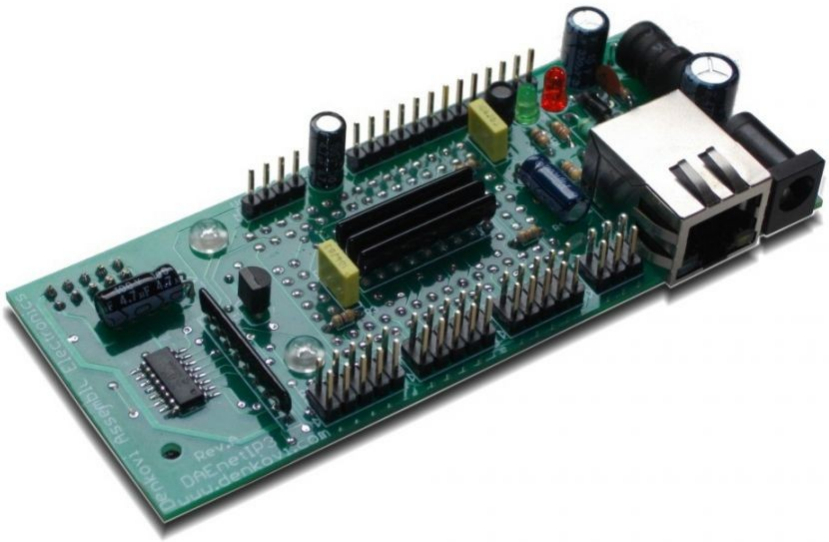
DAEnetIP3

User Manual – Ver. 1.1
Date: 06.12.2011



Content

1. Basic features

DAEnetIP3 is multifunctional standalone Ethernet / Wireless device for remote management and control with Virtual Serial Port, TCP/IP socket based protocol, Web, Telnet and serial commands access. Many controllers can be connected over LAN/WLAN/WAN or serial network. It can work standalone (without PC). Several such controllers can work together (in distributed WAN/WLAN network) and inputs of one controller can control outputs of another one. It can be used in combination with relay boards and input/output boards – some of them may be found on http://www.denkovi.com/

- 10/100 Mbit Ethernet interface with Link Led. Auto MDIX.
- Optional Wireless Wi-Fi 802.11 b/g interface with Link led. Supports WEP - 64 and WEP - 128. It can not work as AP (Access Point), but must connect to another AP (Wi-Fi router for example, PC)
- UART interface for RS232/RS485 serial connection with other such controllers. UART can be used also for configuration of the parameters.
- Power supply: 12VDC.
- Consumption 90 mA (170 mA with Wi-Fi interface) on 12 VDC.
- 1 x 16 digital inputs. Levels: 0 – 3.3V.
- 1 x 8 digital outputs. Levels: 0 – 3.3V.
- 1 x 8 analog outputs. Referent voltage: 2.5 V, resolution: 10 bits.
- On boot the outputs are set with states before reset.
- Built in RTC (Real Time Clock). It can be synchronized via NTP.
- Capacitor power backup keeps time for days during power failure.
- Virtual Serial Port - it may be accessed with Serial RS232 commands over TCP/IP network
- Integrated WEB server with authorization – no need of extra software.
- The web server supports auto-refresh for the I/O values (no need to click browser refresh button each time).
- Simple web drop-down list configuration.
- Telnet
- Supports special ASCII DAEnetIP3 application protocol for configuration over VSP, TCP/IP socket, Telnet and UART.
- Easy software development.
- All the accessing ports can be defined by the user (necessary for “port forwarding”).
- Supports ICMP (ping).
- TFTP protocol - users can install firmware updates when available.
- Optional RC4 encryption for user software development.
- 19 modes for I/O lines such as inverting, timer, pulses, setting output via input and switch ON/OFF according particular time (scheduling).
- Any input may be referred to control any output of this or another controller in the TCP/IP network.
- Distributed mode
- IP address protection.
- Power and status led.

- Size: 108mm x 45mm x 24mm

2. Technical parameters

Table 1. Technical parameters

Parameter	Value
Digital outputs count	16
Analog inputs count	8 (10bit ADC, Vref=2.5V) with 100 kOhm pull-up resistor to GND
Digital inputs count	8
Default settings jumper	Yes
LED (Link, Status, Power On)	Yes
Save digital output states	Yes
Digital configurable ADC filter	Yes
Network parameters	IP/Mask/Default gateway
IP lock (protection)	Yes
Telnet for configuration	Yes
Virtual Serial Port (VSP)	Yes
TCP/IP socket based protocol for direct configuration over LAN, WLAN, WAN	Yes
Web server for configuration/access	Yes
Configuration over Serial port (UART)	Yes
TFTP client for remote firmware update	Yes
Command for TFTP update (Web,socket, Telnet and Serial)	Yes
Enable/disable TFTP update	Yes
Enable/disable Telnet	Yes
Enable/disable RC4 (password protection)	Yes
Size	108mm x 45mm x 24mm
Power supply voltage	12VDC
CPU power supply (output level 3.3VDC)	3.3VDC

3. Application examples

3.1. Remote control of electrical devices

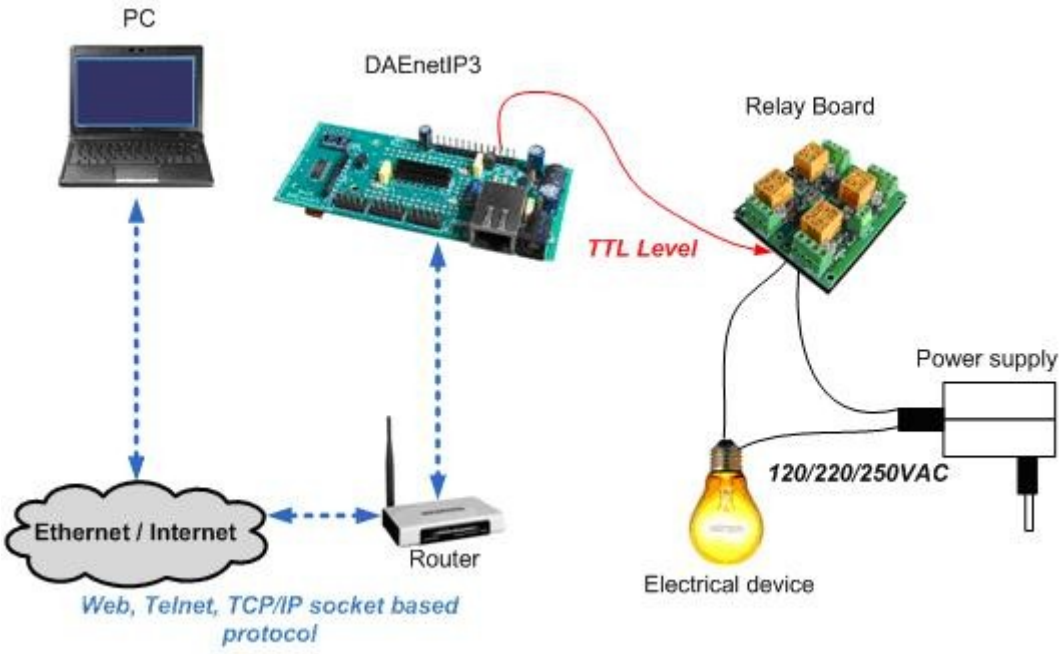


Figure 1. Controlling electrical devices with DAEnetIP3 remotely

DAEnetIP3 has 16 digital outputs that are suitable for controlling electrical devices over the local network or Internet. Using its Wi-Fi 802.11 communication module it is possible to control different electrical devices wireless.

3.2. Tracking sensors

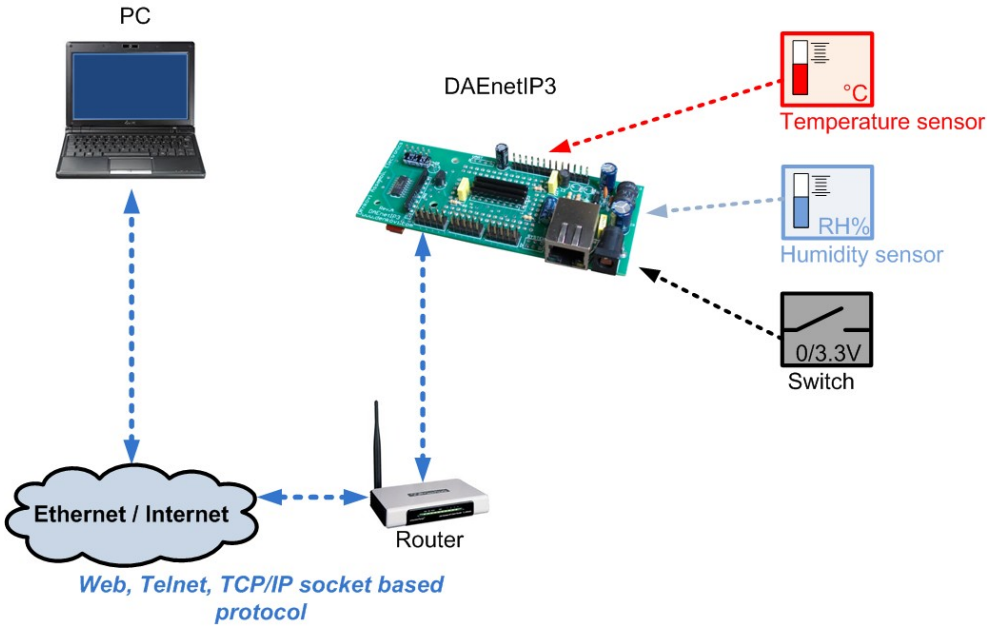


Figure 2. Tracking sensors

DAEnetIP3 has 8 analog inputs (Vref=2.5V / 10bit resolution) and 8 digital inputs (0 – 3.3V). Each sensor producing signal compatible with these inputs levels is suitable. Once, the information (over LAN, WLAN or WAN) from sensors is gathered, it may be received from PC (server) and saved for processing.

3.3. Alarm

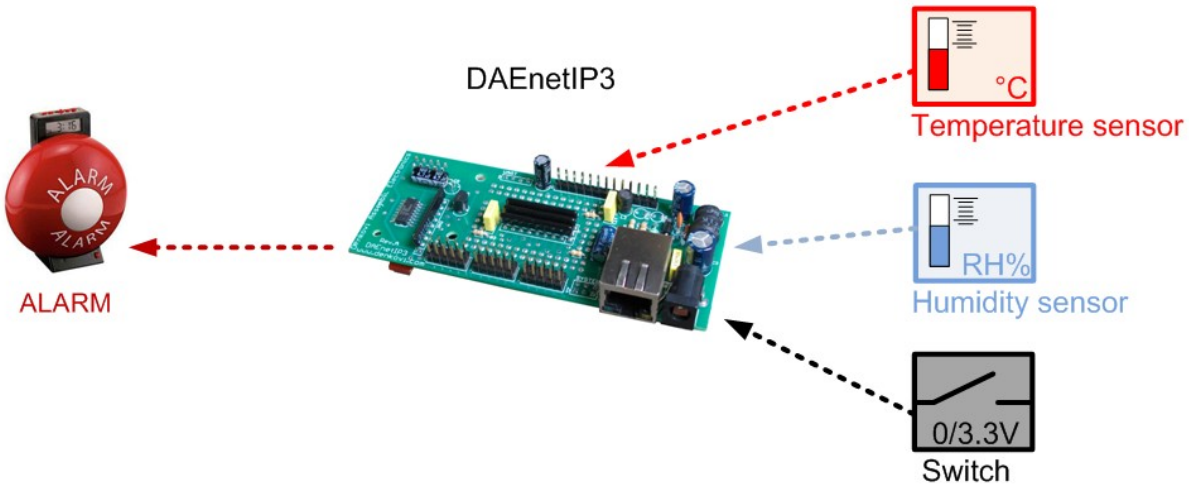


Figure 3. Alarm with DAEnetIP3

DAEnetIP3 can operate as simple alarm. When some input change its state (or cross some threshold – for analog inputs), particular output changes its state also.

3.4. Simple Standalone Web Based Thermostat

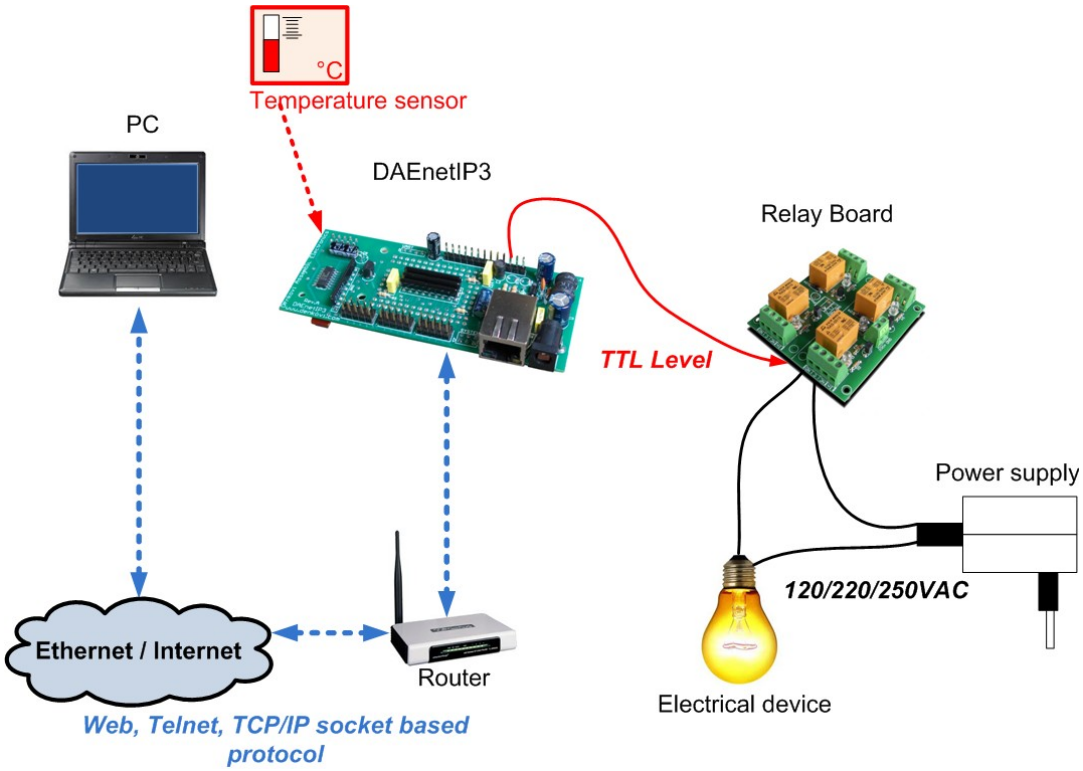


Figure 4. Web based thermostat based on DAEnetIP3, temperature sensor and relay board

DAEnetIP3 gives possibilities to built up to 8 thermostats, using all the 8 analog inputs and 8 of the digital outputs. The flexibility of DAEnetIP3 allows to attach each analog input to each digital output. The combination of different I/O modes makes several variations for the thermostat. Each thermostat can be tracked/configured easily via web browser. The whole process of course may be tracked/adjusted also via Telnet, TCP/IP socket and UART.

