1 °C
- Tin2 (TIn2): 26.2 °C
- Tin3 (TIn3): 30.2 °C
- Tin4 (TIn4): 4.8 °C
- Tin5 (TIn5): -16.9 °C
- Tin6 (TIn6): 15.1 °C
- Tin7 (TIn7): 23.2 °C
- Tin8 (TIn8): --- °C

IP Address: 192.168.1.100

MAC Address: E8:EA:DA:00:00:01

Figure 10.1. A sample “reboot” e-Mail message

10.2. “Event” message

The subject of “event” e-Mail messages is:

smartDEN Notifier "<Device Name>" Alert

where <Device Name> is the name of the module.

The “event” message may contain one or several events (Fig. 10.2).

Threshold event(s)

Digital Inputs:

- Din4 (Din4) is On, Count=2

Analog Inputs:

- Ain1 (AIn3) is high: Measured value=8.1 Volt, ADC value=812
- Ain5 (AIn5) is low: Measured value=49.8 %PH, ADC value=508

Temperature Inputs:

- Tin1 (TIn3) is low: 9.9 °C
- Tin2 (TIn7) is high: 40.1 °C

IP Address: 192.168.1.100

MAC Address: E8:EA:DA:00:00:01

Figure 10.2. A sample “event” e-Mail message

10.3. "Test" message

The subject of "test" e-Mail messages is:

smartDEN Notifier "<Device Name>" Test Mail

where <Device Name> is the name of the module.

The "test" messages contain the current state of all digital, analog and temperature inputs at the moment of clicking the **Test** button from e-Mail settings page (Fig. 10.3).

Test mail

Digital Inputs:

- Din1 (DIn1) is Off, Count=5
- Din2 (DIn2) is Off, Count=32
- Din3 (DIn3) is On, Count=1
- Din4 (DIn4) is Off, Count=21
- Din5 (DIn5) is Off, Count=117
- Din6 (DIn6) is Off, Count=0
- Din7 (DIn7) is On, Count=0
- Din8 (DIn8) is Off, Count=16
- Din9 (DIn9) is Off, Count=427
- Din10 (DIn10) is Off, Count=0
- Din11 (DIn11) is Off, Count=0
- Din12 (DIn12) is On, Count=0
- Din13 (DIn13) is On, Count=0
- Din14 (DIn14) is Off, Count=17
- Din15 (DIn15) is Off, Count=0
- Din16 (DIn16) is Off, Count=0

Analog Inputs:

- Ain1 (AIn1): Measured value=0.0 Volt, ADC value=0
- Ain2 (AIn2): Measured value=1250.0 mA, ADC value=135
- Ain3 (AIn3): Measured value=-2280.0 mV, ADC value=487
- Ain4 (AIn4): Measured value=3.4 Volt, ADC value=342
- Ain5 (AIn5): Measured value=65.4 %PH, ADC value=685
- Ain6 (AIn6): Measured value=5.3 Kg, ADC value=136
- Ain7 (AIn7): Measured value=0.0 Volt, ADC value=0
- Ain8 (AIn8): Measured value=0.0 Volt, ADC value=0

Temperature Inputs:

- Tin1 (TIn1): 17.4 °C
- Tin2 (TIn2): 25.7 °C
- Tin3 (TIn3): 28.5 °C
- Tin4 (TIn4): 3.9 °C
- Tin5 (TIn5): -16.4 °C
- Tin6 (TIn6): 15.2 °C
- Tin7 (TIn7): 23.5 °C
- Tin8 (TIn8): --- °C

IP Address: 192.168.1.100

MAC Address: E8:EA:DA:00:00:01

Figure 10.3. A sample “test” e-Mail message

11. Security considerations

The **SmartDEN Notifier** runs a special firmware and do not use a general-purpose operating system. There are no extraneous IP services found on general-purpose operating systems (e.g. Telnet, FTP, Finger, etc.) that can be particularly vulnerable.

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 Setting** form. Therefore, you must set passwords in a secure environment where you can make sure that no one is "eavesdropping".

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.

12. Mechanical drawing

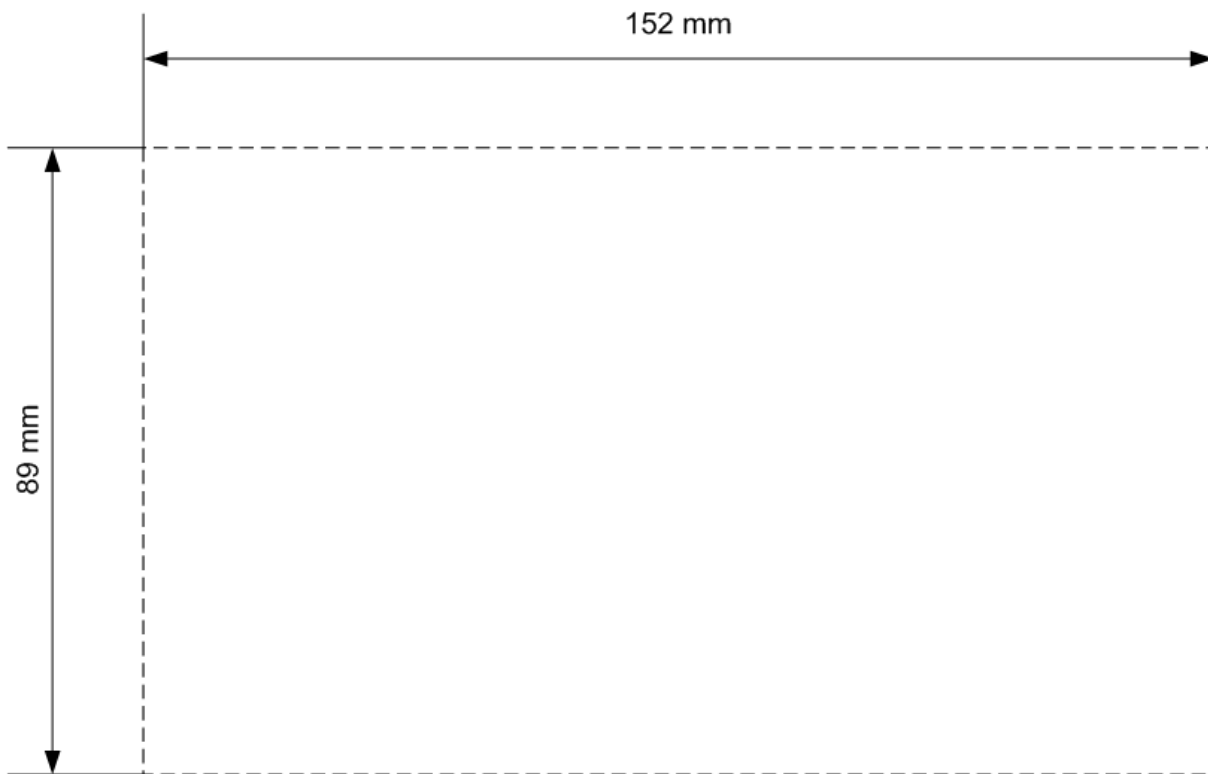


Figure 57. Device size