

Wi-Fi 16 Relay Module

User Manual
Date: 21 Aug 2017



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Document Revision History

Version	Date	Comments
1.00	2016/12/12	The initial release
2.00	2017/08/21	Second release

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1. Specification

Relays:

- 16 x SPDT relays - 10A / 250VAC, 15A / 120VAC, 10A / 28VDC;

Power supply requirement, selectable during purchase:

- 12V DC / 600mA
- 24V DC / 400mA

Wireless Wi-Fi IEEE 802.11 standart:

- Wireless Wi-Fi 802.11 b/g/n;
- External Wi-Fi antenna for better range;
- Supported modes: AP (Access Point), STA (Station) and AP+STA (Access Point + Station);
- Supported encryption modes:
 - WEP;
 - WPAPSK-TKIP;
 - WPAPSK-AES;
 - WPA2PSK-TKIP;
 - WPA2PSK-AES;

Web Interface:

- Configuration of system parameters;
- Secure login authorization;

Network Protocols:

- Standart protocols: DHCP, DNS, ICMP (ping);
- Control relays via TCP/IP, UDP or Virtual Serial Port;

PCB parameters:

- Led indicators: Relays, Power ON, Wi-Fi link, Ready Status;
- FR4 / 1.5mm / two layers / metalized holes / HAL / white stamp / solder mask / Extra PCB openings for better voltage isolation / Doubled PCB tracks for better voltage isolation;

Physical and Environment:

- Operating temperature range: from 0 °C to +70 °C;
- Offered in two versions: PCB only and with DIN RAIL BOX;
- Dimensions:
 - PCB: W=82mm x L=203mm x H=24mm
 - BOX: W=210mm x L=85mm x L=58mm

2. Applications examples

2.1. Control electrical devices wirelessly

The main feature of the module is to control electrical devices wirelessly. It carries 16 relay channels with minimum 7A / 250VAC current rating each. With our popular and free [DRM Software](#) and [Relay Command Line Tool](#) this module is turned in really cost effective solution for wireless control of electrical devices.

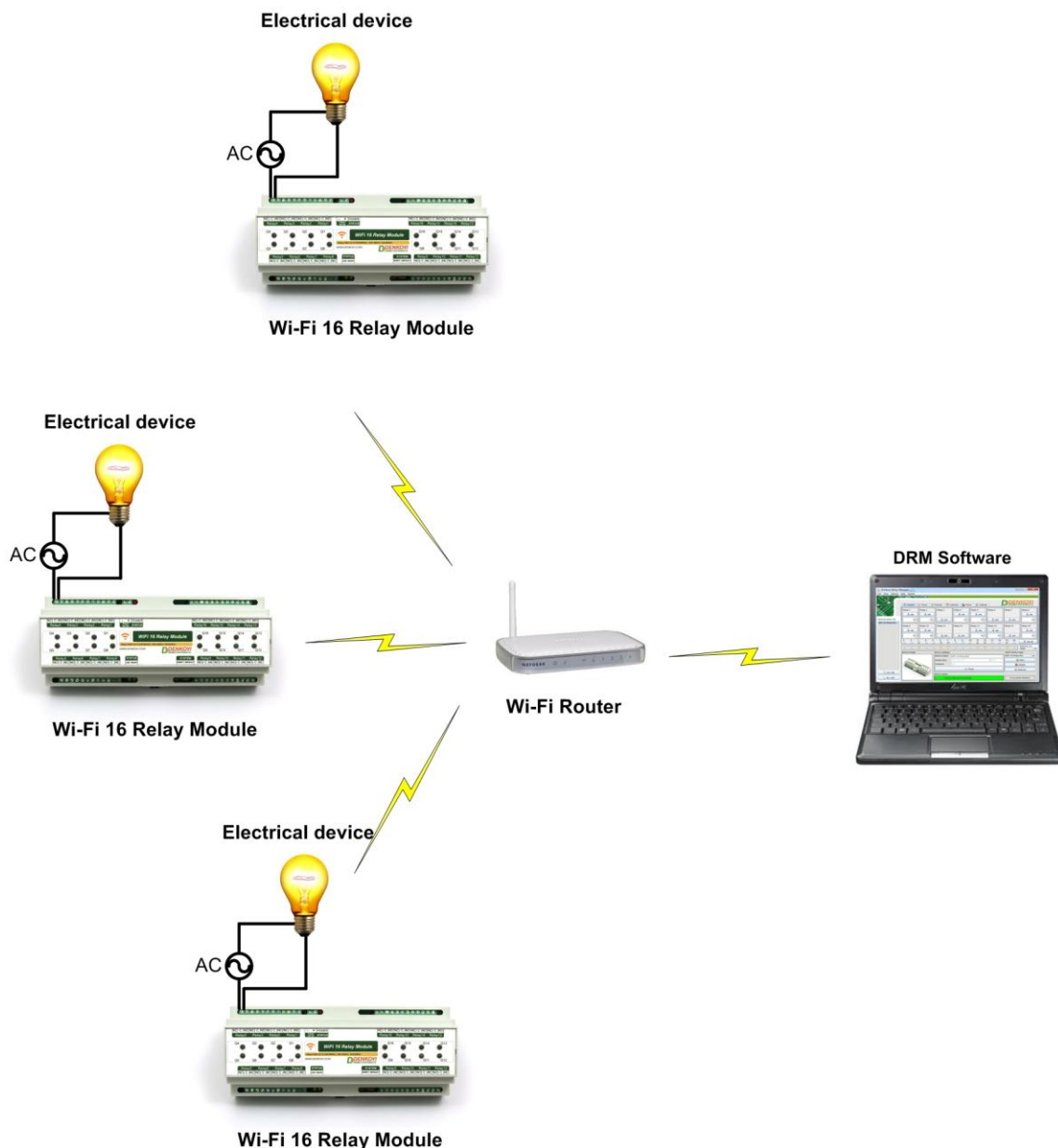


Figure 1. Wi-Fi Relay Module's main feature is to provide wireless control for appliances

2.2. Control electrical devices via Internet

Usually the next step is to control the system via the Internet. The module supports simple ASCII commands via UDP, TCP/IP sockets and Virtual Serial Port as well. There are lot of software on the marked for TCP/IP and UDP control so it's really simple to be organized this scenario.

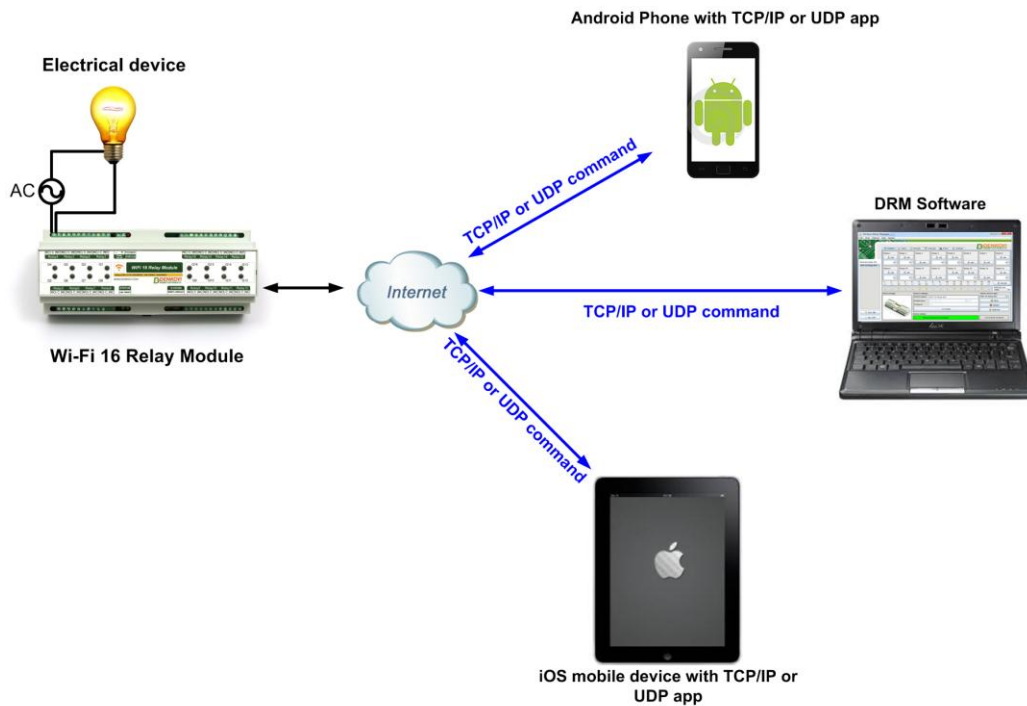


Figure 2. Access via Internet

2.3. Control electrical devices via Virtual Serial (COM) Port

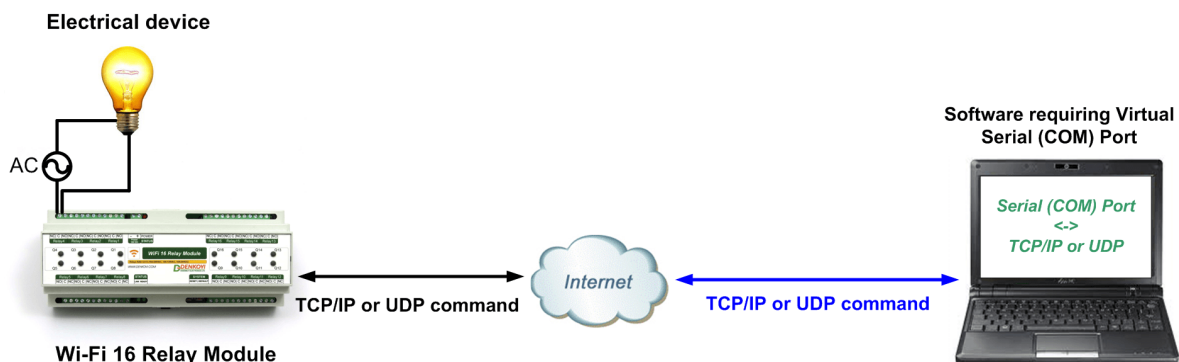


Figure 3. Virtual Serial (COM) Port

3. Technical parameters

Table 1. Physical parameters

Parameter	Value
Box size, mm	210 x 85 x 58
PCB size, mm	203 x 82
Box weight, gr	420
PCB weight, gr	285
Operating temperature, °C	0 to 70