3.5. Simple Standalone PLC

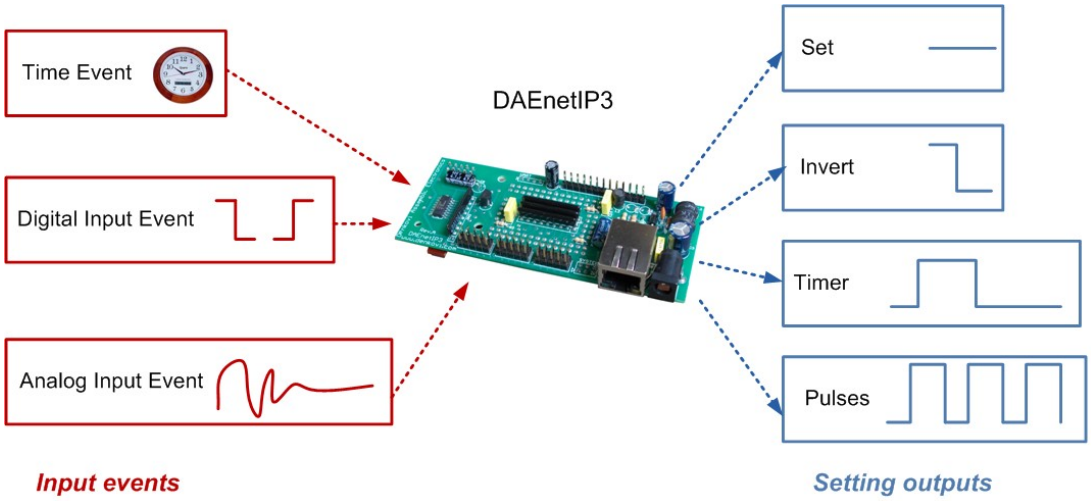


Figure 5. Simple PLC

DAEnetIP3 allows to set the 16 digital outputs according some event. The mode of each digital input determines how it will react when this event appears. The event may be some time, slope of digital input or crossing some threshold for analog input.

3.6. TCP/IP to Serial Bridge

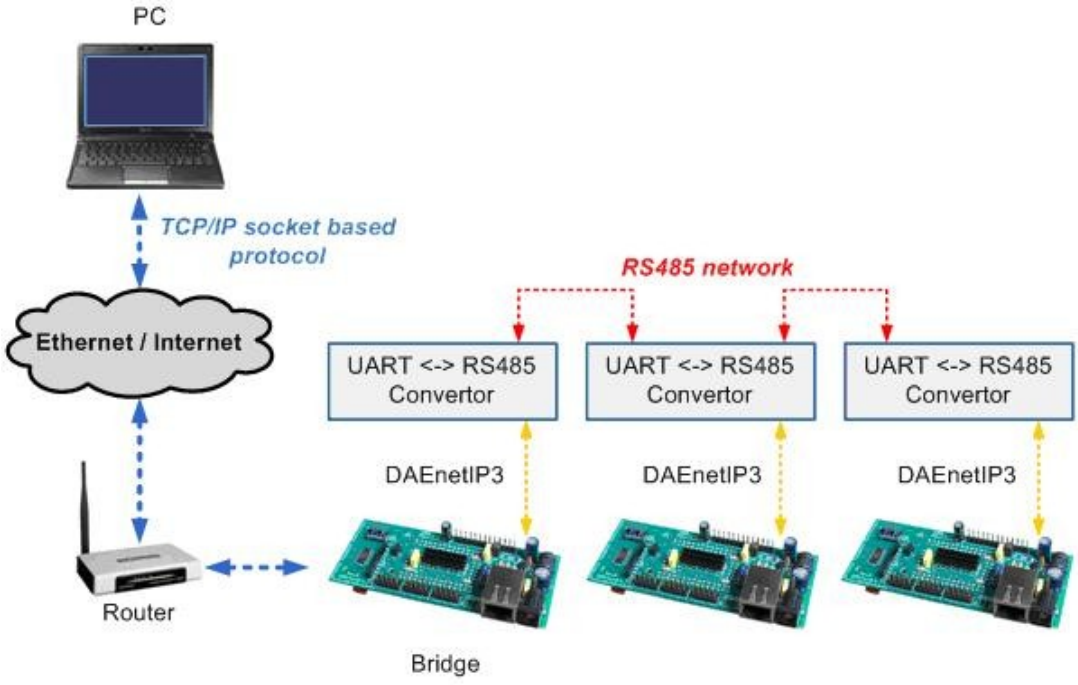


Figure 6. Access RS485 network of many DAEnetIP3s over local network/Internet/Wireless

DAEnetIP3 has UART port (RX,TX and Direction pin) allowing to create RS485 network. DAEnetIP3 acts like a bridge between the two types of networks. This is suitable in cases where single IP address must access many DAEnetIP3 controllers.

3.7. I/O Distributed System

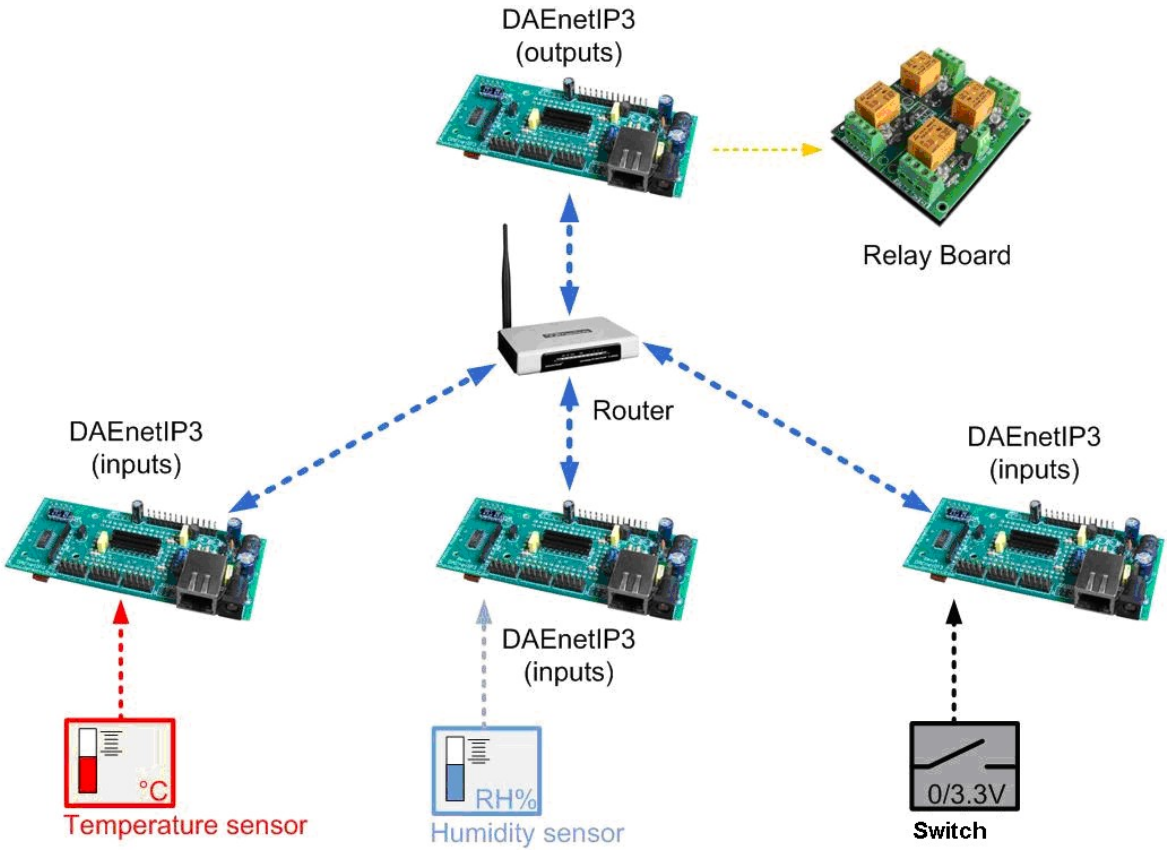


Figure 7. Distributed mode

In many cases the inputs and outputs are not located at the same place. With DAEnetIP3 this is not a problem, because each controller may send message to another one, saying “turn digital output 1 in logical one”. Each DAEnetIP3 may be controller by up to 5 another DAEnetIP3 controllers. The communication is done over the LAN/ WLAN. Once the network is configured, there is no need of PC.

3.8. Combination with peripheral modules

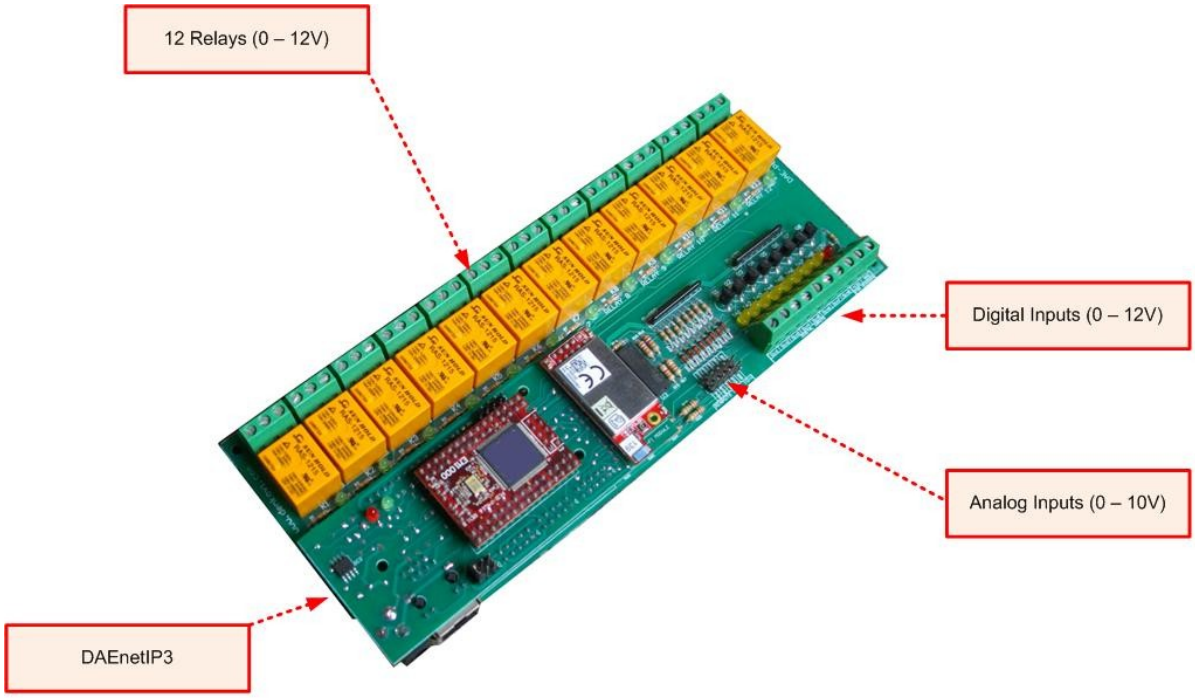


Figure 8. I/O module and DAEnetIP3

DAEnetIP3 can be used in combination with different add-on peripheral modules with relays, analog inputs, digital inputs. The combination for example shown on figure 8 is DAE-PB-RO12/DI8/AI8 + DAEnetIP3, that may be found on http://www.denkovi.com/

4. Default Settings

4.1. Tables with default settings

These are the default (factory) settings of DAEnetIP3. When you buy the controller you will receive it with these settings.

4.1.1. Digital outputs (Port A)

Table 2. Port A default settings

Parameter	Value
Output state	Low (0V)
Mode	On/Off setting
ON	1
OFF	1
Delay	5
Time1	00:00:00
Time2	00:01:00
Description	DO**x**, where x is the number of digital output (0-15)

4.1.2. Digital Inputs (Port B)

Table 3. Port B default settings

Parameter	Value
Mode	Simple reading
PortA pin	0…7
Remote	No (False)
Description	DI**x**, where x is the number of digital input (0-7)

4.1.3. Analog Inputs (Port C)

Table 4. Port C default settings

Parameter	Value
Refresh	1
LT (Low Threshold)	200
HT (High Threshold)	700
LH (Low Hysteresis)	5
HH (High Hysteresis)	5
Mode	None
PortA Pin	0…7
Remote	No (False)
Description	AI**x**, where x is the number of analog input (0-15)

4.1.4. Serial Port

Table 5. Serial Port default settings

Parameter	Value
Serial address	0x00
Baud rate	9600
Stop bits	1
Parity	None
Data bits	8
CRC	No
Duplex mode	Full Duplex
CRC16	No

4.1.5. System clock

Table 6. System clock default settings

Parameter	Value
GMT	+2

4.1.6. Admin

Table 7. Admin default settings

Parameter	Value
IP Address	192.168.0.100
Subnet Mask	255.255.255.0
Default Gateway	192.168.0.1
Remote Server IP: Port	192.168.0.1:1005
NTP Server IP: Remote Port	64.90.182.55: 37
TFTP Server IP: Remote Port	192.168.0.1: 69
TFTP firmware file	DAEnetIP3fw.bin
HTTP Port	80
Local Port Range	1005-1009
User Socket Port	1010
Working Mode*	Ethernet 10/100 Mbit
Telnet password	admin
RC4 password	admin
Web password	admin
Access IP	0.0.0.0 (disabled)
Enable TFTP	Yes
Enable Telnet	Yes
Enable RC4 encoding	Yes

*Only for DAEnetIP3-Wx. If DAEnetIP3-Ex – this parameter is not available. (Working mode is only Ethernet 10/100 Mbit)

4.1.7. Wi-Fi Settings

Table 8. Wi-Fi default settings*

Parameter	Value
IP Address	192.168.1.100
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
Region	EU (chn: 1-13)
SSID	Network
WEP Key	admin

*Only for DAEnetIP3-Wx. If DAEnetIP3-Ex – these parameters are not available because there is not Wi-Fi interface.

5. Digital outputs port (Port A)

DAEnetIP3 has 16 bit digital output port with 10 kOhm pull-up resistors to GND.

5.1. Setting the digital outputs

The 16 bit digital outputs port can be set in two ways. It is possible to set single output line in low/high level or set the whole port. In some modes the user can not set the outputs manually, because they are set by time events, input signals or another DAEnetIP3 controller.

5.2. Reading the digital outputs states

It is possible to read digital output states anytime. User can read single line or the whole port (all the 16 output lines).

5.3. Saving the states

Two of the digital output modes support “states saving” function. This function allows when the controller is started again initially to set its output states to be same as just before last shutting off of the power. The modes are “On/Off setting” and “Inverting”. When the output state is changed by the user it is saved in the DAEnetIP3 EEPROM (this is the only way because DAEnetIP3 doesn’t have power off detection circuit). That’s why the rest modes does not support this feature – they are not controlled by the user but by inputs, time events or another DAEnetIP3 controller inputs. This is some kind of protection against EEPROM destruction because large amount of write cycles.