Table 2. System parameters

Parameter	Value
Power supply voltage, VDC	12 or 24 (depends on the model) $\pm 5\%$
Maximum current consumption at 12VDC (when all relays are ON), mA	600
Maximum current consumption at 24VDC (when all relays are ON), mA	400
Protection against reverse polarity	Yes
Default settings button	Yes
Reset button	Yes

Table 3. Relays

Parameter	Value
Relays maximum switchable current / voltage	10A / 250VAC, 15A / 120VAC, 10A / 28VDC

Table 4. Network

Parameter	Value
DHCP	Yes
DNS	Yes
ICMP	Yes
Network parameters	IP/Mask/Default gateway
Web server for configuration/access	Yes
Control Relays via WEB server	No
TCP/IP socket support	Yes
UDP socket support	Yes

4. Connectors, ports and led indicators

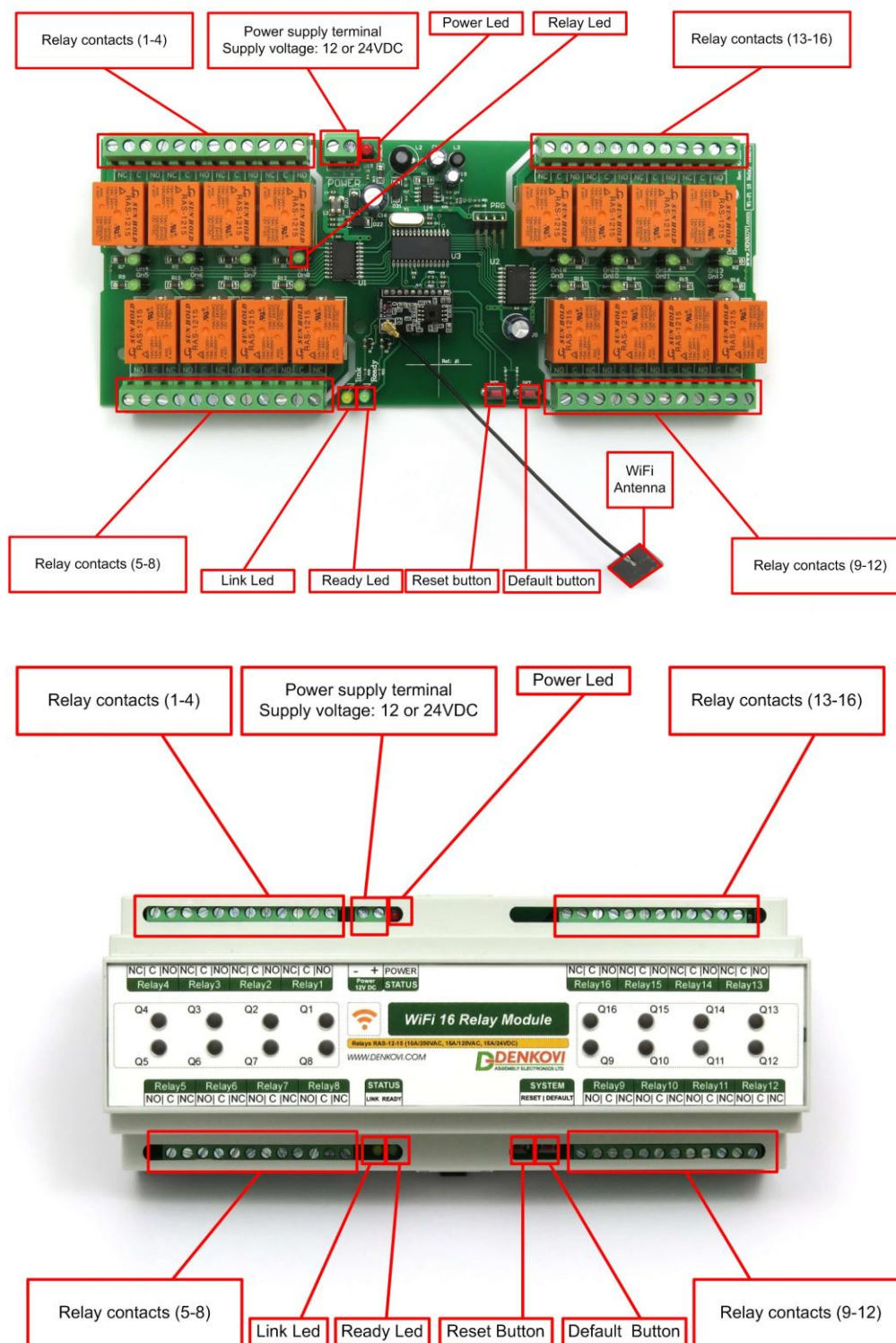


Figure 4. Device overview

5. Installation

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

5.1. Box mounting



Figure 5. Mounting the device to DIN rail

WiFi 16 Relay Module (DIN BOX version) can be mounted to a standard (35mm by 7.55mm) DIN rail. Attach the module to the DIN rail by hooking the hook on the back of the enclosure to the DIN rail and then snap the bottom hook into place.

5.2. Power supply

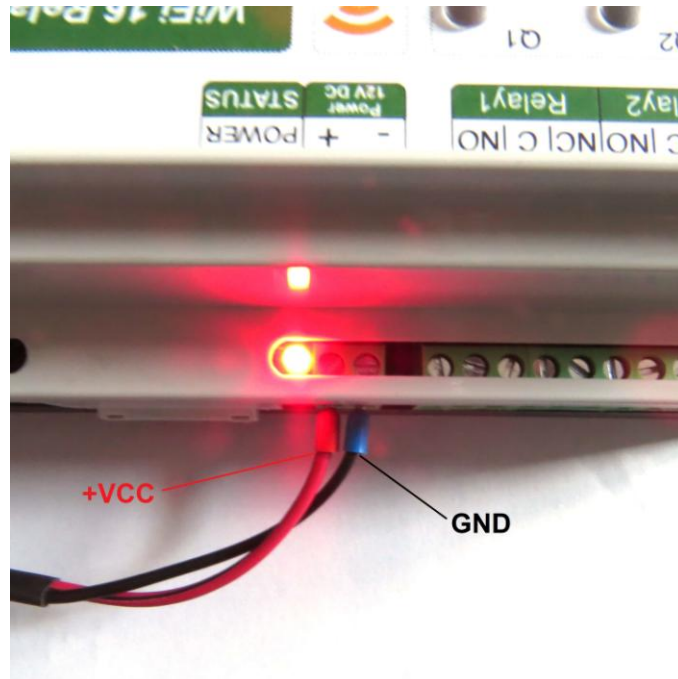


Figure 6. Power supply

Depending on the selected model during purchase the power supply source for **WiFi 16 Relay Module** must be with voltage either **12VDC** or **24VDC** stabilized and filtered. After power on, the power led must be on and **ready led indicator** must on as well.

- ❗ Please keep the polarity and supply voltage range!
- ❗ **WiFi 16 Relay Module** does not accept AC supply voltage. It is highly recommended to check the power supply source parameters before supply the module.
- ❗ The power supply equipment shall be resistant to short circuit and overload in secondary circuit.
- ❗ When in use, do not place the equipment so that it is difficult to disconnect the device from the power supply.

5.3. Relay connection

The module carries 16 SPDT relays with parameters specified in the technical parameters section. Every relay channel has normally open (NO) and normally closed (NC) contacts connected directly to the terminals.

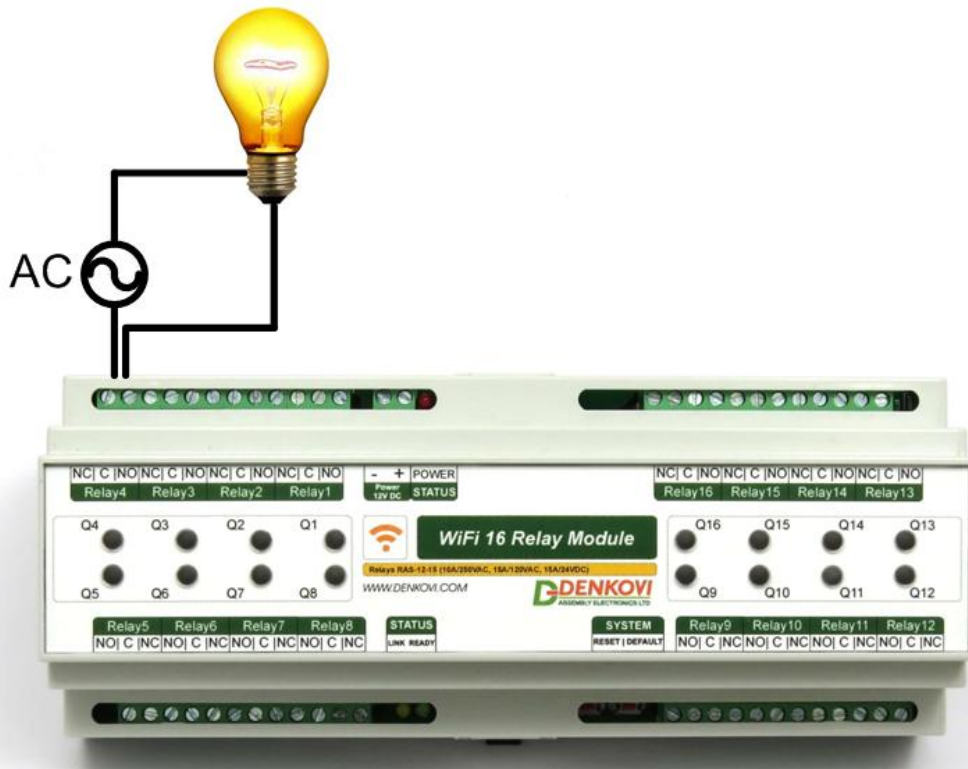


Figure 7. Connecting a lamp to relay

5.4. WiFi connection for very first time

The module is shipped with set Wi-Fi mode **AP (Access Point)**. The default SSID is **WiFi16_Relay** and there is not password. When the module is powered on and the **Ready Led** is ON as well, it should appear in your Wi-Fi scanned networks list.