5.4. Port A modes

DAEnetIP3 supports 19 digital output modes

5.4.1. On/Off setting

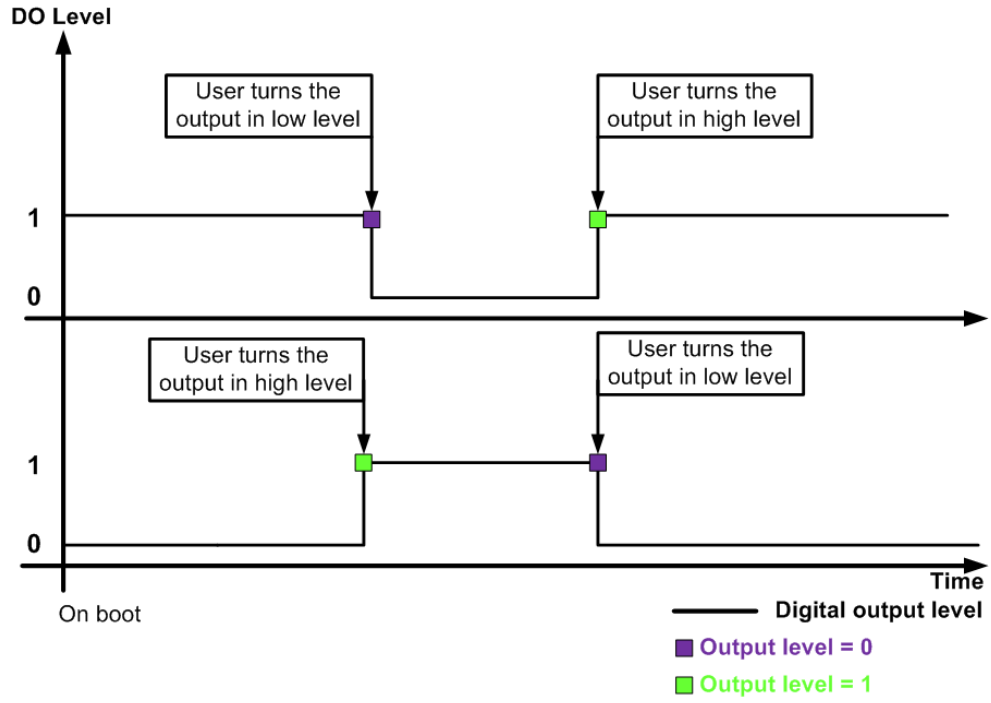


Figure 9. On/Off setting

This is simple setting of the outputs (figure 9). The user can set the output in on (logical 1, output level=3.3V) and in off (logical 0, output level=0V). This mode supports "states saving" function On boot the output state is the same as before shutting down.

5.4.2. On/Off setting and digital input

In this mode (figure 10) the output is set according falling/rising slope of some digital input level. "States saving" function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

- When DI is in "Set output during rising slope" mode, the DO is set in high level during rising slope of the DI level. DO is set in low level during falling slope of the DI level.
- When DI is in "Set output during falling slope" mode, the DO is set in low level during rising slope of the DI level. DO is set in high level during falling slope of the DI level.

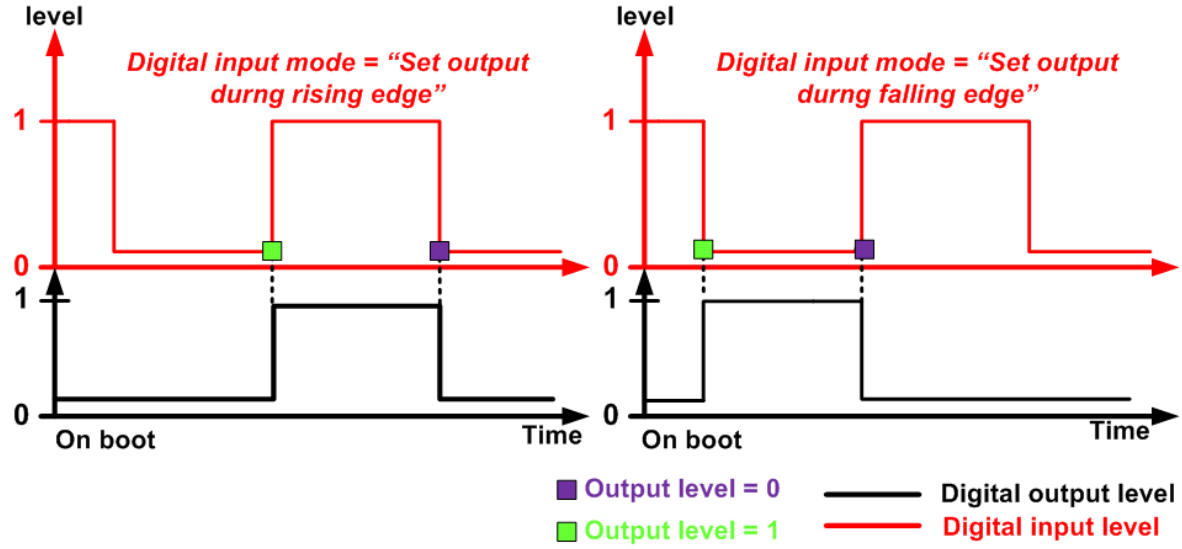


Figure 10. On/Off setting and digital input

5.4.3. On/Off setting and analog input

On figure 11 is shown the dependence between digital output (On/Off setting) and analog input (the four modes). "States saving" function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

- In "Low" mode the output level is set high when the rising analog input level crosses the LT+LH/2 limit and set low when the falling analog input level crosses the LT-LH/2 limit.
- In "High" mode the output level is set low when the rising analog input level crosses the HT+HH/2 limit and set high when falling analog input level crosses the HT-HH/2 limit.
- In "Acc" mode the output level is set high when the rising analog input level crosses the HT+HH/2 and set low when the rising analog input level crosses the LT-LH/2.
- In "Low/High" mode the output level is set high when the rising (falling) analog input level crosses the LT+LH/2 (HT-HH/2). The output level is set

low when the rising (falling) analog input level crosses the HT+HH/2 (LT-LH/2).

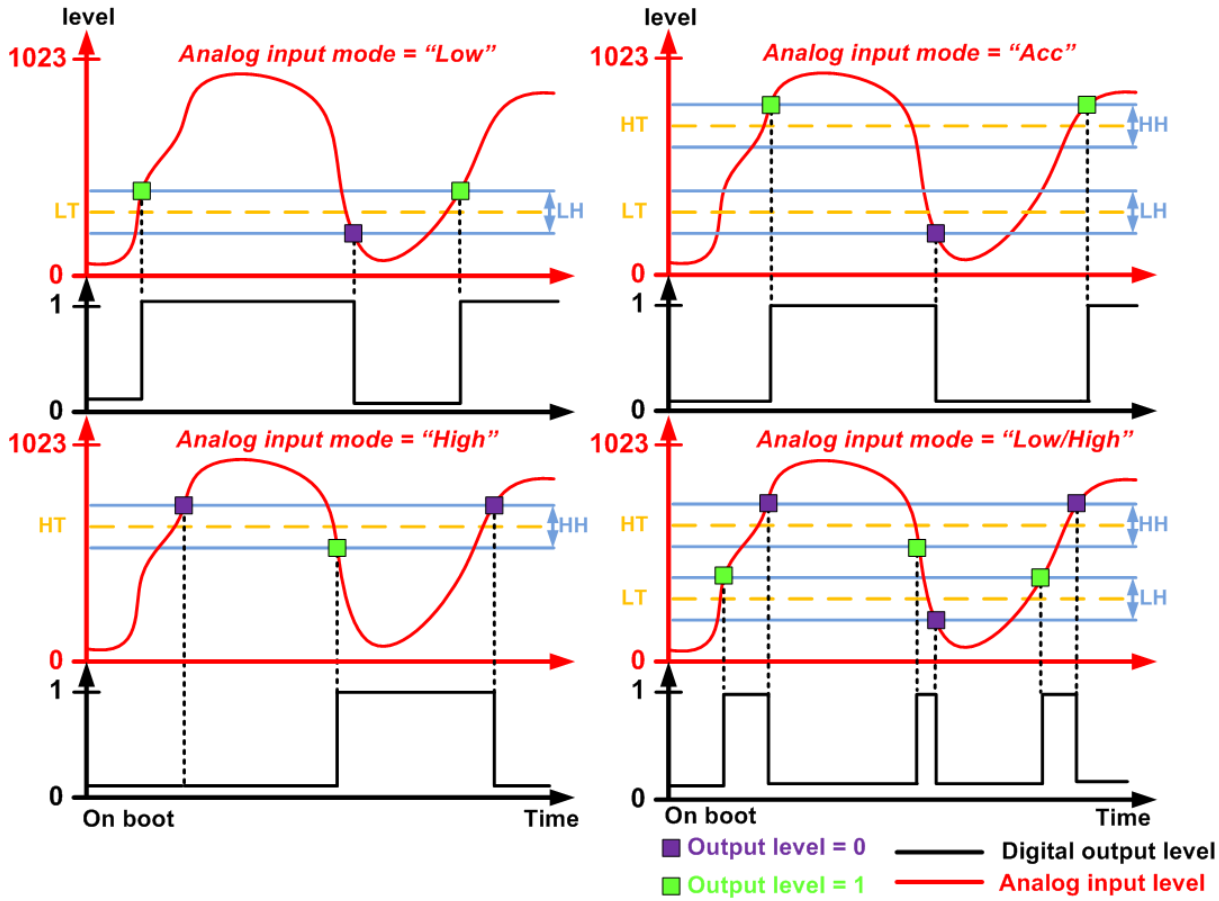


Figure 11. On/Off setting and analog input

5.4.4. On/Off setting and schedule

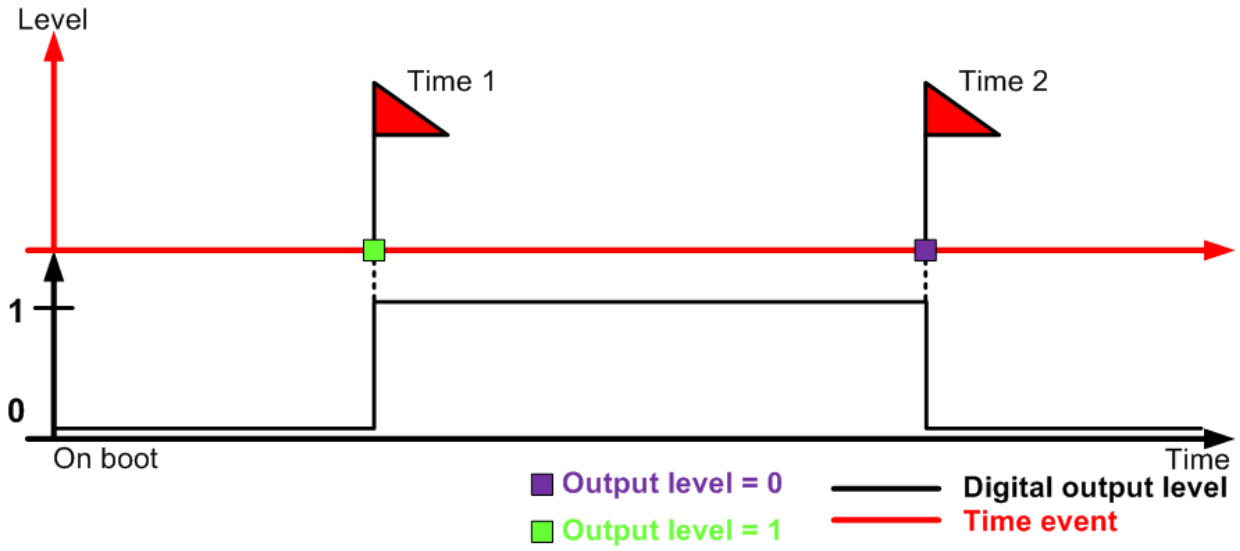


Figure 12. On/Off setting and schedule

This mode (figure 12) is designed for setting digital outputs based on time events. There are two time events – *Time 1* and *Time 2*. When *Time 1* appears the output will be turned in high level and when Time 2 appears it will be in low level. There is no matter is *Time 1* is before *Time 2* or the Time 2 is before Time 1. Time 1 is determined by the field 'Time1' and Time 2 by 'Time2' from the configuration web page. "States saving" function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

5.4.5. On/Off setting and remote

In this mode the output can be controlled by input (digital or analog) from another DAEnetIP3 controller over the network. "States saving" function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

5.4.6. Inverting

In this mode the user is able to invert the digital outputs. If the previous output state was 0, after inverting it will be 1 and vices versa. It is supported "States saving" function - after reset the system keeps the output states in this mode same as before shutting off the power supply.

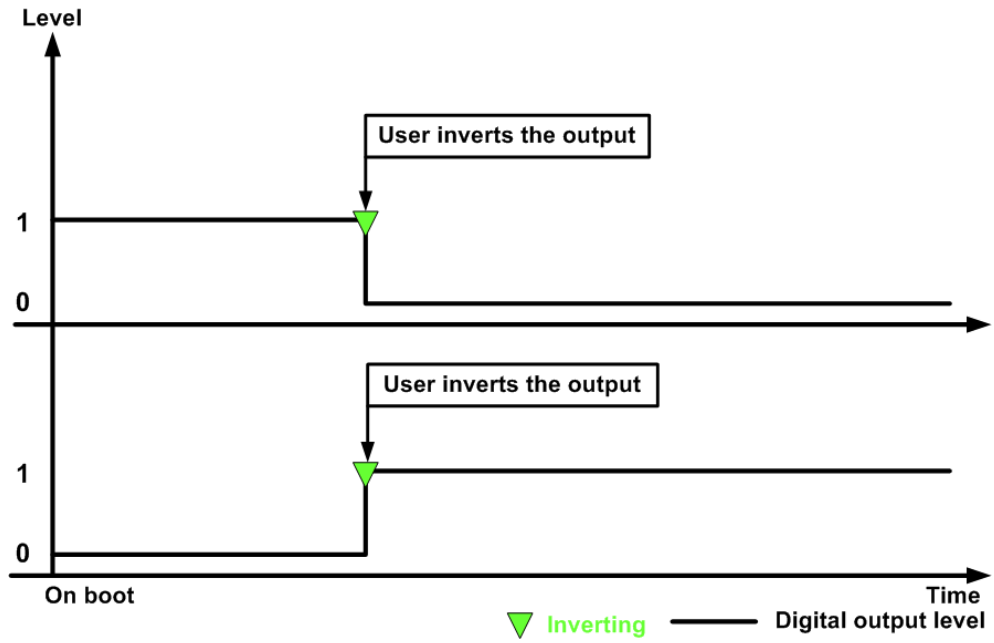


Figure 13. Inverting

5.4.7. Inverting and digital input

In this mode (figure 14) the digital outputs are inverted by falling/rising slope of some digital input. The user can not control(invert) manually the output state in this mode. "States saving" function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

- When DI is in "Set output during rising slope" mode, the DO state is inverted during rising slope of the DI level.
- When DI is in "Set output during falling slope" mode, the DO state is inverted during falling slope of the DI level.