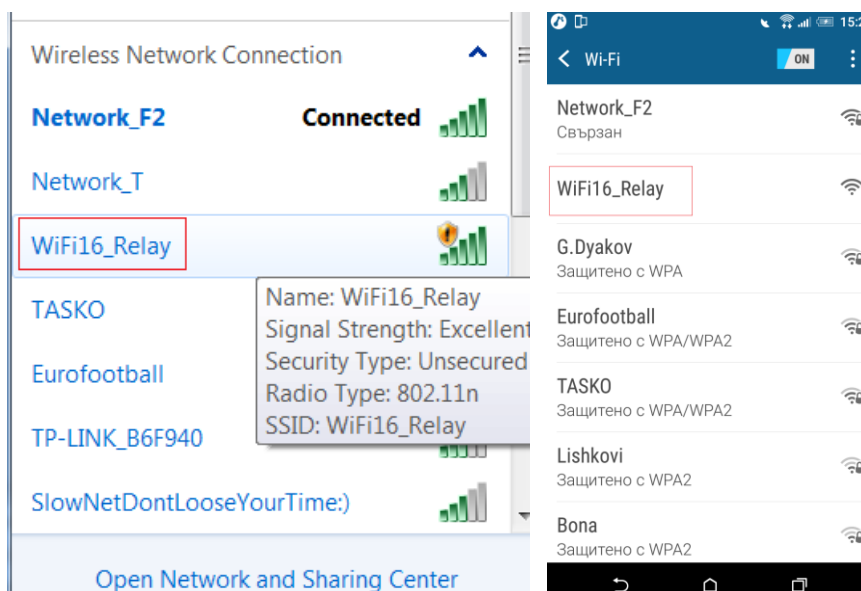


Figure 8. Default AP network name

Next is to connect to this network.

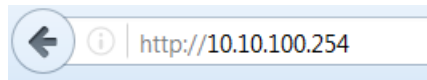


Please note DHCP of your Wi-Fi network adapter must be turned ON in order to receive IP address from the board.

After successful connection, the **Link Led** is turned ON.

5.5. Set-up the module via web browser

Open web browser and type in address bar: **http://10.10.100.254**



Login to the web server, the default username/password is **admin/admin**. Now it should appear the bellow welcome page:



Figure 9. Web server welcome page

Go to "Sockets" tab and be sure the following settings are entered (they are for the software communication):

SOCKET_A Settings

Protocol	TCP-Server
Port ID	8899
Server Address	10.10.100.254
TCP Time Out Setting	300

SOCKET_B Settings

Enable/Disable	Enable
Protocol	UDP-Server
Port ID	8899
Server Address	10.10.100.254
TCP Time Out Setting	300

Save

Figure 10. Sockets settings

Now a reboot is required in order the new settings take effect.

5.6. Control with DRM Software

Download and install DRM Software from this link:

<http://denkovi.com/drm-software>

Run the software and open the device with name "WiFi 16 Relay Brd"

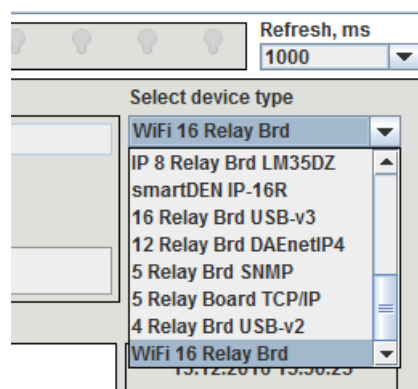


Figure 11. DRM device settings

It will be created new instance of this device type with the following settings:

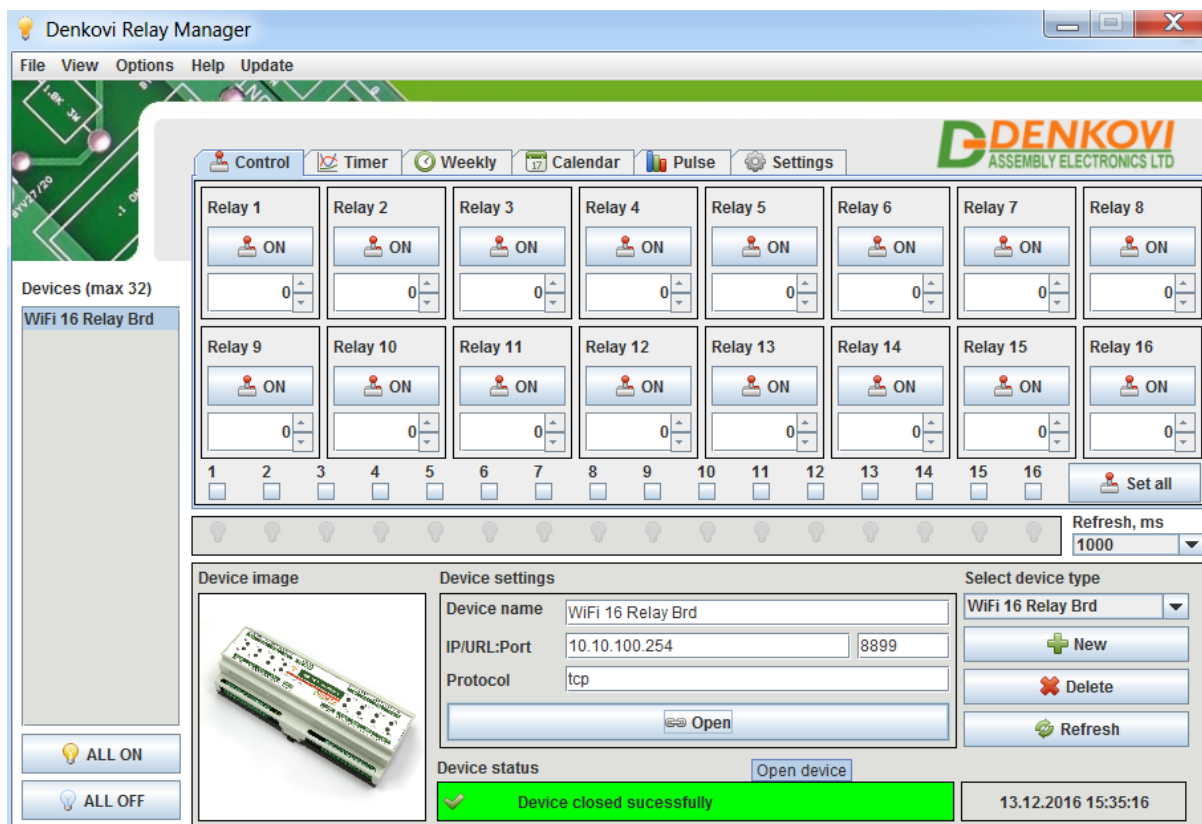


Figure 12. DRM settings

Please check the following settings:

- **DRM Software IP/URL** must be the **IP address** of the module;
- **DRM Software Port** must be the **Port ID** from the module webserver -> Network -> SOCKET_A SETTINGS or SOCKET_B SETTINGS;
- **DRM Software Protocol** must be **tcp / udp** depending on parameter **Protocol** = "TCP-Server" / "UDP-Server" from the module webserver -> Network -> SOCKET_A SETTINGS or SOCKET_B SETTINGS;



Please note DRM software will work with the relay module only if the **Protocol** parameter is "**TCP-Server**" or "**UDP-Server**" from webserver -> Network -> SOCKET_A SETTINGS or SOCKET_B SETTINGS

Now, click the "Open" button. The relays are available for controlling.

6. Default settings

6.1. List with factory settings

Table 5. Default (Factory) settings

Settings group	Parameter (according Web pages)	Value
WiFi Settings	WiFi Work Mode	AP (Access Point)
	SSID	WiFi16_Relay
	Wireless AP Security Setting	Disable
Network Settings	DHCP	Enabled
	IP Address	10.10.100.254
	Gateway	10.10.100.254
	Subnet Mask	255.255.255.0
Communication Sockets	Socket_A Protocol	TCP-Server
	Port ID	8899
	Server Address	10.10.100.254
	TCP Time Out Setting	300
	Socket_B	enable
	Protocol	UDP-Server
	Port ID	8899
	Server Address	10.10.100.254
	TCP Time Out Setting	8899
Web Server Settings	Server Port	80
	User name	admin
	Password	admin

6.2. Procedure for loading the factory settings

The default (factory) settings can be loaded if **button Default** (or **DFT**) is pressed and hold for more than 3 seconds at any time.