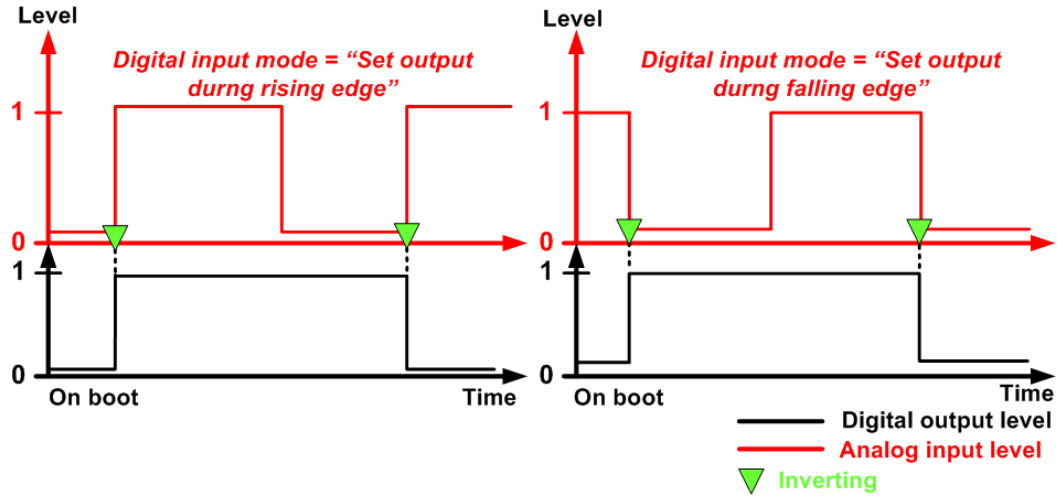


Figure 14. Inverting and digital input

5.4.8. Inverting and analog input

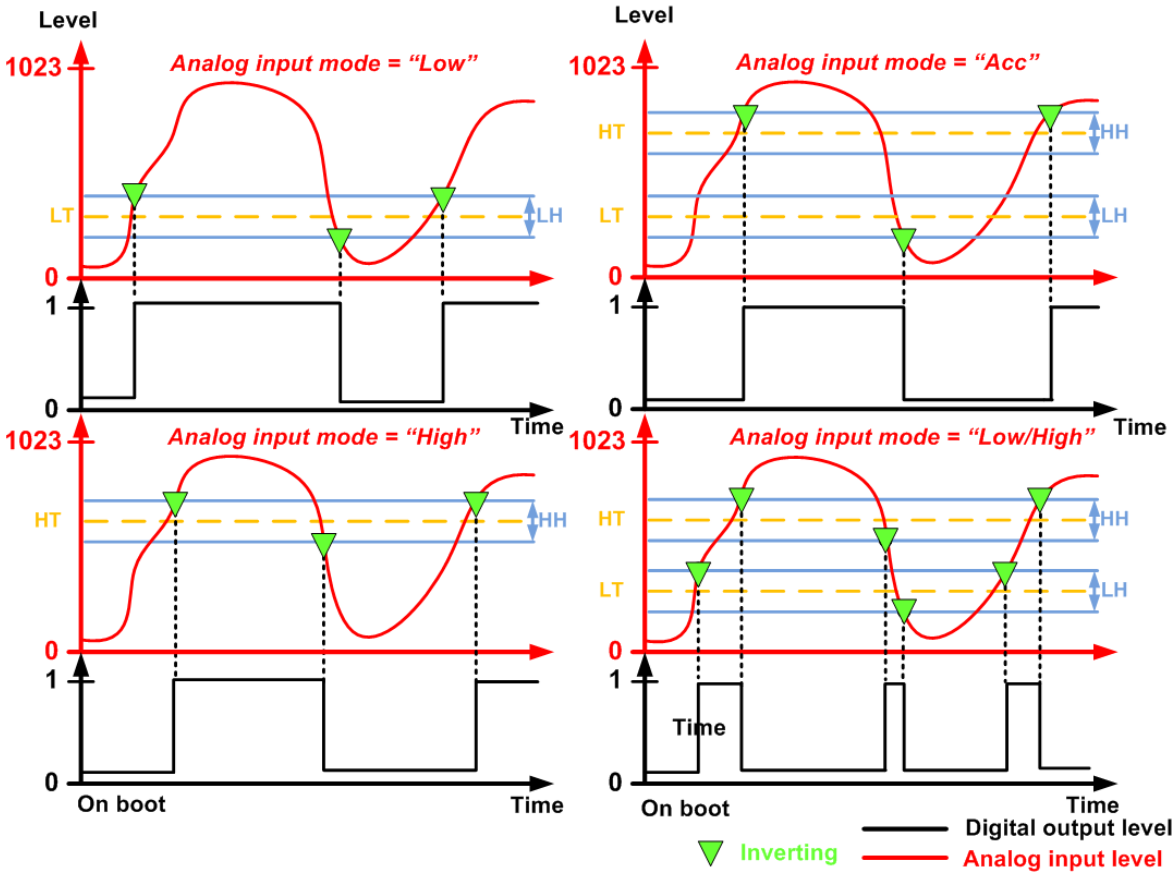


Figure 15. Inverting and analog input

In this mode (figure 15) the digital output state is inverted when some analog input level crosses the given threshold. In the figure it is shown the graphics when the initial output state is 0. If the initial state was 1, the logic is the same but the output levels will be reversed, because of the inverting. "States saving" function is not

supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

- In “Low” mode the output level is inverted when the rising analog input level crosses the LT+LH/2 limit and when the falling analog input level crosses the LT-LH/2 limit.
- In “High” mode the output level is inverted when the rising analog input level crosses the HT+HH/2 limit and when falling analog input level crosses the HT-HH/2 limit.
- In “Acc” mode the output level is inverted when the rising analog input level crosses the HT+HH/2 and when the rising analog input level crosses the LT-LH/2.
- In “Low/High” mode the output level is inverted when the rising (falling) analog input level crosses the LT+LH/2 (HT-HH/2) and when the rising (falling) analog input level crosses the HT+HH/2 (LT-LH/2).

5.4.9. Inverting and schedule

In this mode (Figure 16) the digital output states are inverted by the two time events (Time 1 and Time 2). “States saving” function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

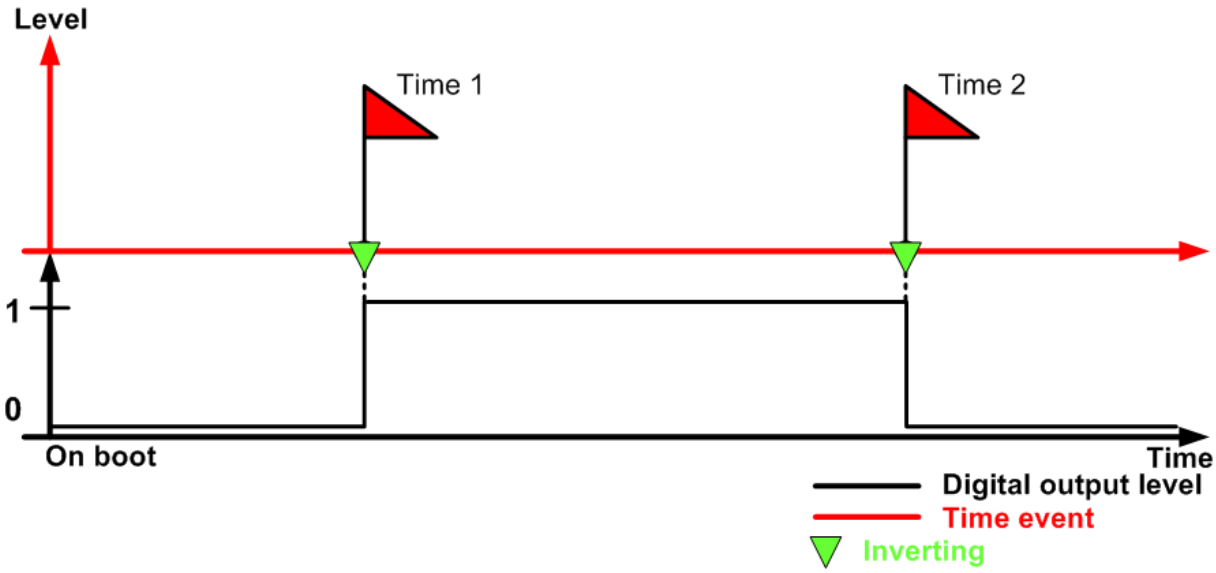


Figure 16. Inverting and schedule

5.4.10. Inverting and remote

In this mode the output can be inverted by input (digital or analog) from another DAEnetIP3 controller over the network. “States saving” function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

5.4.11. Pulses

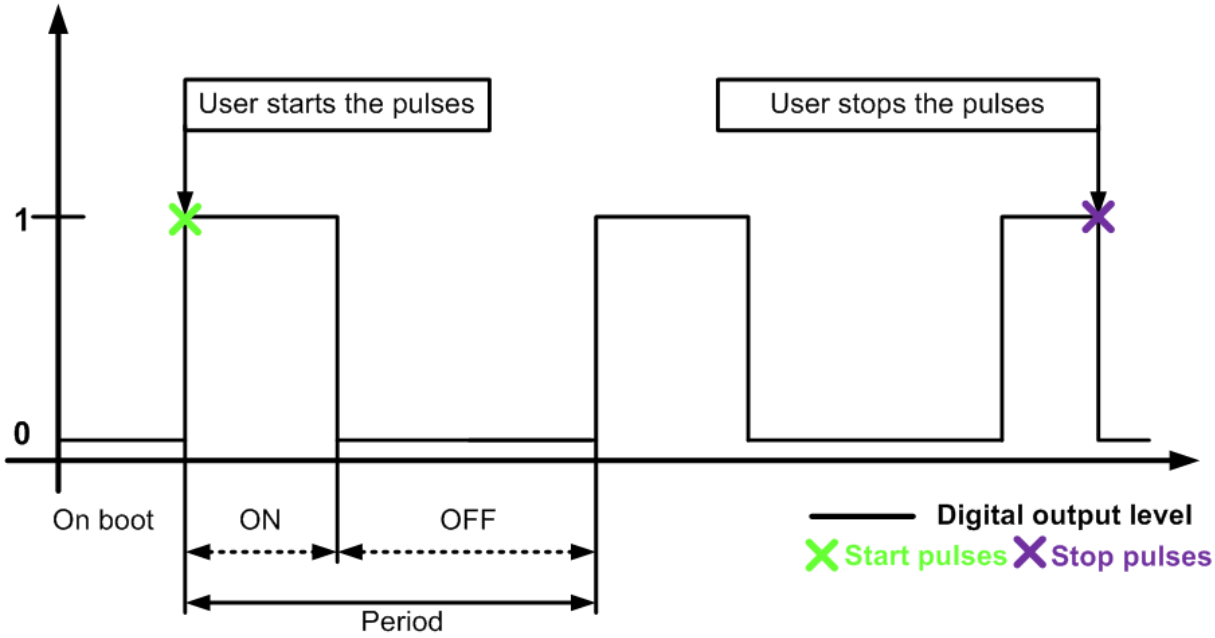


Figure 17. Pulses

In this mode (figure 17) the digital output is set in 1 for some time (ON time) and after that set in 0 for some time (OFF time). In this way the DAEnetIP3 controller can make pulses with custom period based on ON/OFF times. The user can starts (stops) the pulses. The pulse generating always starts with the ON time. When the user stops the pulses, the output state becomes 0. “States saving” function is not supported but on boot DAEnetIP3 controller may generate (not generate) pulses depending if before power shutting down pulses have been generated (or not).

5.4.12. Pulses and digital input

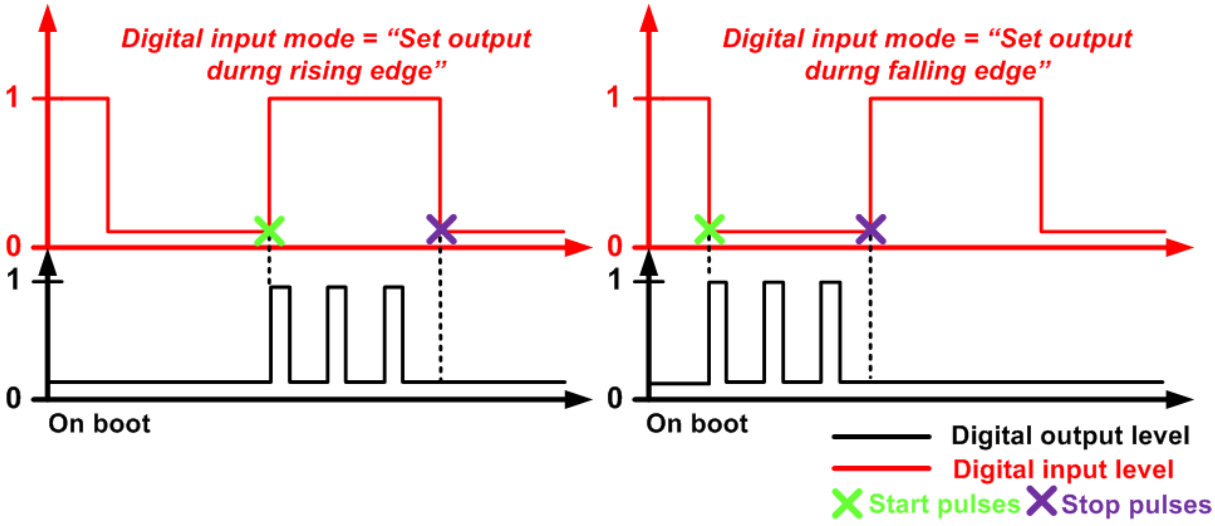


Figure 18. Pulses and digital input

This mode (figure 18) configures the outputs to work as pulse generator based on digital input falling/rising slope. Actually the rules for pulse generation are the same

as point 8.4.11. When the input level makes falling or rising slope, the pulse generation is started or stopped (depending on the digital input mode). "States saving" function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

- When DI is in "Set output during rising slope" mode, the pulses are started during rising slope of the DI level and during falling slope of the DI level.
- When DI is in "Set output during falling slope" mode the pulses are started during rising slope of the DI level and stopped during falling slope of the DI level.

5.4.13. Pulses and analog input

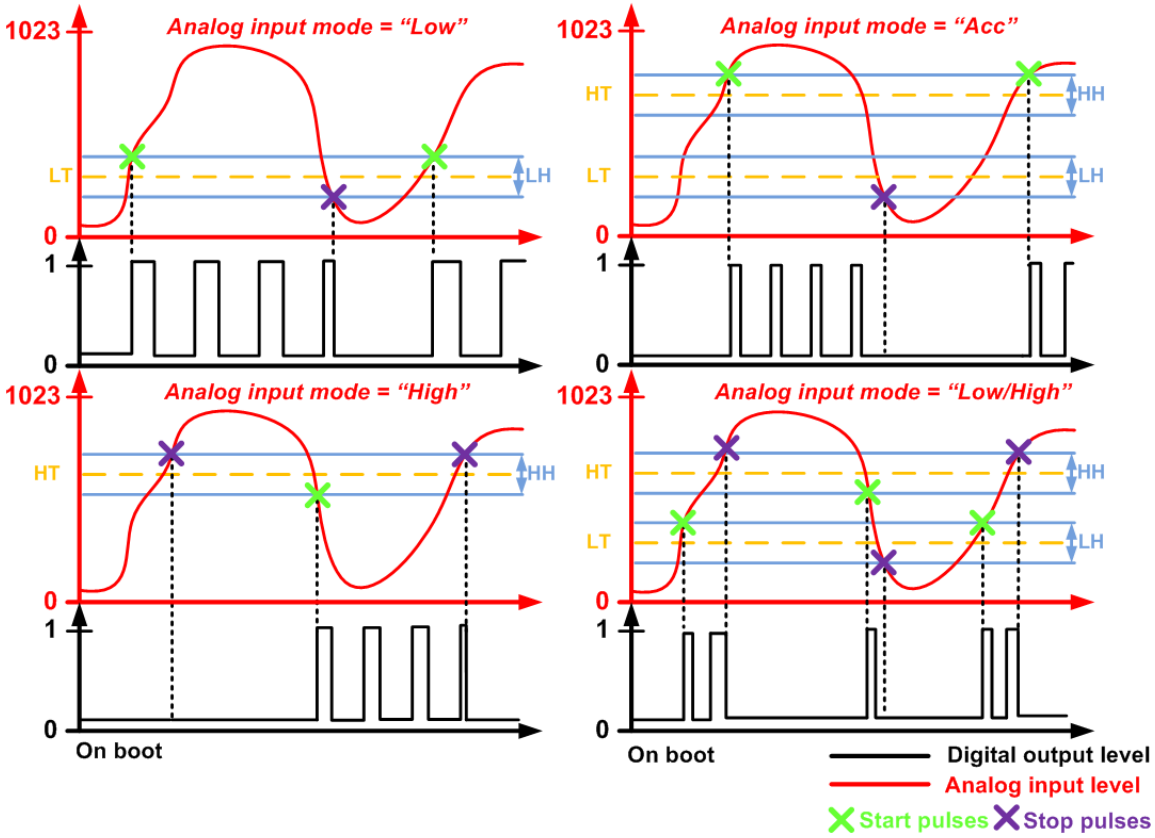


Figure 19. Pulses and analog input

In this mode (figure 19) when some analog input level crosses the given threshold, the pulse generating is started or stopped. "States saving" function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

- In "Low" mode pulses are started when the rising analog input level crosses the LT+LH/2 limit and stopped when the falling analog input level crosses the LT-LH/2 limit.
- In "High" mode pulses are started when the rising analog input level crosses the HT+HH/2 limit and stopped when falling analog input level crosses the HT-HH/2 limit.