7. Web access

To access the setup pages, run a web browser (Internet Explorer, Mozilla Firefox or similar), and enter the WiFi 16 Relay Module IP address, for example: <http://10.10.100.254>

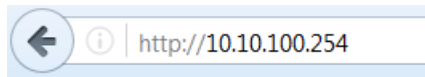


Figure 16. Open via browser

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

7.1. Home

The welcome page is shown bellow.

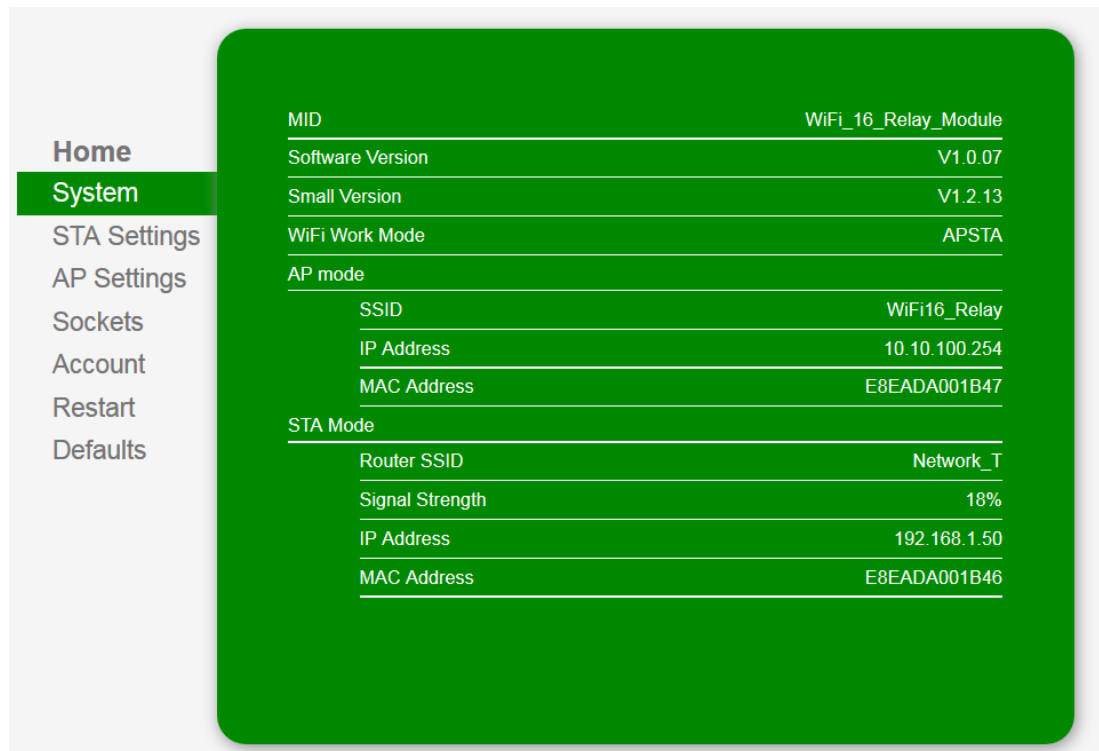


Figure 17. Home page

From this page it is possible to make fast scan of the Wi-Fi networks within the range and to connect the module to this network.

7.2. System

This page displays general information for the module.



WiFi_16_Relay_Module	
MID	WiFi_16_Relay_Module
Software Version	V1.0.07
Small Version	V1.2.13
WiFi Work Mode	APSTA
AP mode	
SSID	WiFi16_Relay
IP Address	10.10.100.254
MAC Address	E8EADA001B47
STA Mode	
Router SSID	Network_T
Signal Strength	18%
IP Address	192.168.1.50
MAC Address	E8EADA001B46

Figure 18. System page

- **MID:** Module ID, for this device it is WiFi_16_Relay_Module;
- **Software Version:** The firmware version of the Wi-Fi interface;
- **Small Version:** The minor firmware version of the Wi-Fi interface;
- **Wi-Fi Work Mode:** The working mode of the Wi-Fi interface - it may be AP (Access Point), STA (Station) or APSTA (Access Point and Station at the same time);
- **AP Mode:** In this mode the current module creates network and acts like **access point**. If this mode is active it will display the below settings:
 - **SSID:** The SSID of the AP network;
 - **IP Address:** The IP of the AP network;
 - **MAC Address:** The MAC address of the AP network;
- **STA Mode:** In this mode the current module connects to another network. If this mode is active it will display the below settings:
 - **Router SSID:** The SSID of the network, to which is connected the current module (usually router);
 - **Signal Strength:** This signal strength of the network;
 - **IP Address:** The IP address of the network (usually this is the AP router IP address) to which is connected the current module;
 - **MAC Address:** Usually the MAC address of the router or AP;

7.3. STA Settings

These are the settings for STA mode. In this mode the relay module is connected to another Wi-Fi network - usually created by AP router.

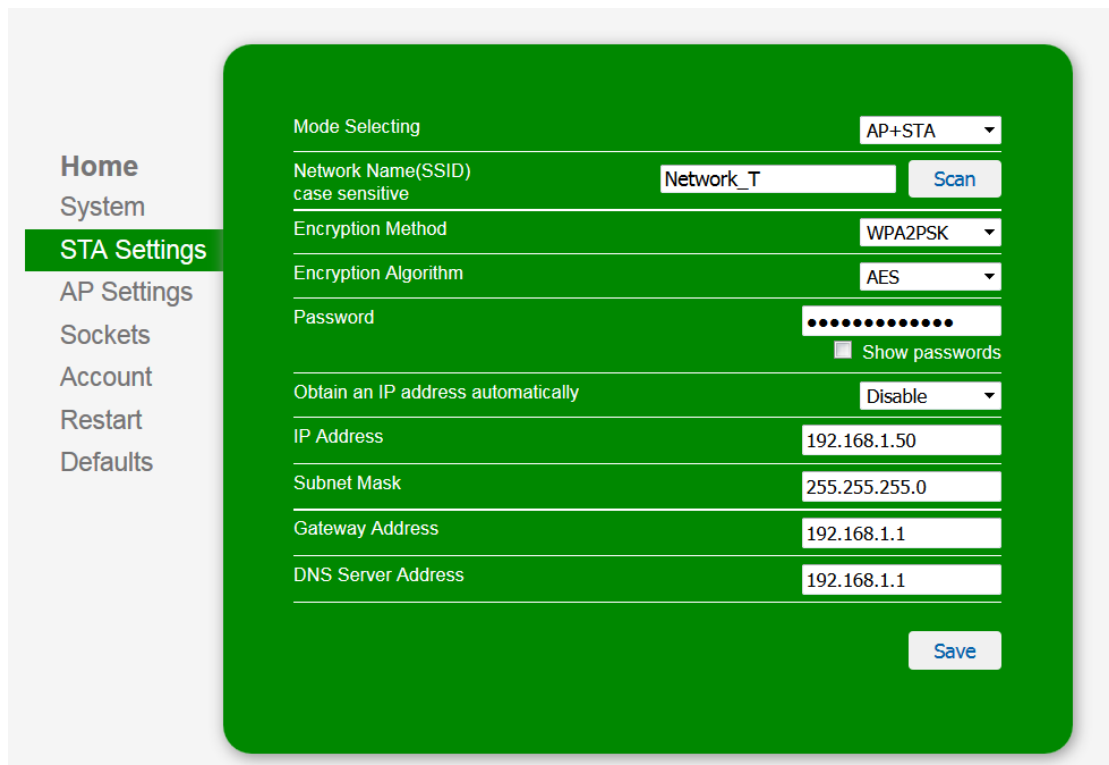


Figure 19. STA Settings page

- **Mode:** The working mode of the Wi-Fi interface. It can be:
 - **STA:** In this mode the board connects to another Wi-Fi network (usually created by AP router);
 - **AP+STA:** The above mode plus additional Wi-Fi network created by the module. Here it is AP and client at the same time.
 - **Network Name (SSID):** The name (SSID) of the network to which must be connected the module;
- **Scan button:** Starts scanning the available Wi-Fi networks within the range;
- **Encryption Method:** The encryption method for the Wi-Fi network (OPENWEP, SHAREDWEP, WPAPSK, WPA2PSK);
- **Encryption Algorithm:** AES or TKIP;
- **Encryption Type:** HEX or ASCII;
- **Password:** password for the network. When method is OPENWEP pr SHAREDWEP length must be 10 or 26 symbols (for HEX encryption type) and 5 or 13 symbols (for ASCII encryption type). For rest of cases when password is required it may be maximum 64 symbols and minimum 8 symbols;
- **Obtain an IP address automatically:** Enable or disable DHCP. When disabled, the bellow settings will be active to be set;
- **IP Address:** The IP address of the module;

- **Subnet Mask:** The mask;
- **Gateway Address:** The gateway IP address (usually the address of the AP or router);
- **DNS Server Address:** The DNS IP address (usually the address of the AP or router);
- **Save button:** Once you have changed the settings as required, click this button.

When the **Scan button** is pressed, the scanning will begin and the bellow screen will appear asking for select the Wi-Fi network to connect to.

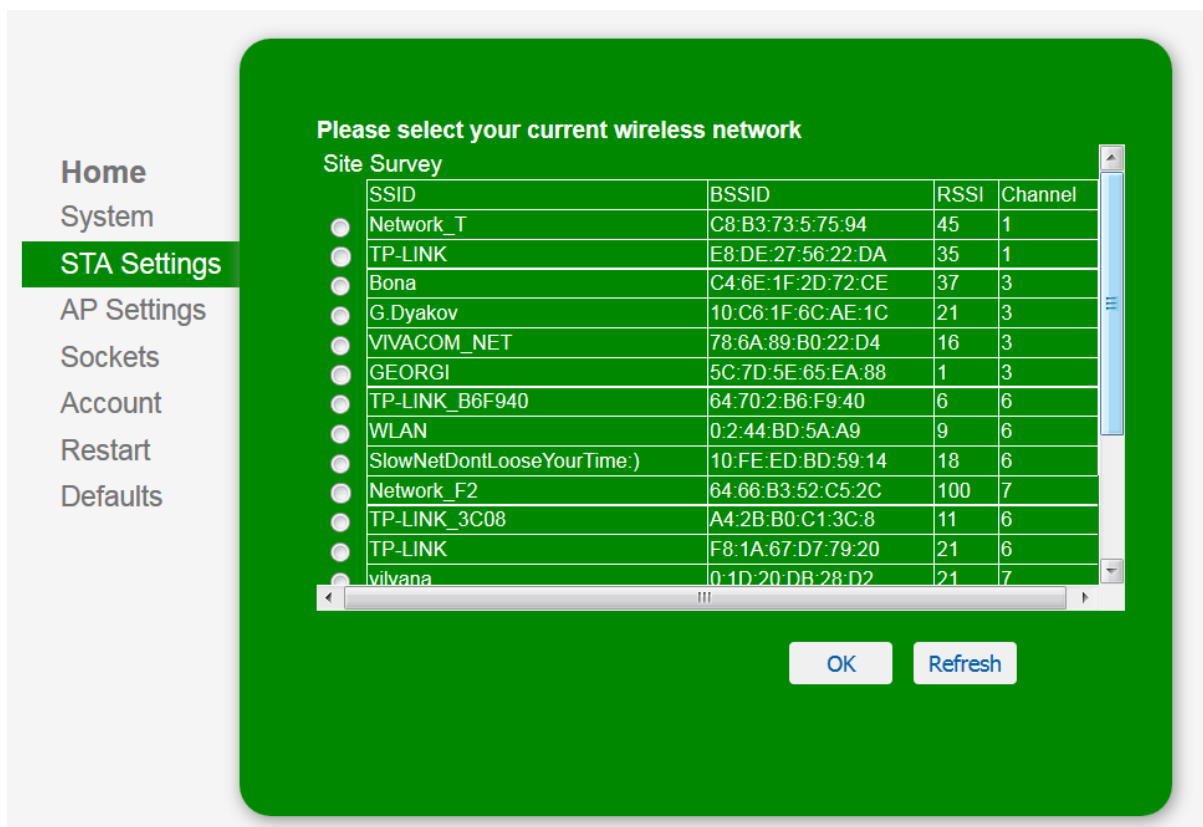


Figure 20. List with available Wi-Fi networks within the range



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

7.4. AP Settings

These are the settings for AP (Access Point) mode.

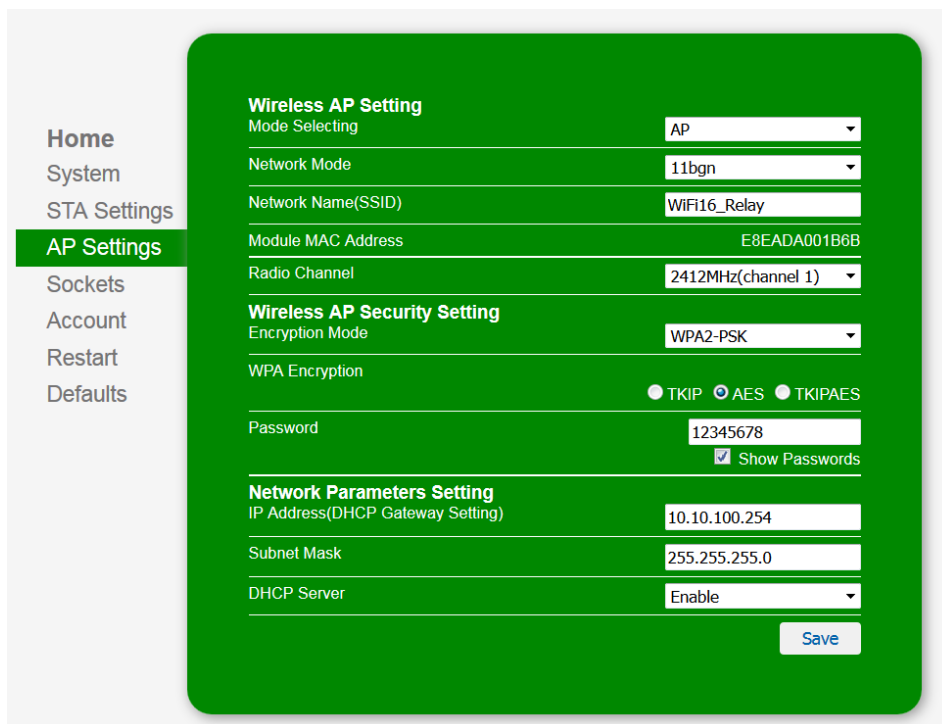


Figure 21. AP Settings

- **Mode:** The working mode of the Wi-Fi interface. It can be:
 - **AP:** In this mode the board works as Access Point only;
 - **AP+STA:** Access Point and station at the same time;
 - **Network Name (SSID):** The name of the Wi-Fi network which will be created by the module;
- **Module MAC Address:** The MAC address of the AP interface;
- **Radio Channel:** Select the radio channel for the Wi-Fi network;
- **Wireless AP Security Setting:** It may be either disabled either WPA2-PSK;
- **WPA Encryption:** If security setting is WPA2-PSK, it may be TKIP, AES or TKIPAES;
- **Password:** If security setting is WPA2-PSK, this is the AP Wi-Fi network. May be max 20 characters;
- **IP Address (DHCP Gateway Setting):** The IP address of the module in this mode;
- **Subnet Mask:** The network mask;
- **DHCP Server:** Enable or disable the DHCP setting of the module in AP mode;
- **Save button:** Once you have changed the settings as required, click this button.



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

7.5. Sockets

From the bellow page it is possible to be adjusted the communication sockets parameters. The sockets are used for communication between software (computer, mobile apps) and the relay module.

SOCKET_A Settings

Protocol	TCP-Server
Port ID	8899
Server Address	10.10.100.254
TCP Time Out Setting	300

SOCKET_B Settings

Enable/Disable	Enable
Protocol	UDP-Server
Port ID	8899
Server Address	10.10.100.254
TCP Time Out Setting	300

Save

Figure 22. Sockets page

7.5.1. SOCKET_A Settings

- **Protocol:** This parameter may be:
 - **TCP-Server:** In this mode the socket works like TCP/IP server;
 - **TCP-Client:** In this mode the socket works like TCP/IP client;
 - **UDP-Server:** In this mode the socket works like UDP server;
 - **UDP-Client:** In this mode the socket works like UDP client;
- **Port ID:** The port number of the socket (1...65535);
- **Server Address:** Valid only if socket is server;
- **TCP Time Out Setting:** timeout (in seconds), only if TCP mode is selected (0...600 sec);

7.5.2. SOCKET_B Settings

- **Enable/Disable:** Enable or disable the second socket;
- **Protocol:** This parameter may be:
 - **TCP-Client:** In this mode the socket works like TCP/IP client;
 - **UDP-Server:** In this mode the socket works like UDP server;
 - **UDP-Client:** In this mode the socket works like UDP client;
- **Port ID:** The port number of the socket (1...65535);
- **Server Address:** Valid only if socket is server;
- **TCP Time Out Setting:** timeout (in seconds), only if TCP mode is selected (0...600 sec);



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

7.5.3. Sockets Mechanism

Socket A supports four modes: TCP Server, TCP Client, UDP Client and UDP Server. The software developed by Denkovi A. E. LTD usually works with sockets set up like TCP Server or UDP Server.

When Socket A is configured as TCP Server, it supports "Multi-TCP link" connection and maximum 5 TCP clients are permitted to connect.

"Multi-TCP link" connection works in this way:

- All data from different TCP connections or clients will be transmitted to the module as a sequence.
- The answer from the module will be duplicated and broadcasted to every TCP connection or client (it doesn't matter if it is Socket A or Socket B).

Socket B supports three modes: TCP Client, UDP Client and UDP Server.

7.6. Account

Set the username and password for web server access.