- In “Acc” mode the pulses are started when the rising analog input level crosses the HT+HH/2 and stopped when the rising analog input level crosses the LT-LH/2.
- In “Low/High” pulses are started when the rising (falling) analog input level crosses the LT+LH/2 (HT-HH/2). The pulses are stopped when the rising (falling) analog input level crosses the HT+HH/2 (LT-LH/2).

5.4.14. Pulses and schedule

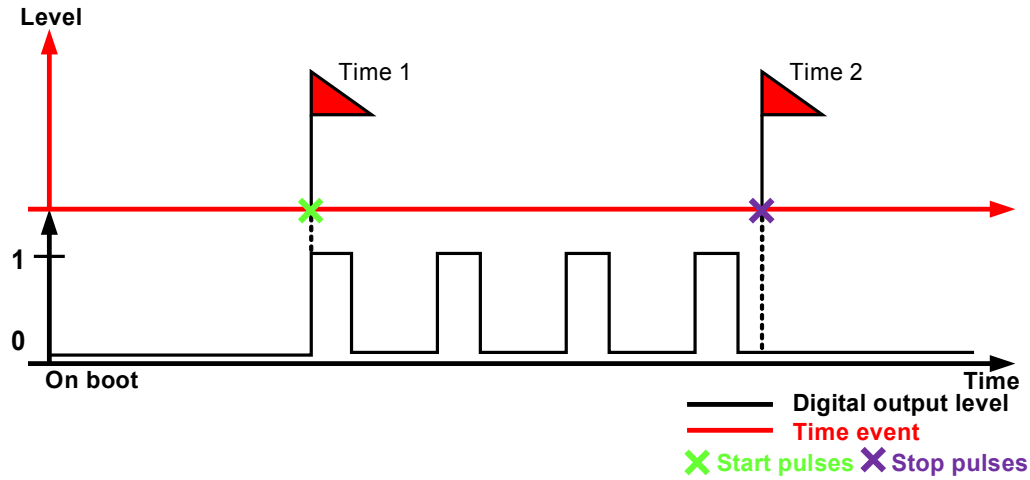


Figure 20. Pulses and schedule

On figure 20 it is shown the digital output mode “Pulses and schedule”. If the moment given by Time 1 appears, then pulse generating is started. If Time 2 appears, then pulse generating is stopped. “States saving” function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

5.4.15. Pulses and remote

In this mode the pulse generating for this digital output can be started/stopped by input (digital or analog) from another DAEnetIP3 controller over the network. “States saving” function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

5.4.16. Timer

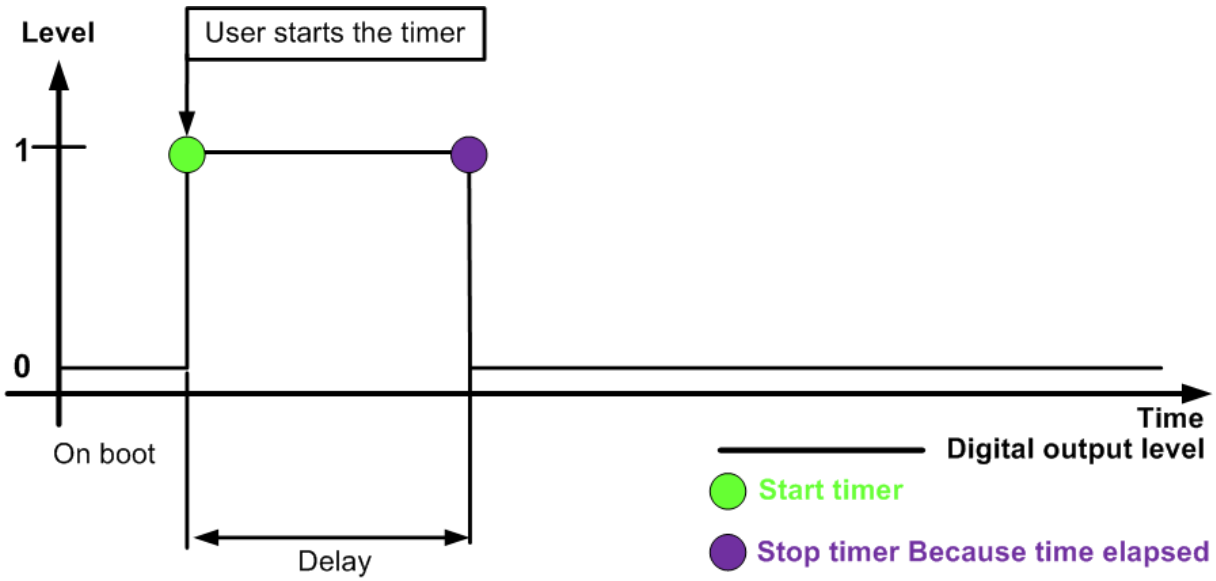


Figure 21. Timer

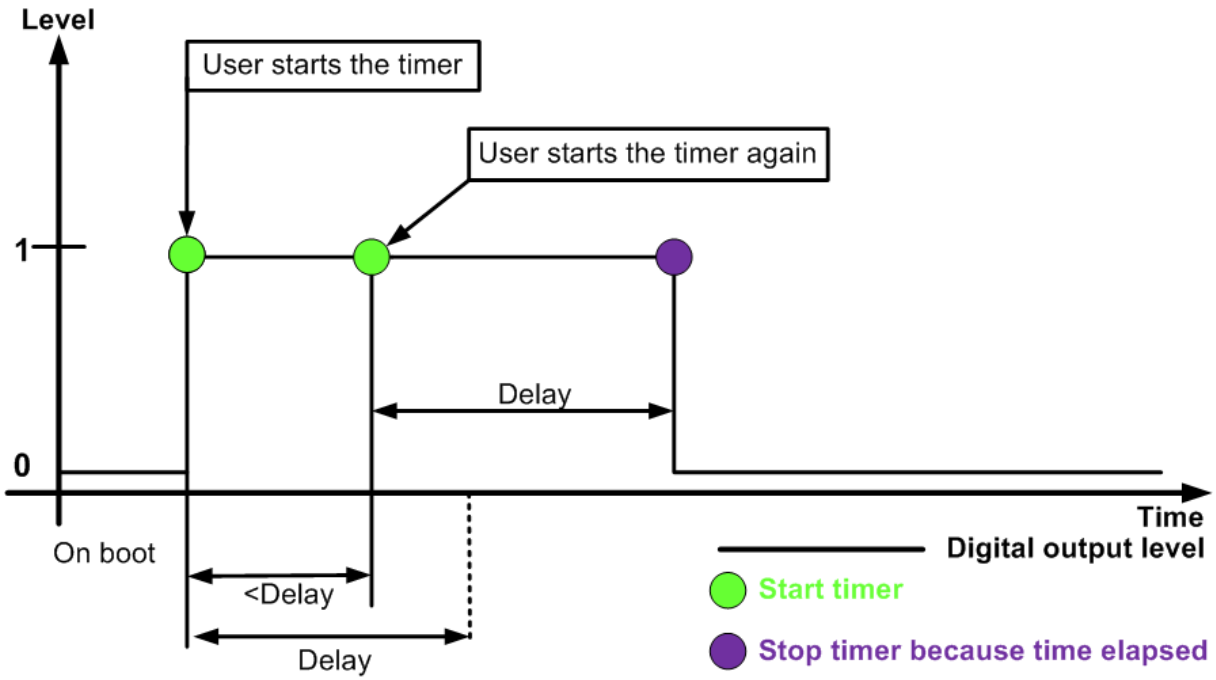


Figure 22. Timer requests

This mode (figure 21) allows the given digital output mode to make single (one-shoot) pulse with custom delay. The pulse can not be stopped, only can be started. If the current pulse is started and not elapsed and new request for single pulse is appeared then the pulse will be stopped after the delay time after the last pulse is started (figure 22). The reason for this is that the DAEnetIP3 controller accepts that the last received request for single pulse is with highest priority. “States saving” function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

5.4.17. Timer and digital input

This mode (figure 23) configures the digital output to work as single pulse generator based on digital input falling/rising slope. Because the pulse can not be stopped, it can be only started during falling/rising slope depending on the mode in which the digital input works in. Note that if the time between two falling (rising) slopes is less than the delay of the single pulse, the digital output level will be in 1 until this interval became greater than Timer delay. “States saving” function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

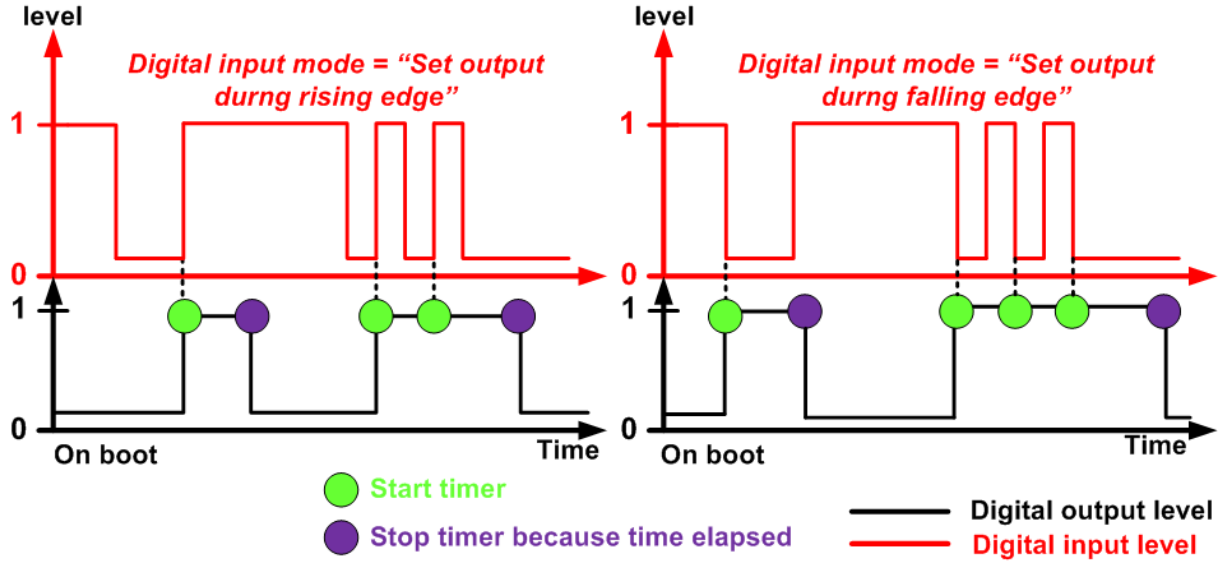


Figure 23. Timer and digital input

5.4.18. Timer and analog input

This mode combines the timer mode and analog inputs (figure 24). “States saving” function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

- In “Low” mode the timer is started when the rising analog input level crosses the LT+LH/2 limit.
- In “High” mode the timer is started when the falling analog input level crosses the HT-HH/2 limit.
- In “Acc” mode the timer is started when the rising analog input level crosses the HT+HH/2 limit.
- In “Low/High” mode the timer is started when the rising analog input level crosses the LT+LH/2 limit or the falling analog input level crosses the HT-LH/2 limit.

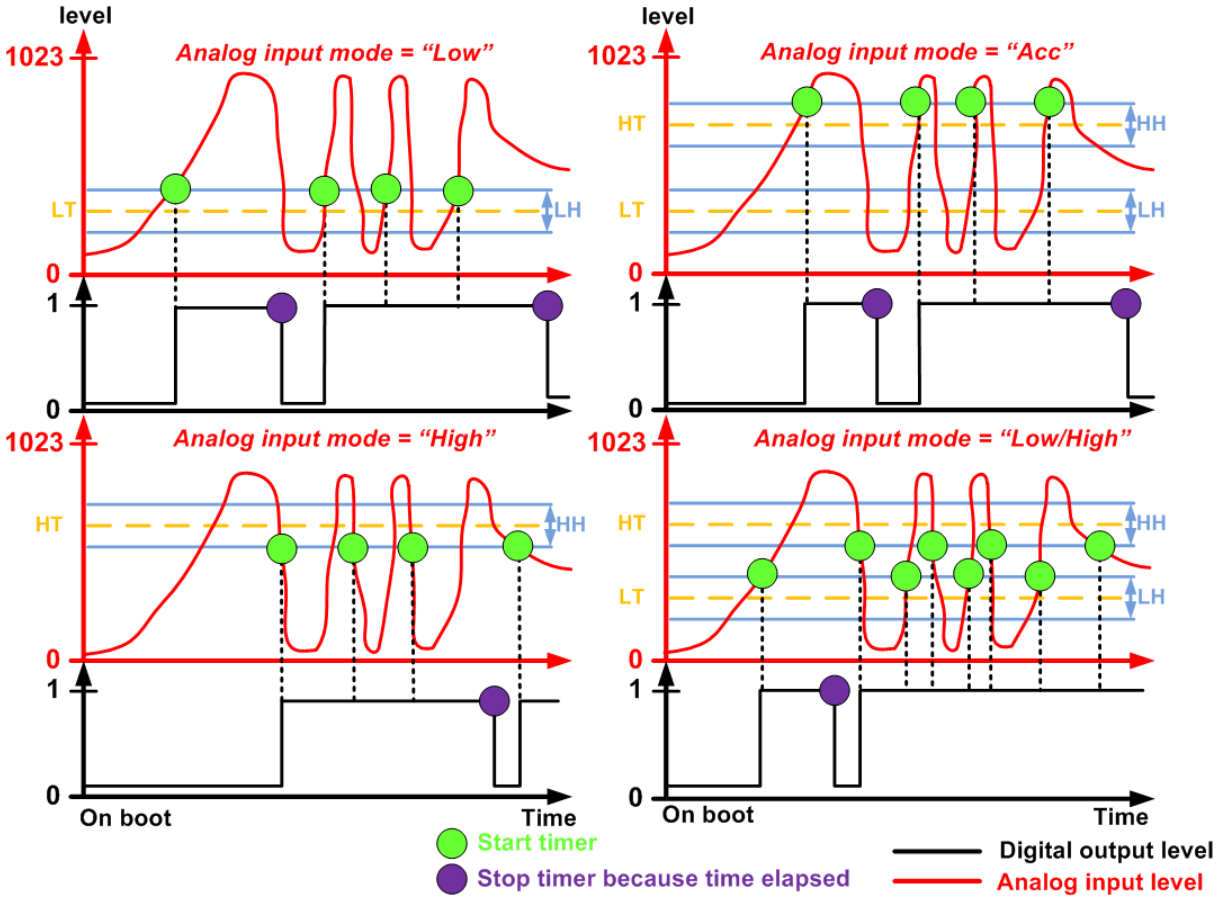


Figure 24. Timer and analog input

5.4.19. Timer and remote

In this mode the single pulse (timer) can be started by input (analog or digital) from another DAEnetIP3 controller over the network. "States saving" function is not supported (initial output state is set in low level) and the user can not control manually the outputs in this mode.