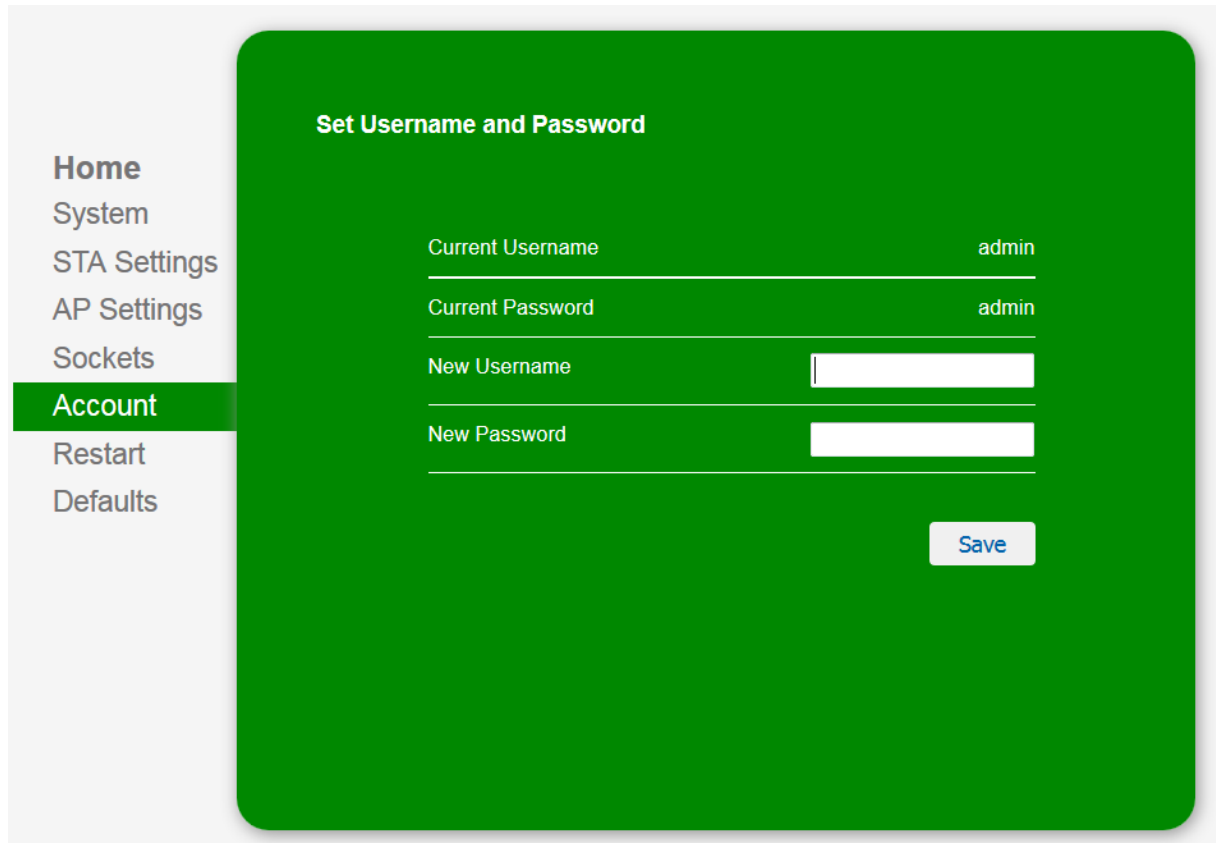


Figure 23. Account page

The maximum length for the username and password is 20 characters and the minimum is 1 character.



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

7.7. Restart

From this page it is possible to restart the module (only the Wi-Fi interface).

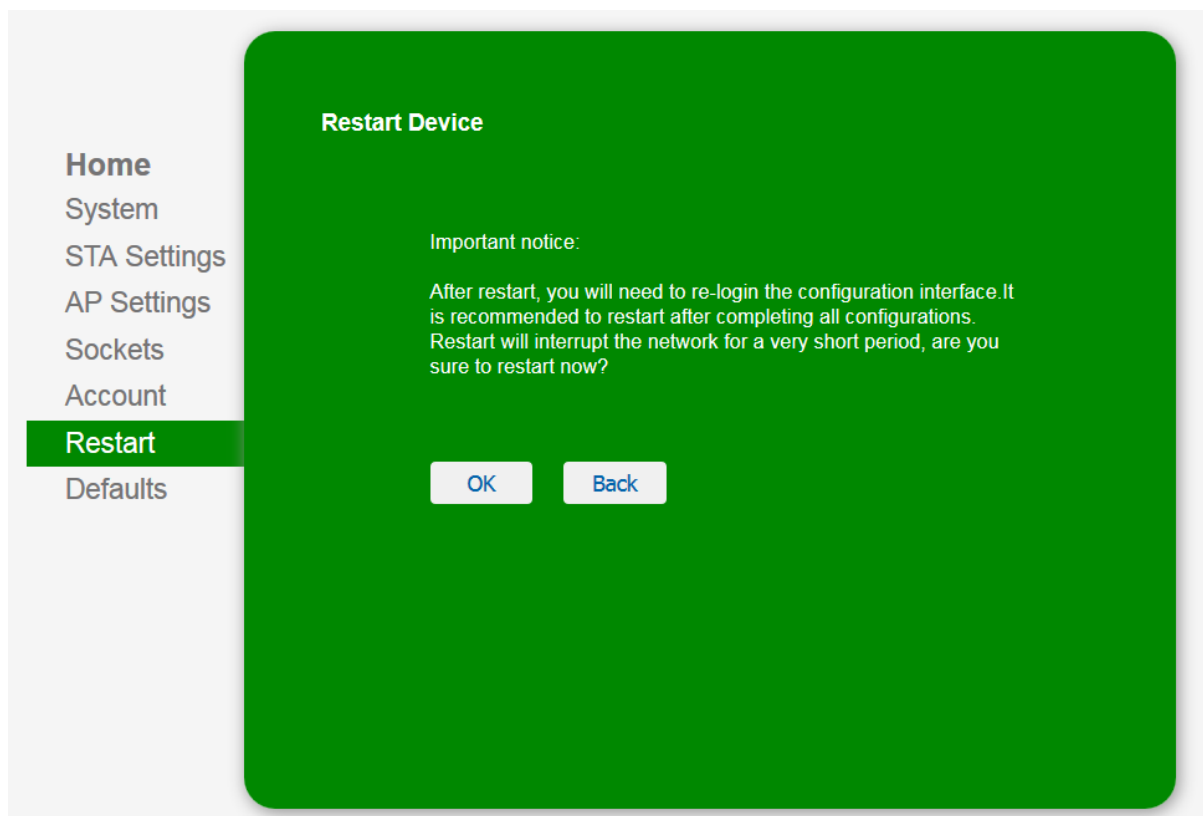


Figure 24. Restart page

7.8. Defaults

Loads the default (factory) settings.

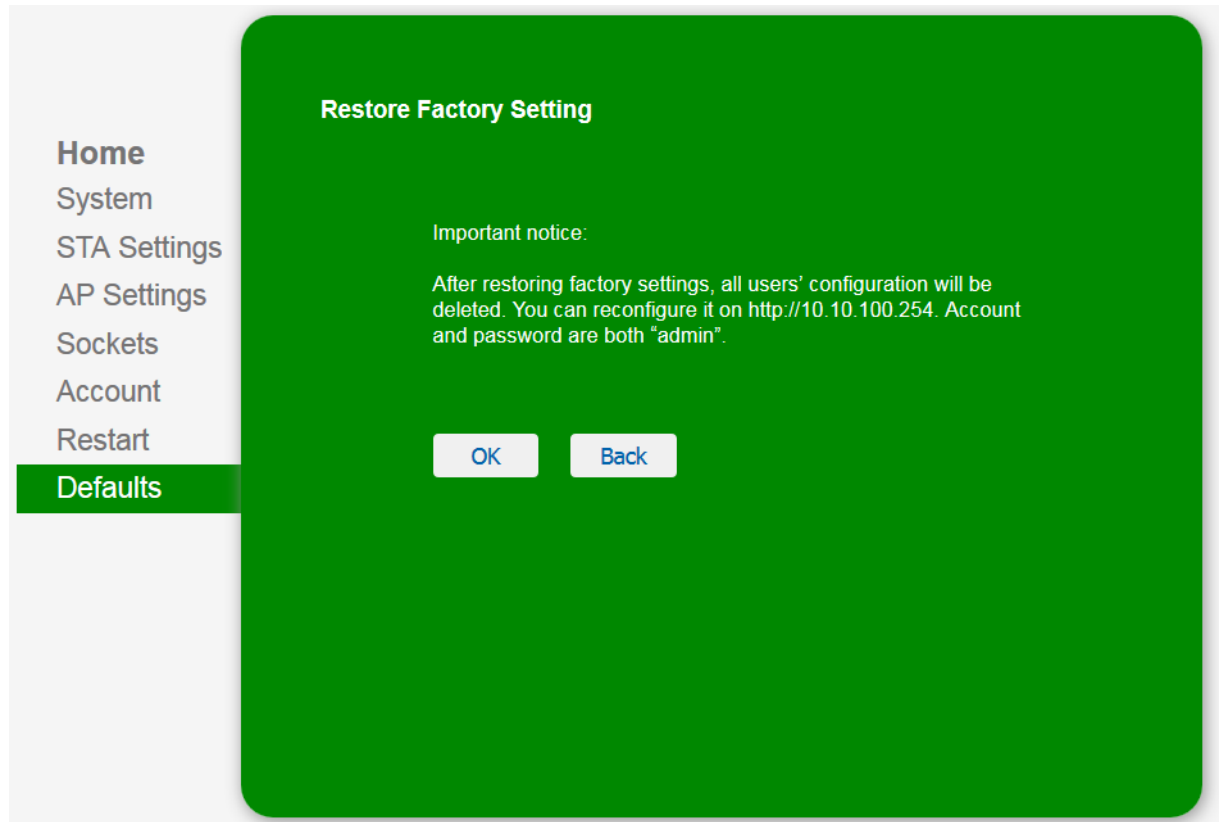


Figure 25. Defaults page

8. Protocol description

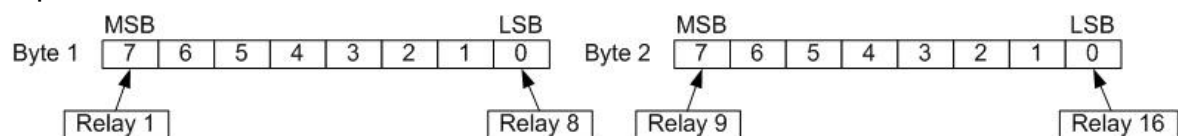
The Wi-Fi 16 Relay Module supports simple custom synchronous protocol for setting/getting the relays status. The communication may be used over TCP/IP or UDP sockets or Virtual Serial Port (Virtual Com Port) technology.

8.1. Command for receiving relay status

Command format

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
'a'	's'	'k'	'/'	'/'

Expected answer



The answer is 2 bytes. If the bit is 0, relay is OFF, if the bit is 1 relay is ON.