5.5. "ON" value

This value is available for each digital output and determines the ON time (the time when the output is in high level) when the output works in some of the pulse modes. The ON value is >=1 and <=99.

5.6. "OFF" value

This value is available for each digital output and determines the OFF time (the time when the output is in low level) when the output works in some of the pulse modes. The OFF value is >=1 and <=99.

5.7. "Delay" value

This value is available for each digital output and determines the one shot pulse delay time when the output works in some of the timer modes. The Delay value is >=1 and <=99.

5.8. "Time 1" value

This value is available for each digital output and determines the Time 1 moment when the output works in some of the schedule modes. The Time 1 value is with format *hh:mm:ss*

5.9. "Time 2" value

This value is available for each digital output and determines the Time 2 moment when the output works in some of the schedule modes. The Time 2 value is with format *hh:mm:ss*

6. Digital Inputs Port (Port B)

Port B is 8 bit digital inputs port. Each channel has pull-up resistor to +3.3V.

6.1. Reading the digital inputs

The digital inputs can be read separately (only single line) or it can be read the whole port at a time. The state of the digital input mode can be read anytime and it doesn't matter in what mode works each input channel.

The controller has simple digital input filter. It measures the signal level on the digital input pin and stores it in variable with name diValue. This variable will contain 0 or 1 (depending what was the level detected by the controller). After about 100 ms, the controller measures the input level again and stores the new value in diNewValue. If the diValue is different than diNewValue that's mean the input level is not stable and the controller does not accept it. But if diValue is the same as diNewValue that's mean the digital input signal is stable and it can be accepted. After that diValue = diNewValue and after about 100ms the algorithm is repeated. In this way DAEnetIP3 has simple digital input filter. The controller can handle only digital signals with frequency less than 10Hz (1/0.1s).

6.2. Port B modes

6.2.1. Simple reading

This mode is simple reading of the digital inputs value. There are no reactions based on this input.

6.2.2. Set output during rising slope

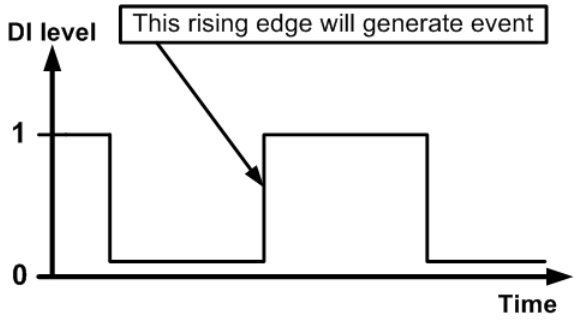


Figure 25. "Set output during rising slope" mode

In this mode (figure 25) DAEnetIP3 controller generates event if it is detected rising slope of the digital input. The type of the event depends on the mode of the attached digital output to this input. For more information about the digital outputs modes see chapter xxx.

6.2.3. Set output during falling slope

In this mode (figure 26) DAEnetIP3 controller generates event if it is detected falling slope of the digital input. The type of the event depends on the mode of the attached digital output to this input. For more information about the digital outputs modes see chapter 8.4.

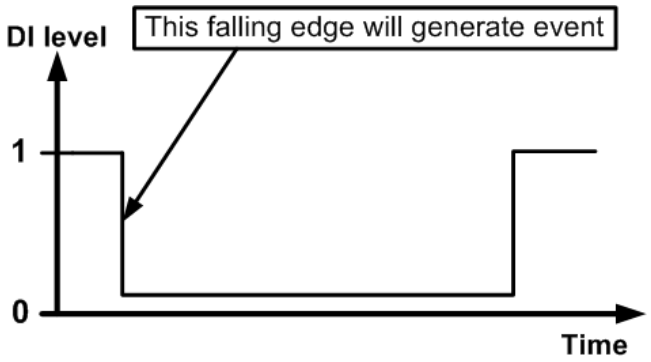


Figure 26. "Set output during falling slope" mode

6.2.4. "Port A pin" value

This is abstract variable that is available for each digital input. It contains the number of some of the digital output lines. It determines which is the attached output line to this input. This means which output will react when this input detects falling/rising slope of the input signal.

6.2.5. "Remote" value

This boolean value (accept only true/false) is available for each digital inputs and determines if the digital output (given by "Remote" value) is of the current DAEnetIP3 controller or it is of another DAEnetIP3 controller in the network. If the value is "true" then the input controls another DAEnetIP3's digital output, otherwise (if "false") it controls the current DAEnetIP3 digital output line.

7. Analog Inputs Port (Port C)

Port C is 8 channel analog input port (8 x ADC). The reference voltage is 2.5VDC and each channel is with 10 bit resolution (1024).

7.1. Reading the analog inputs

Each of the eight analog inputs can be read by any time. The returned value is a number between 1 and 1023.

Each analog input has software filter. The filter is shown on figure 27.

Figure 27. Structure of ADC filter

The filter is actually buffer (array) with 8 elements. When the user (or firmware) reads some analog input value, actually the returned result is the sum of all elements divided to 8 (the length of the buffer). In this way it is retrieved the average value of the analog signal and not the moment (which very often may not be correct).

The time interval between two measured values (elements) is determined by the user. It is called *Refresh time.* The minimum value is 100ms. **So single reading of the analog input channel may be minimum 0.8 seconds.**

The algorithm for filling the buffer is showed on figure 28. This is actually FIFO (First In First Out) buffer.

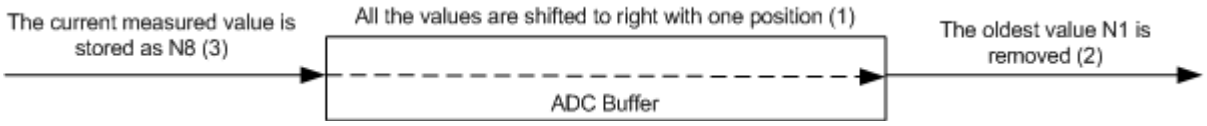


Figure 28. ADC FIFO buffer

1. Firstly, it is performed right sift.
2. Secondly, the oldest value (N1, which came first) now is removed
3. Thirdly, the new measured ADC value is stored as N8 (the newest value)

This cyclic action is performed with period "*Refresh Time"*.

The formula for calculating the analog input voltage is given below:

$$Vin[n] = \frac{Ain[n] * 2.5}{1023}, V$$

where Vin is the voltage of the ADC channel and n is the number of the channel (from 0 up to 7). The reference voltage is 2.5V.

7.2. Refresh time

This is the period for reading (refreshing) the analog inputs. The minimum value is 1 (0.1s=100ms). The maximum is 99 (9.9ms=9900ms). The default value is 1.

7.3. Low Threshold (LT)

This is one of the thresholds (limits) that is used for events generating. The value is between 1 and 1023.

7.4. High Threshold (HT)

This is the second threshold (limit) that is used for events generating. The value is between 1 and 1023.

7.5. Low Hysteresis (LH)

This value is the hysteresis for the Low Threshold. The value is between 1 and 512.

7.6. High Hysteresis (HH)

This value is the hysteresis for the High Threshold. The value is between 1 and 512.

7.7. Analog Input Mode

Generally there are 5 modes for the analog inputs:

7.7.1. Simple reading

This mode is simple reading of the analog input value. There are no reactions (events) based on this input. It is used only to retrieve the values from the analog inputs.

7.7.2. Low

In this mode (figure 29) the threshold for events is the *Low Threshold.*

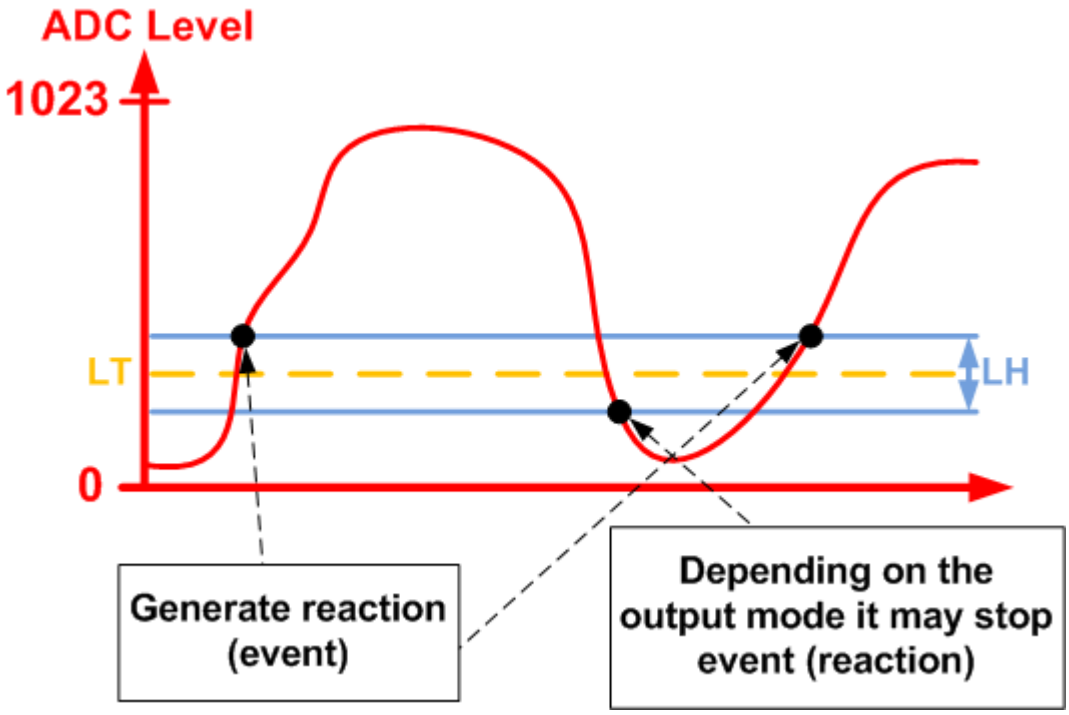


Figure 29. ADC mode “Low”.

7.7.3. High

In this mode (figure 30) the threshold for events is the *High Threshold*.

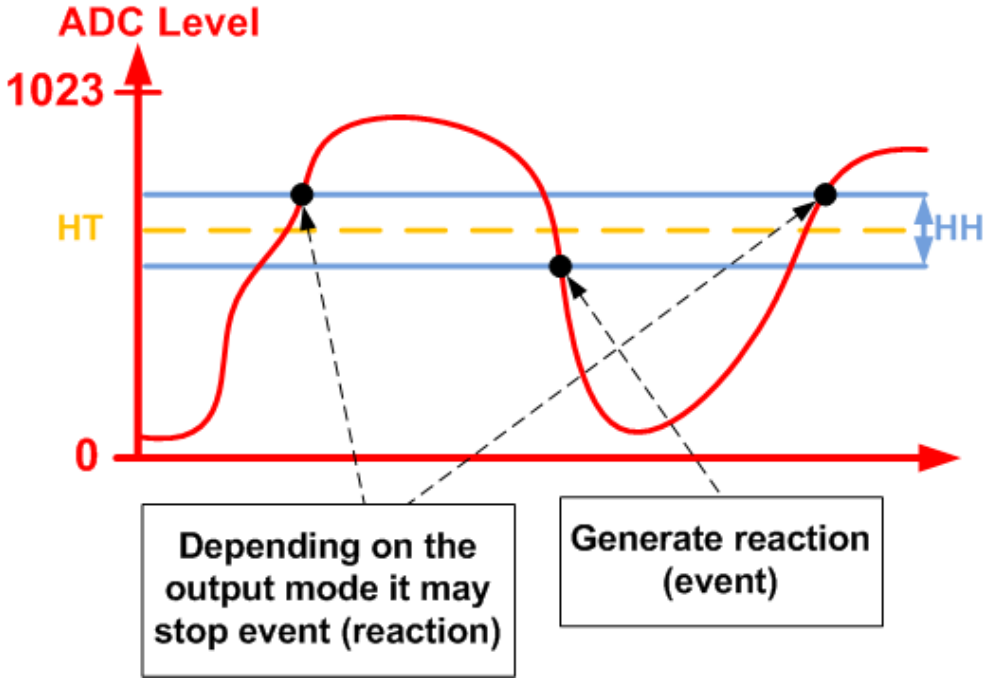


Figure 30. ADC mode “High”.

7.7.4. Acc

In this mode (figure 31) the threshold for events are the *Low and High Threshold*.

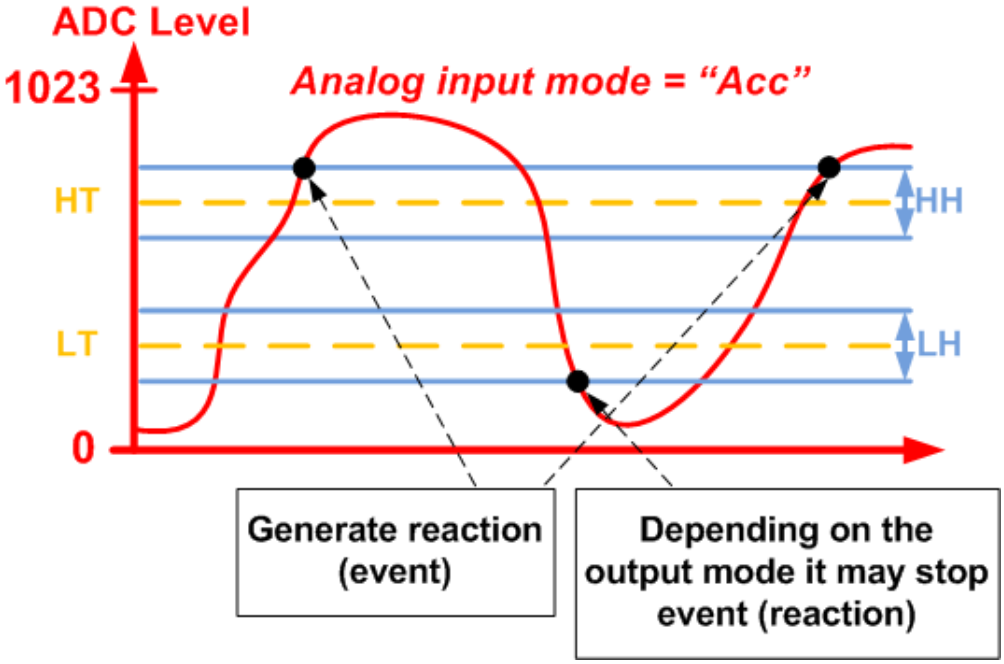


Figure 31. ADC mode “Acc”.

7.7.5. Low/High

In this mode (figure 32) the threshold for events are the *Low and High Threshold*.