- Byte1.Bit7 represents relay 1
- Byte1.Bit0 represents relay 8
- Byte2.Bit7 represents relay 9
- Byte2.Bit0 represents relay 16

Example:

- answer 1: 00 -> relays from 1 to 16 are OFF.
- answer 2: 255(dec) 255(dec) -> relays from 1 to 16 are ON.
- answer 3: 81(dec) 81(dec) -> Relays 1,8,9,16 - ON, the rest are OFF.

Please note that data received from this command is not always in printable ASCII format!

o Command for setting single relay ON/OFF

Command format

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Address1	Address2	Sign	'/'	'/'

- Address1 and Address2 represent the relay number - from '0' '1' up to '1' '6' (for 16 relays)
- Sign is '+' for relay ON and '-' for relay OFF.

Command format

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Address1	Address2	Sign	'/'	'/'

Expected answer - if the command is successful, the answer is exactly the same like the command.

Example:

- "01-/" - Relay 1 is switched OFF
- "12+/" - Relay 12 is switched ON

○ Command for setting all relays ON

Command format

Byte 1	Byte 2	Byte 3	Byte 4
'o'	'n'	'/'	'/'

Expected answer - if the command is successful, the answer is exactly the same like the command i.e. "on//".

Example:

- "on//" - all relays ON

○ Command for setting all relays OFF

Command format

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
'o'	'f'	'f'	'/'	'/'

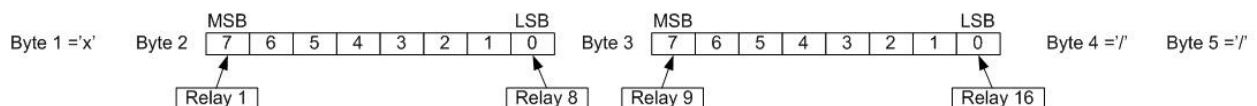
Expected answer - if the command is successful, the answer is exactly the same like the command i.e. "off//".

Example:

- "off//" - all relays OFF

○ Command for setting all relays at a time

Command format



- Byte2.Bit7 is the state of Relay 1
- Byte2.Bit0 is the state of Relay 8
- Byte3.Bit7 is the state of Relay 9
- Byte3.Bit0 is the state of Relay 16
- If bit is 0, the relay state is OFF, if bit is 1 the relay state is ON

Expected answer - if the command is successful, the answer is exactly the same like the command sent.

Example:

Send: 'x' 1A 05 '/' '/'

1A(hex)=00011010(bin)

05(hex)=00000101(bin)

Relays 1,2,3,6,8,9,10,11,12,13,15 - switched OFF

Relays 4,5,7,14,16 - switched ON

Please note that State1 and State2 are not always printable ASCII chars. These bytes are binary representation of the relays.

9. Communication methods

9.1. TCP/IP or UDP Sockets

There are really lot of software for sending messages via TCP/IP or UDP sockets. Our [DRM Software](#) uses exactly this communication method. We also provide several examples demonstrating the communication with the module.

For example one such free tool for Windows and Linux (there is and command line support) is [Packet Sender](#):

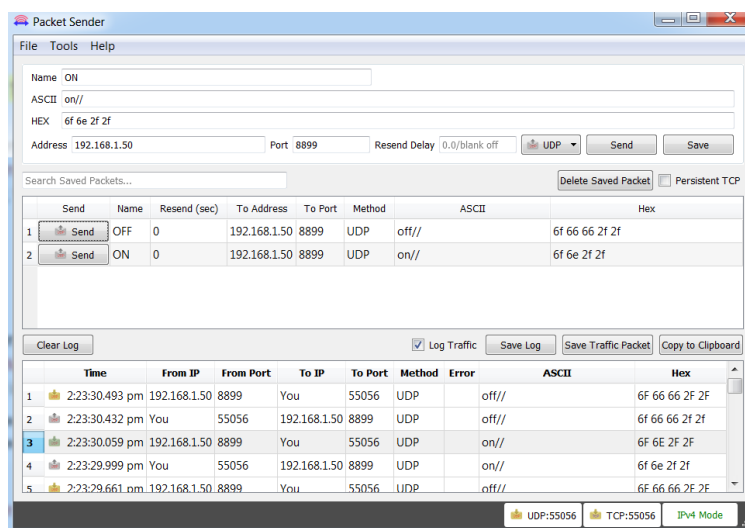


Figure 26. Packet Sender

Of course there is lot of mobile apps as well. For Android a good tool is [Socket Control Widget](#)

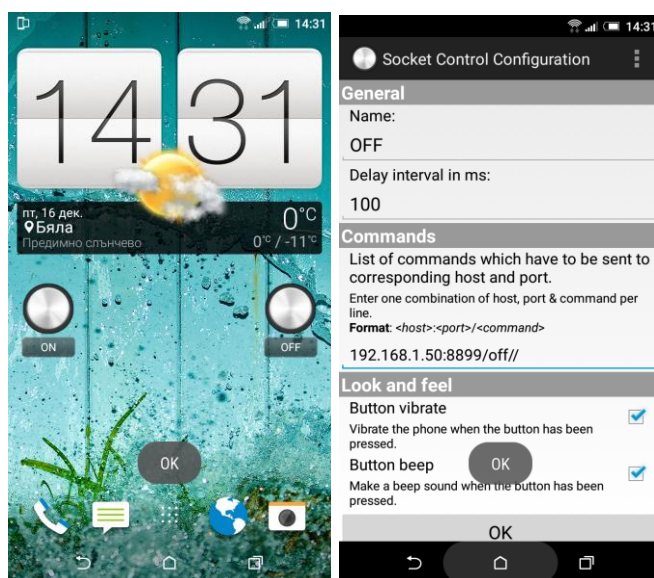


Figure 27. Android software

9.2. Virtual Serial (COM) Port

This method is also communication via TCP/IP or UDP socket, but this time the end software works with serial (com) port mapped to the certain socket. We assume the settings of the **Wi-Fi Relay Module** in that example are:

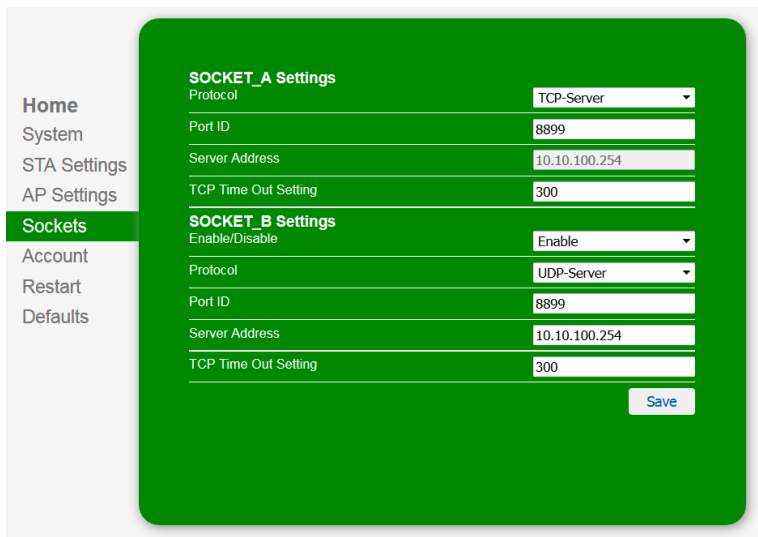


Figure 28. Sockets settings for Virtual Com Port

9.2.1. Windows

There are many applications for Windows OS for creating Virtual Com Port connected to TCP/UDP socket. For example one such tool is [VSP Manager](#) which is part of **Tibbo Device Server Toolkit**. It is available for download from [here](#), or here:

- 32 bit Windows installation: [download](#)
- 64 bit Windows installation: [download](#)

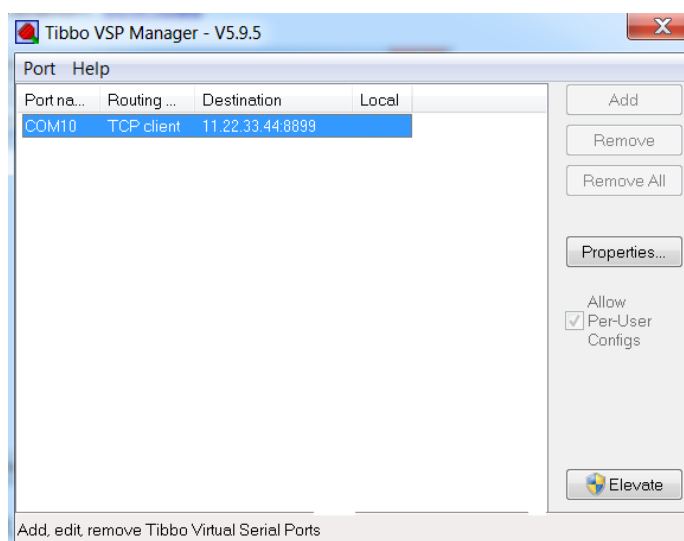


Figure 29. VSP Manager

To create virtual com port, you have to do the following settings. Make sure the IP, Port, and TCP/IP or UDP settings are the same with the Wi-Fi 16 Relay Module. Here the **Routing mode** must be "client" because the relay module is the server.

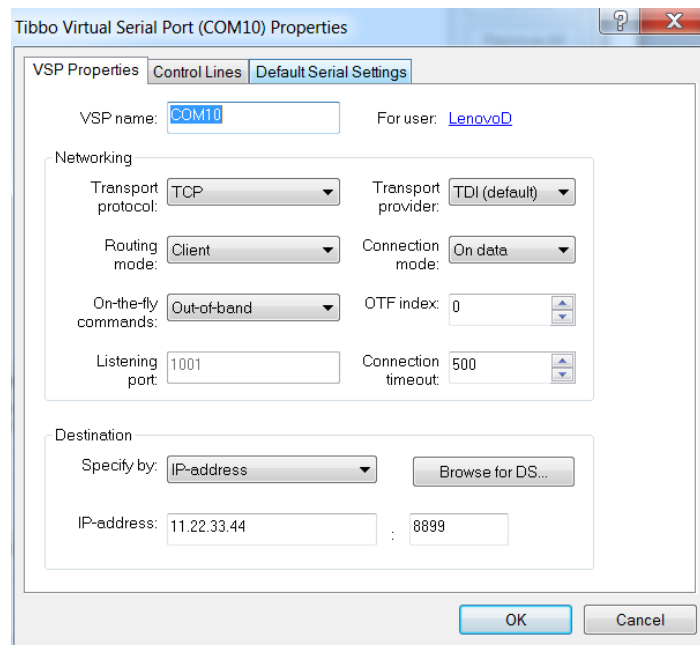


Figure 30. VSP Manager settings

After that, there should be created new com port in Device Manager (COM10):

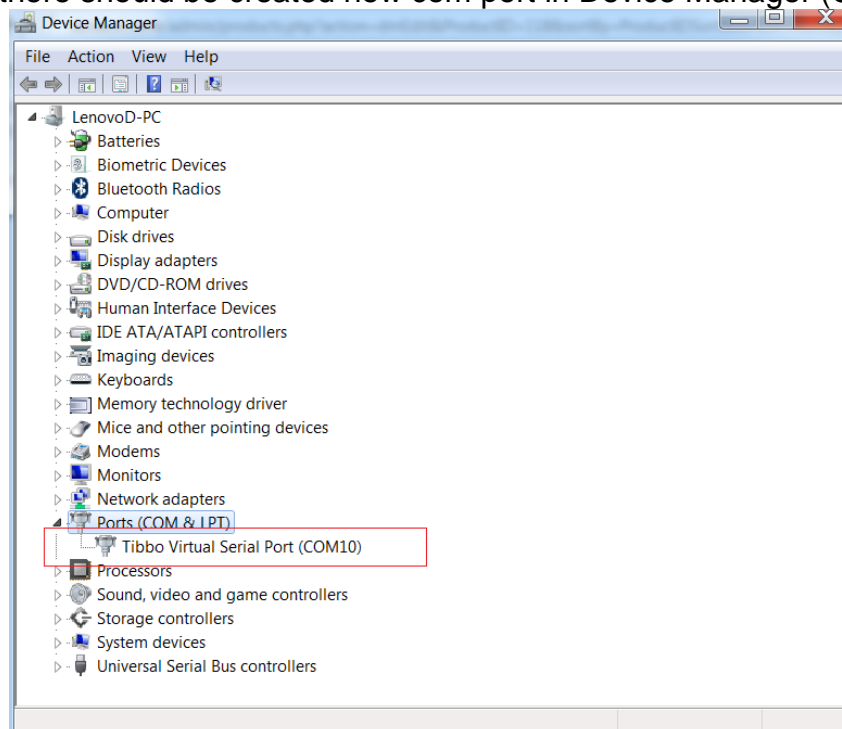


Figure 31. COM port shown in device manager

Sending and receiving data from PuTTY to and from COM10 in such case is simple.

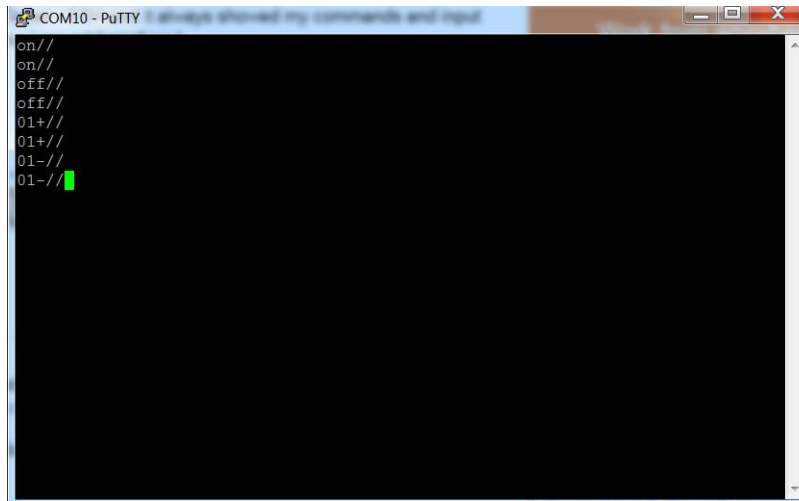


Figure 32. Sending and receiving data via PuTTY



If somewhere is required baud rate setting, it must be 9600.

9.2.2. Linux

In Linux, a very simple way to interact between serial port and TCP/UDP is using [socat](#) tool.

Firstly, you will need to create link (map) between the virtual serial port and **Wi-Fi Relay Module**. In the example the module is with IP address 10.10.100.254, port 8899 for UDP and TCP.

```
socat pty,link=/dev/virtualcom0,raw tcp:10.10.100.254:8899&
```

or

```
socat pty,link=/dev/virtualcom0,raw udp:10.10.100.254:8899&
```

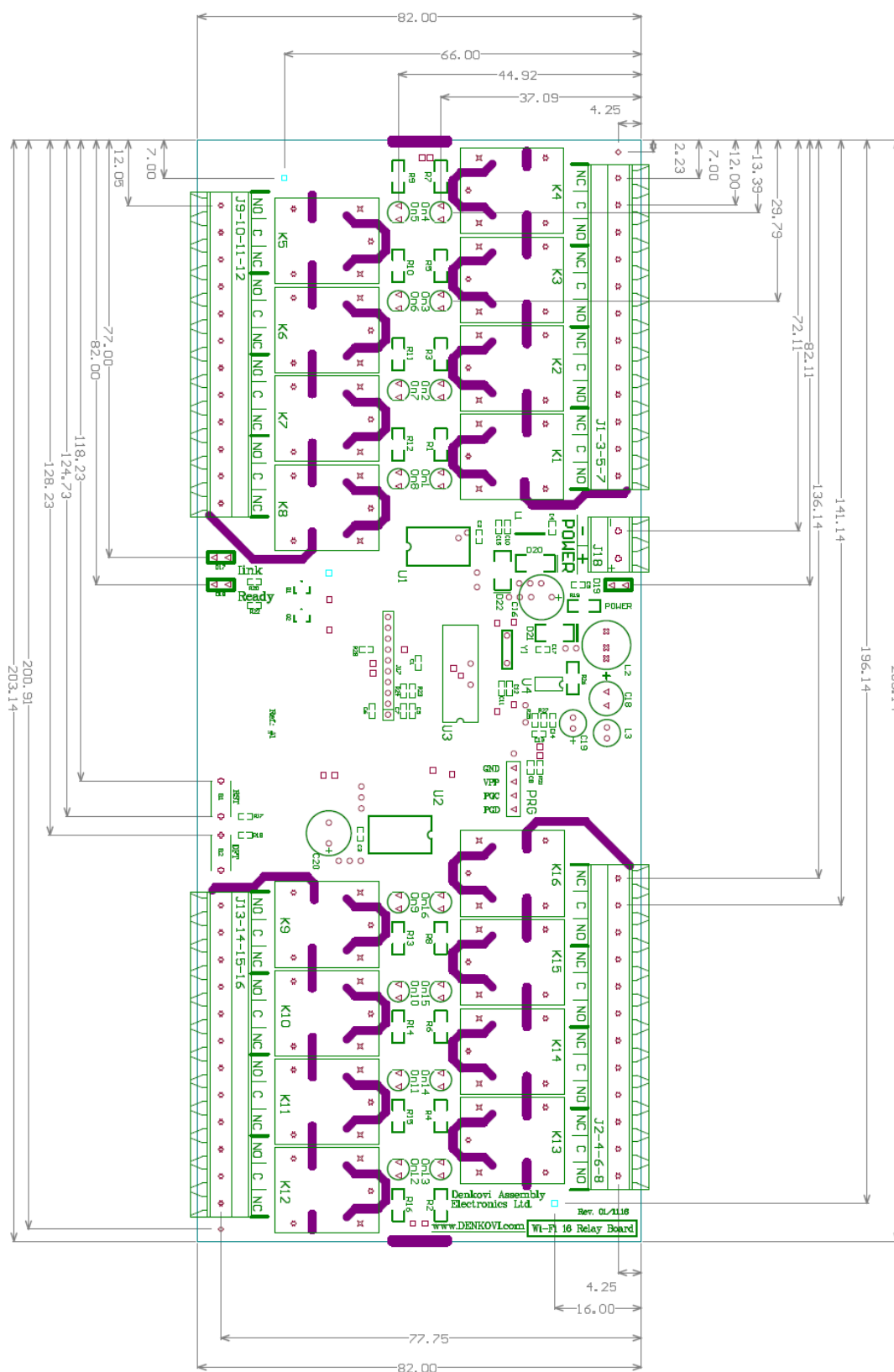
Then, you have to just send the commands to /dev/virtualcom0:

```
echo -e "on//" > /dev/virtualcom0  
echo -e "off//" > /dev/virtualcom0  
echo -e "01+//" > /dev/virtualcom0  
echo -e "16-//" > /dev/virtualcom0
```

In order to send hex data when needed to set all relays at a time, you can use this command:

```
echo -e "\x00\xff//" > /dev/virtualcom0  
echo -e "\xff\xff//" > /dev/virtualcom0  
echo -e "\x12\x34//" > /dev/virtualcom0
```

10. Appendix 1. PCB dimensions



11. Appendix 2. BOX dimensions