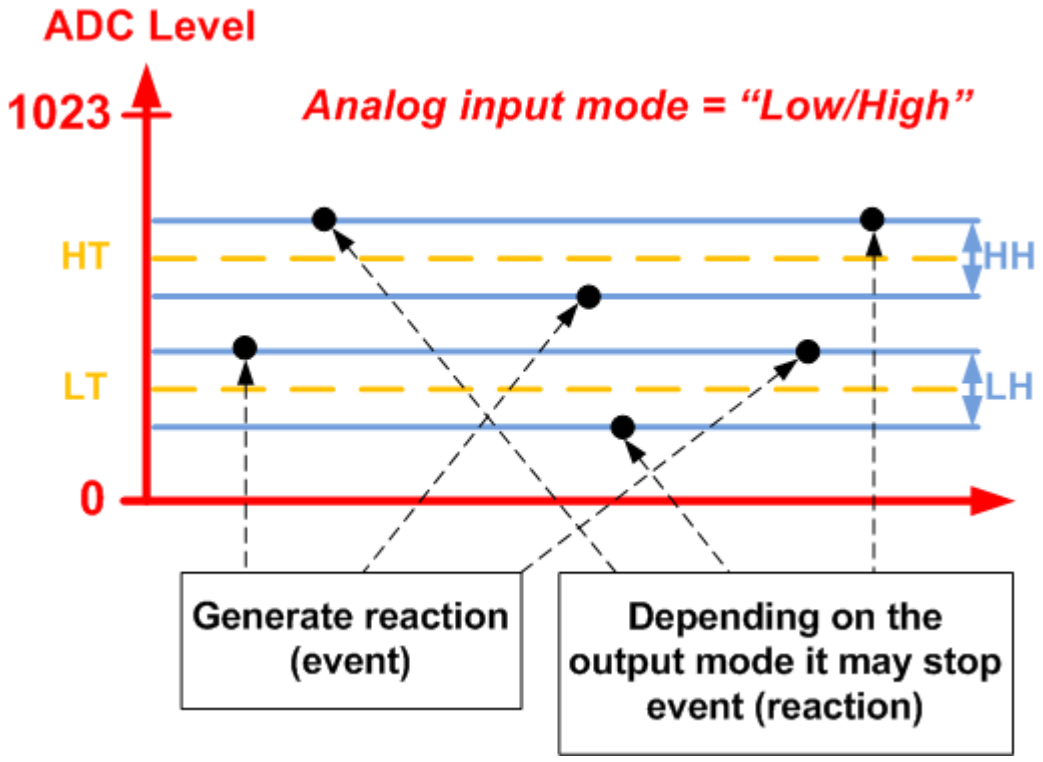


Figure 32. ADC mode "Low/High".

7.7.6. "Port A pin" value

This is abstract variable that is available for each analog input. It contains the number of some of the digital output lines. It determines which is the attached output line to this input. This means which output will react when this input generates event,

7.7.7. "Remote" value

This boolean value (accept only true/false) is available for each analog inputs and determines if the digital output (given by "Remote" value) is of the current DAEnetIP3 controller or it is of another DAEnetIP3 controller in the network. If the value is "true" then the input controls another DAEnetIP3's digital output, otherwise (if "false") it controls the current DAEnetIP3 digital output line.

8. Distributed mode

In some cases it is necessary controlling the digital outputs from digital/analog inputs. But the sensors connected to the inputs may not be close to the devices controlled by the outputs. In such case it is necessary two or more DAEnetIP3 controllers to be connected through the LAN/WAN/WLAN. They should work together and the inputs of one DAEnetIP3 must controls the outputs of another DAEnetIP3 controller. In this mode the controllers connected in one distributed network can work together without computer. DAEnetIP3 support such function. It is called “Distributed mode”.

Bellow in the documentation will be used the notations controlling DAEnetIP3 (controller with inputs) and controlled DAEnetIP3 (controller). Controlling DAEnetIP3 means this is controller that will send TCP/IP messages based on its inputs changes. Controlled DAEnetIP3 is this one that accepts the messages from controlling DAEnetIP3 and it sets its outputs based on the received TCP/IP messages. From the networking side the controlling DAEnetIP3 is ***client*** and the controlled one is ***server***.

This mode is organized with TCP/IP sockets. Each DAEnetIP3 controller has one socket for output connection and 5 sockets for input connections. The output socket servers for controlling others DAEnetIP3 controllers. Each DAEnetIP3 controller can control only one another DAEnetIP3 controller and can be controlled by maximum 5 DAEnetIP3 controllers.

The user must configure two ports for these sockets. The first port is for outgoing connection socket and this is the port of the controlled DAEnetIP3 (***Remote Port***). The second port is for incoming connections. For example the incoming port is 1000, the other four incoming ports are 1001,1002,1003 and 1004. Actually this is ***Local Port Range***.

Bellow they are given the parameters used for distributed mode.

8.1. Configuring the digital outputs

Each digital output has 19 modes. Four of these modes allow this output to be controlled by remote input (input that belongs to another DAEnetIP3 controller). These modes are ***On/Off setting and remote, Inverting and remote, Pulses and remote, Timer and remote.*** If the output is not configured to work in some of these modes, it is not possible to be controlled by remote input of another DAEnetIP3 controller.

8.2. Configuring the digital/analog inputs

Each digital/analog input has parameter that describes which is the digital output line that must be controlled by this input. This parameter must be set to the desired output line (1-16) of Port A. The inputs have also another very important booelan parameter (Remote). If this parameter is set that’s mean this input controls output from another DAEnetIP3 controller. If this parameter is not set that’s mean this input controls output from the current DAEnetIP3 controller.

Note that more than one digital/analog inputs may control same digital output line. The user must configure these settings properly to avoid errors.

8.3. Configuring the network parameters

8.3.1. Ethernet (Wi-Fi) IP address, MASK and Gateway

The controllers desired to work as distributed system must be in same network, so the IP address and MASK must be set with appropriate values. Note that the controller may support two kind of interfaces Ethernet and optional Wi-Fi.

8.3.2. Remote server IP

This is the IP address of the DAEnetIP3 controller which digital outputs must be controlled by the current DAEnetIP3 controller.

8.3.3. Local Port Range

These are the five ports determined to accept incoming connections from DAEnetIP3 controller with digital/analog inputs.

8.3.4. Remote server Port

This is the network port of the remote server. This port must be in the Local Port Range of the remote DAEnetIP3 controller (remote server).

8.3.5. Working mode

This parameter determines if the outgoing connection (this is valid for DAEnetIP3 controller with inputs) will be established over Ethernet interface or Wi-Fi interface. Because the controller has two network settings groups (one for Ethernet and one for Wireless), the settings that will be valid for the distributed mode are determined by the working mode (Ethernet or Wi-Fi interface).

8.4. Examples

8.4.1. Example 1: Two DAEnetIP3 controllers connected via UTP cable

This example (figure 33) illustrates how two DAEnetIP3 controllers can be connected via single UTP cable. They can work standalone without computer or router. It is described how one digital input and one analog input of one DAEnetIP3 controller (with inputs) can control two digital outputs of another DAEnetIP3 controller (with outputs).

DAEnetIP3 controller with inputs for example can read some temperature sensor (connected to AI1) and switch (connected to DI1). DAEnetIP3 controller with outputs will listen for requests and set its DO1 and DO2 according the given settings. For example these outputs can control directly relay board.

The settings for the two DAEnetIP3 controllers that must be done are provided also. Note that in this example are used the Ethernet interface network settings (not the Wi-Fi interface).

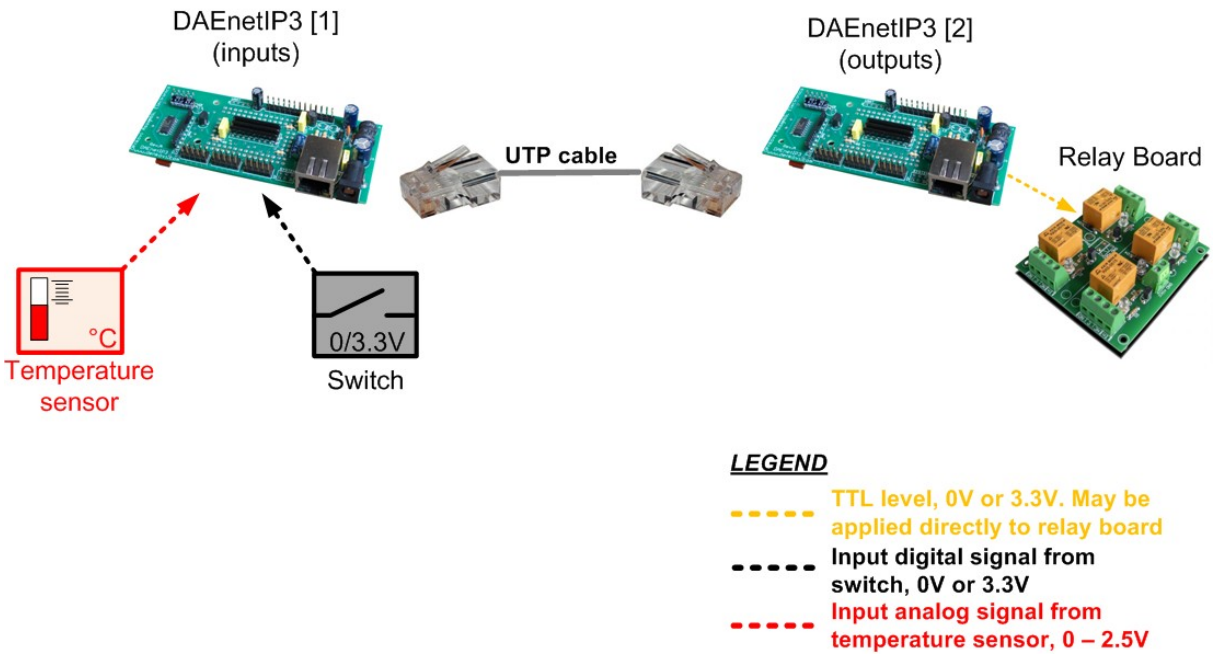


Figure 33. Two DAEnetIP3 controllers connected via UTP cable

Table 9. Example 1 settings

DAEnetIP3 [1] (inputs)	***DAEnetIP3 [2] (outputs)***
Network Settings Eth IP address = 192.168.0.100 Eth Mask = 255.255.255.0 Eth GW = 192.168.0.101 Remote Server IP:Port = 192.168.0.101:1005 Working mode = Ethernet 10/100 Mbit **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 1, Remote = true **Digital Input 1 (Port B – Pin 1)** Mode = Set output during rising slope, PortA Pin = Pin 2, Remote = true	**Network Settings** Eth IP address = 192.168.0.100 Eth Mask = 255.255.255.0 Eth GW = 192.168.0.101 Local Port Range = 1005:1009 **Digital Output 1 (Port A - Pin 1)** Mode = On/Off setting and remote **Digital Output 2 (Port A - Pin 2)** Mode = On/Off setting and remote

8.4.2. Example 2: Two DAEnetIP3 controllers connected via WLAN

This example (figure 34) is extension of the previous one. It demonstrates how two DAEnetIP3 controllers can be connected to each other but this time over WLAN. It is used Wi-Fi router. Again one analog and one digital inputs of one DAEnetIP3 controller control two digital outputs of another DAEnetIP3 controller. It used the Wi-Fi interface, so the Wi-Fi network settings must be set properly.

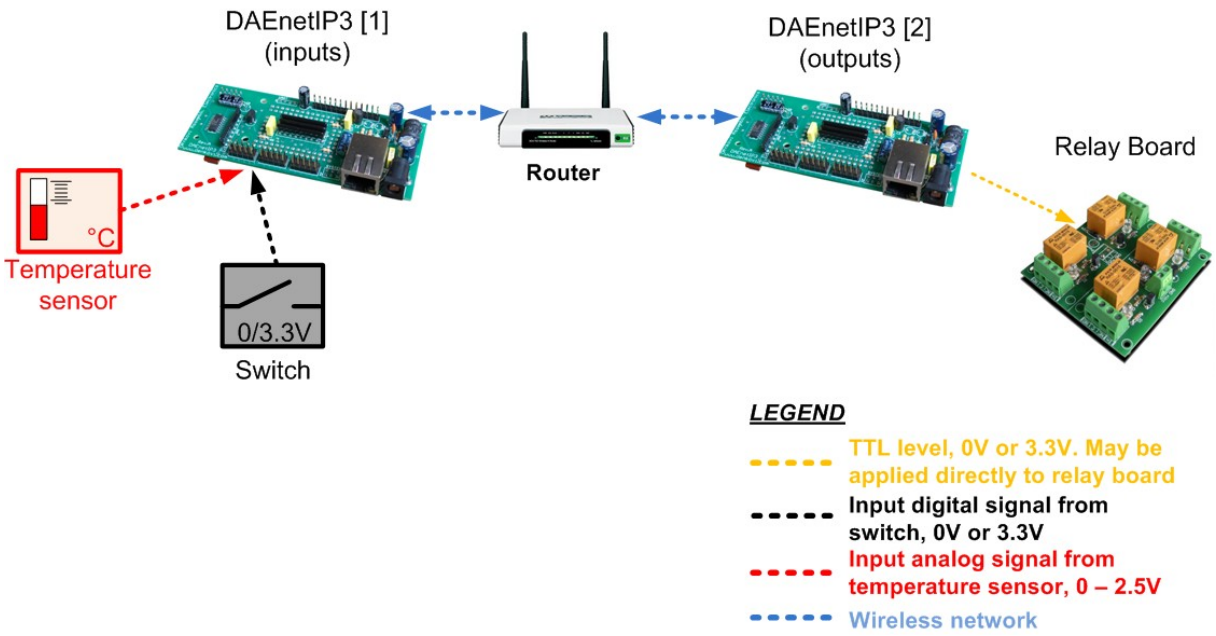


Figure 34. Two DAEnetIP3 controllers connected via WLAN

Table 10. Example 2 settings

DAEnetIP3 [1] (inputs) **Network Settings** Wln IP address = 192.168.1.100 Wln Mask = 255.255.255.0 Wln GW = 192.168.1.1 Remote Server IP:Port = 192.168.1.101:1005 Working mode = Wi-Fi 802.11 b/g **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 1, Remote = true **Digital Input 1 (Port B – Pin 1)** Mode = Set output during rising slope, PortA Pin = Pin 2, Remote = true **Wi-Fi Settings** WEP SSID = Network WEP Key = admin	***DAEnetIP3 [2] (outputs)*** **Network Settings** Wln IP address = 192.168.1.101 Wln Mask = 255.255.255.0 Eth GW = 192.168.1.1 Local Port Range = 1005:1009 **Digital Output 1 (Port A - Pin 1)** Mode = On/Off setting and remote **Digital Output 2 (Port A - Pin 2)** Mode = On/Off setting and remote **Wi-Fi Settings** WEP SSID = Network WEP Key = admin
Router Settings IP address = 192.168.1.1 WEP SSID = Network WEP Key = admin	

8.4.3. Example 3: Two DAEnetIP3 controllers connected via LAN

This example (figure 35) is similar with the previous one. The connection is done with two UTP cables and router. It is used Ethernet interface settings.

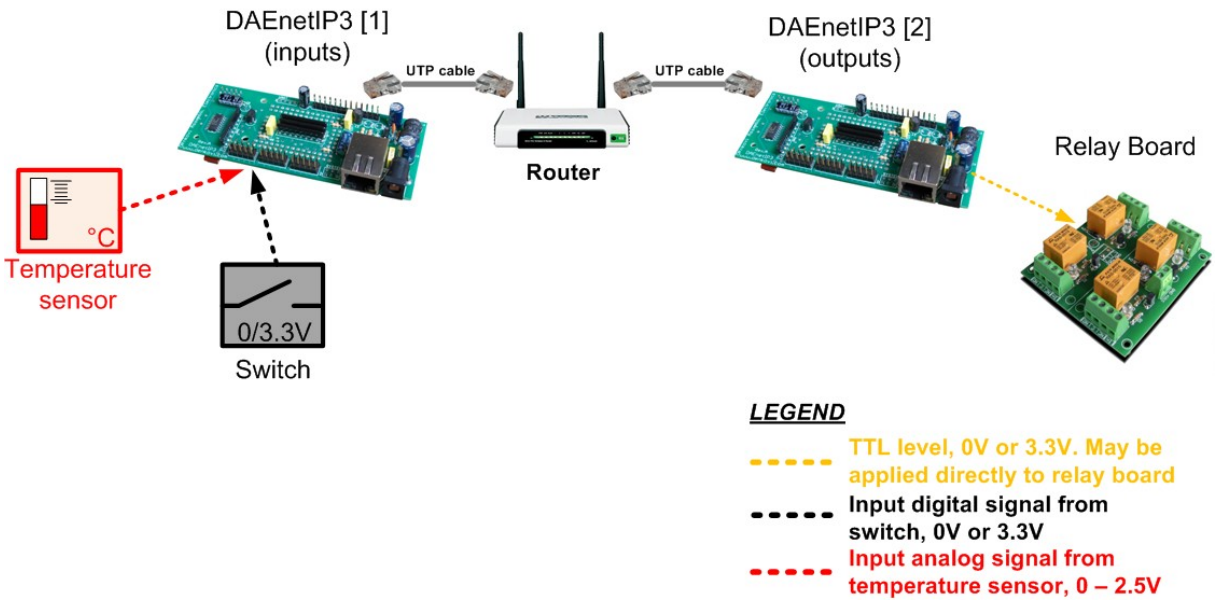


Figure 35. Distributed mode – example 3

Table 11. Example 3 settings

DAEnetIP3 [1] (inputs) **Network Settings** Eth IP address = 192.168.1.100 Eth Mask = 255.255.255.0 Eth GW = 192.168.1.1 Remote Server IP:Port = 192.168.1.101:1005 Working mode = Ethernet 10/100 Mbit **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 1, Remote = true **Digital Input 1 (Port B – Pin 1)** Mode = Set output during rising slope, PortA Pin = Pin 2, Remote = true	***DAEnetIP3 [2] (outputs)*** **Network Settings** Eth IP address = 192.168.1.101 Eth Mask = 255.255.255.0 Eth GW = 192.168.1.1 Local Port Range = 1005:1009 **Digital Output 1 (Port A - Pin 1)** Mode = On/Off setting and remote **Digital Output 2 (Port A - Pin 2)** Mode = On/Off setting and remote
Router Settings IP address = 192.168.1.1	

8.4.4. Example 4: Configuration "5 to 1" over LAN

This example (figure 36) shows how 5 controllers with a temperature sensor can control one controller with outputs over the LAN. That's why the configuration is called "5 to 1". This is the maximum controllers that may control another DAEnetIP3. Note that each controlling DAEnetIP3 has different Remote Port parameter – 1005,1006,1007, 1008, 1009 and they are in the local port range of the controlled DAEnetIP3.

Each of the five controlling DAEnetIP3 [2…6] have one analog input "attached" to 5 (totally) digital outputs of the controlled DAEnetIP3 [1].

In this mode it is possible to measure 5 different temperatures in 5 points and set relays of a single relay board.

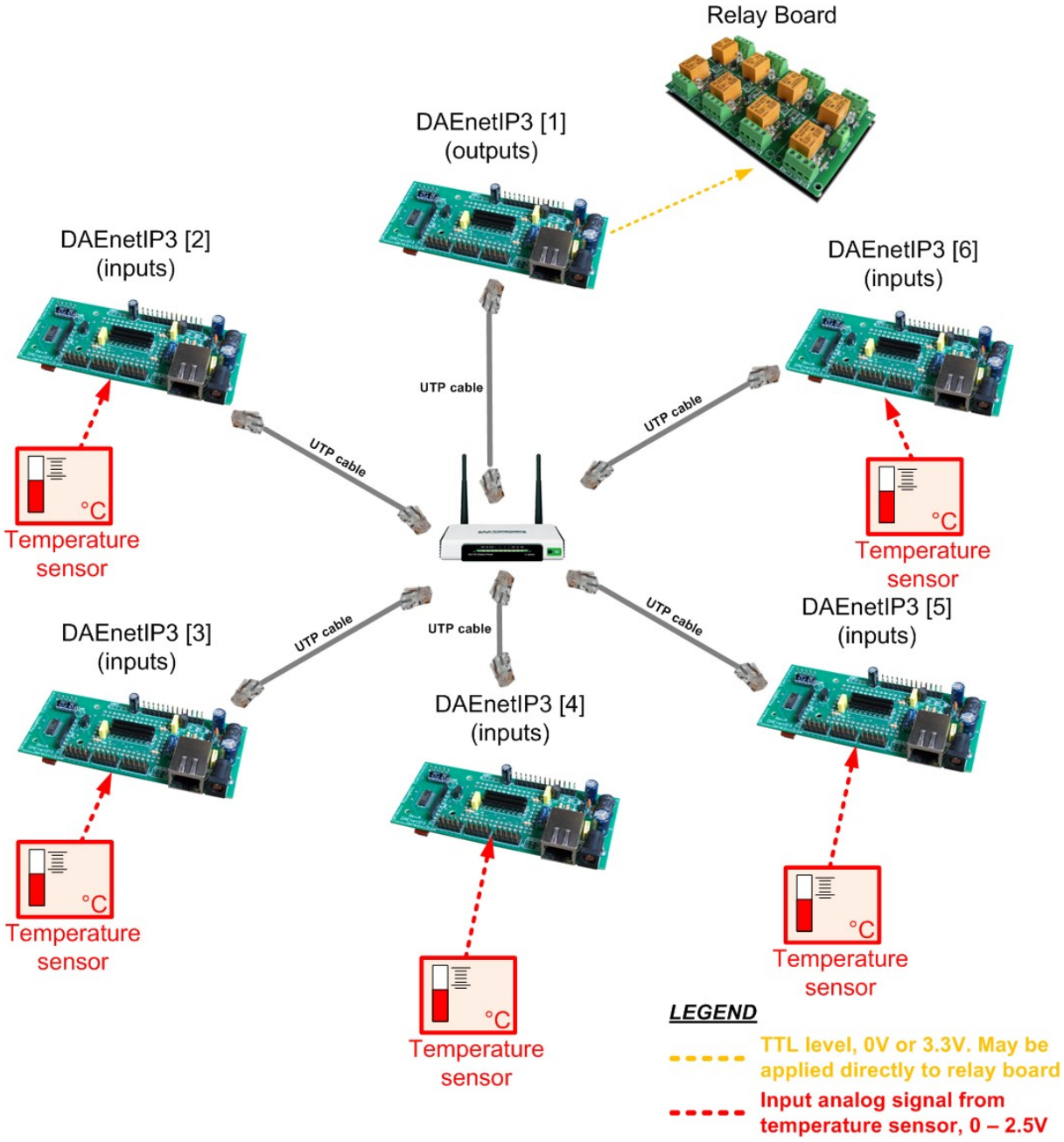


Figure 36. Configuration 5 to 1 over LAN

Table 12. Example 4 settings

DAEnetIP3 [1] (outputs) **Network Settings** Eth IP address = 192.168.1.100 Eth Mask = 255.255.255.0 Eth GW = 192.168.1.1 Local Port Range = 1005:1009 **Digital Output 1 (Port A - Pin 1)** Mode = On/Off setting and remote **Digital Output 2 (Port A - Pin 2)** Mode = On/Off setting and remote **Digital Output 1 (Port A - Pin 3)** Mode = On/Off setting and remote **Digital Output 2 (Port A - Pin 4)** Mode = On/Off setting and remote **Digital Output 1 (Port A - Pin 5)** Mode = On/Off setting and remote	***DAEnetIP3 [2] (inputs)*** **Network Settings** Eth IP address = 192.168.1.101 Eth Mask = 255.255.255.0 Eth GW a= 192.168.1.1 Remote Server IP:Port = 192.168.1.100:1005 Working mode = Ethernet 10/100 Mbit **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 1, Remote = true
DAEnetIP3 [3] (inputs) **Network Settings** Eth IP address = 192.168.1.102 Eth Mask = 255.255.255.0 Eth GW a= 192.168.1.1 Remote Server IP:Port = 192.168.1.100:1006 Working mode = Ethernet 10/100 Mbit **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 2, Remote = true	***DAEnetIP3 [4] (inputs)*** **Network Settings** Eth IP address = 192.168.1.103 Eth Mask = 255.255.255.0 Eth GW a= 192.168.1.1 Remote Server IP:Port = 192.168.1.100:1007 Working mode = Ethernet 10/100 Mbit **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 3, Remote = true
DAEnetIP3 [5] (inputs) **Network Settings** Eth IP address = 192.168.1.104 Eth Mask = 255.255.255.0 Eth GW a= 192.168.1.1 Remote Server IP:Port = 192.168.1.100:1008 Working mode = Ethernet 10/100 Mbit **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 4, Remote = true	***DAEnetIP3 [6] (inputs)*** **Network Settings** Eth IP address = 192.168.1.105 Eth Mask = 255.255.255.0 Eth GW a= 192.168.1.1 Remote Server IP:Port = 192.168.1.100:1009 Working mode = Ethernet 10/100 Mbit **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 5, Remote = true
Router Settings IP address = 192.168.1.1	

8.4.5. Example 5: Configuration "5 to 1" over WLAN

This example (figure 37) is same as the previous one, but it is used Wi-Fi interface of all the DAEnetIP3 controllers.

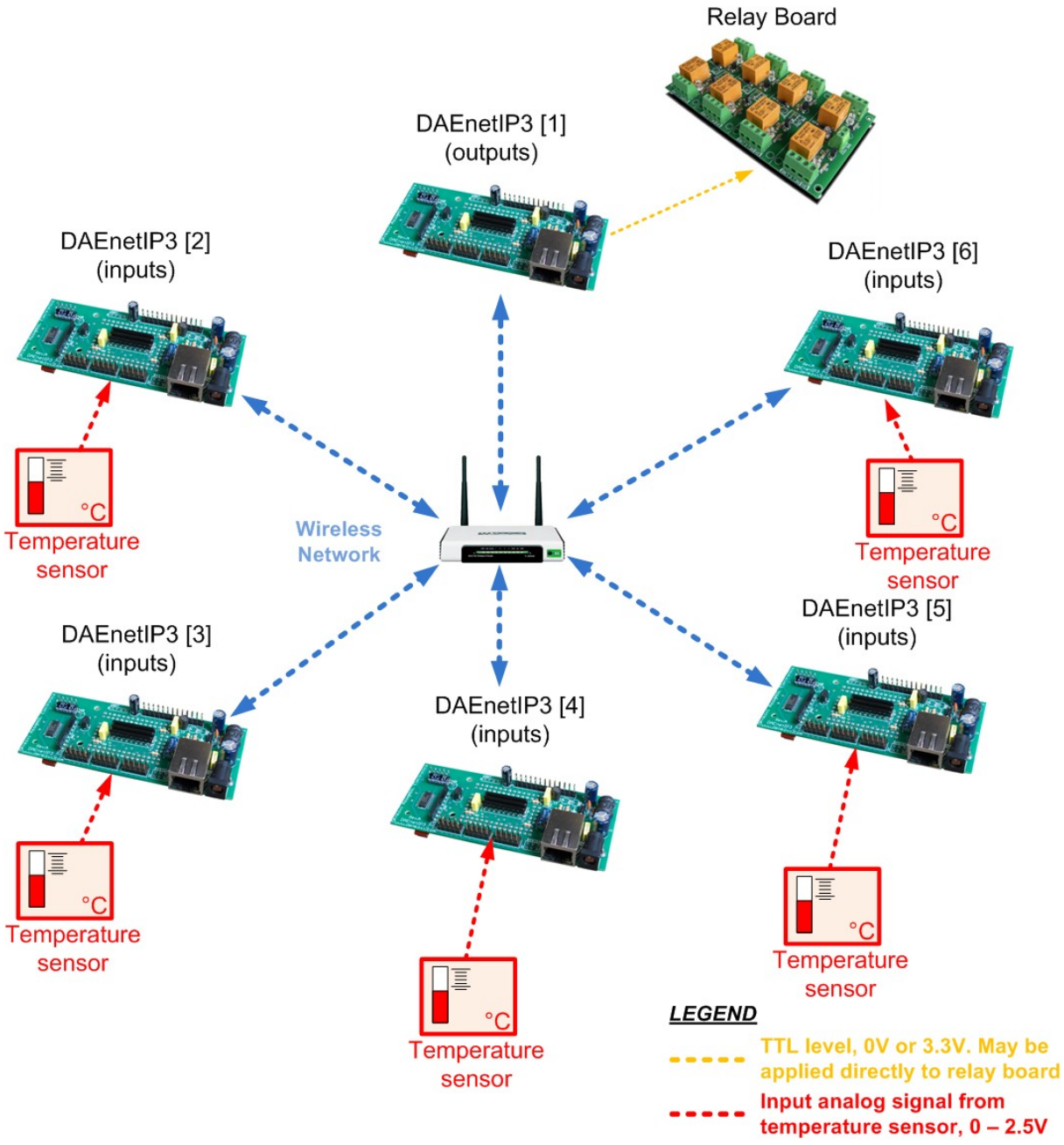


Figure 37. Distributed mode – example 4

Table 13. Example 5 settings

DAEnetIP3 [1] (outputs) **Network Settings** Wln IP address = 192.168.1.100 Wln Mask = 255.255.255.0 Wln GW = 192.168.1.1 Local Port Range = 1005:1009 **Digital Output 1 (Port A - Pin 1)** Mode = On/Off setting and remote **Digital Output 2 (Port A - Pin 2)** Mode = On/Off setting and remote **Digital Output 1 (Port A - Pin 3)** Mode = On/Off setting and remote **Digital Output 2 (Port A - Pin 4)** Mode = On/Off setting and remote **Digital Output 1 (Port A - Pin 5)** Mode = On/Off setting and remote **Wi-Fi Settings** WEP SSID = Network WEP Key = admin	***DAEnetIP3 [2] (inputs)*** **Network Settings** Wln IP address = 192.168.1.101 Wln Mask = 255.255.255.0 Wln GW a= 192.168.1.1 Remote Server IP:Port = 192.168.1.100:1005 Working mode = Wi-Fi 802.11 b/g **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 1, Remote = true **Wi-Fi Settings** WEP SSID = Network WEP Key = admin
DAEnetIP3 [3] (inputs) **Network Settings** Wln IP address = 192.168.1.102 Wln Mask = 255.255.255.0 Wln GW a= 192.168.1.1 Remote Server IP:Port = 192.168.1.100:1006 Working mode = Wi-Fi 802.11 b/g **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 2, Remote = true **Wi-Fi Settings** WEP SSID = Network WEP Key = admin	***DAEnetIP3 [4] (inputs)*** **Network Settings** Wln IP address = 192.168.1.103 Wln Mask = 255.255.255.0 Wln GW a= 192.168.1.1 Remote Server IP:Port = 192.168.1.100:1007 Working mode = Wi-Fi 802.11 b/g **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 3, Remote = true **Wi-Fi Settings** WEP SSID = Network WEP Key = admin
DAEnetIP3 [5] (inputs) **Network Settings** Wln IP address = 192.168.1.104 Wln Mask = 255.255.255.0 Wln GW a= 192.168.1.1 Remote Server IP:Port = 192.168.1.100:1008 Working mode = Wi-Fi 802.11 b/g **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 4, Remote = true **Wi-Fi Settings** WEP SSID = Network WEP Key = admin	***DAEnetIP3 [6] (inputs)*** **Network Settings** Wln IP address = 192.168.1.105 Wln Mask = 255.255.255.0 Wln GW a= 192.168.1.1 Remote Server IP:Port = 192.168.1.100:1009 Working mode = Wi-Fi 802.11 b/g **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 5, Remote = true **Wi-Fi Settings** WEP SSID = Network WEP Key = admin
Router Settings IP address = 192.168.1.1 WEP SSID = Network WEP Key = admin	

8.4.6. Example 6: Mixed configuration

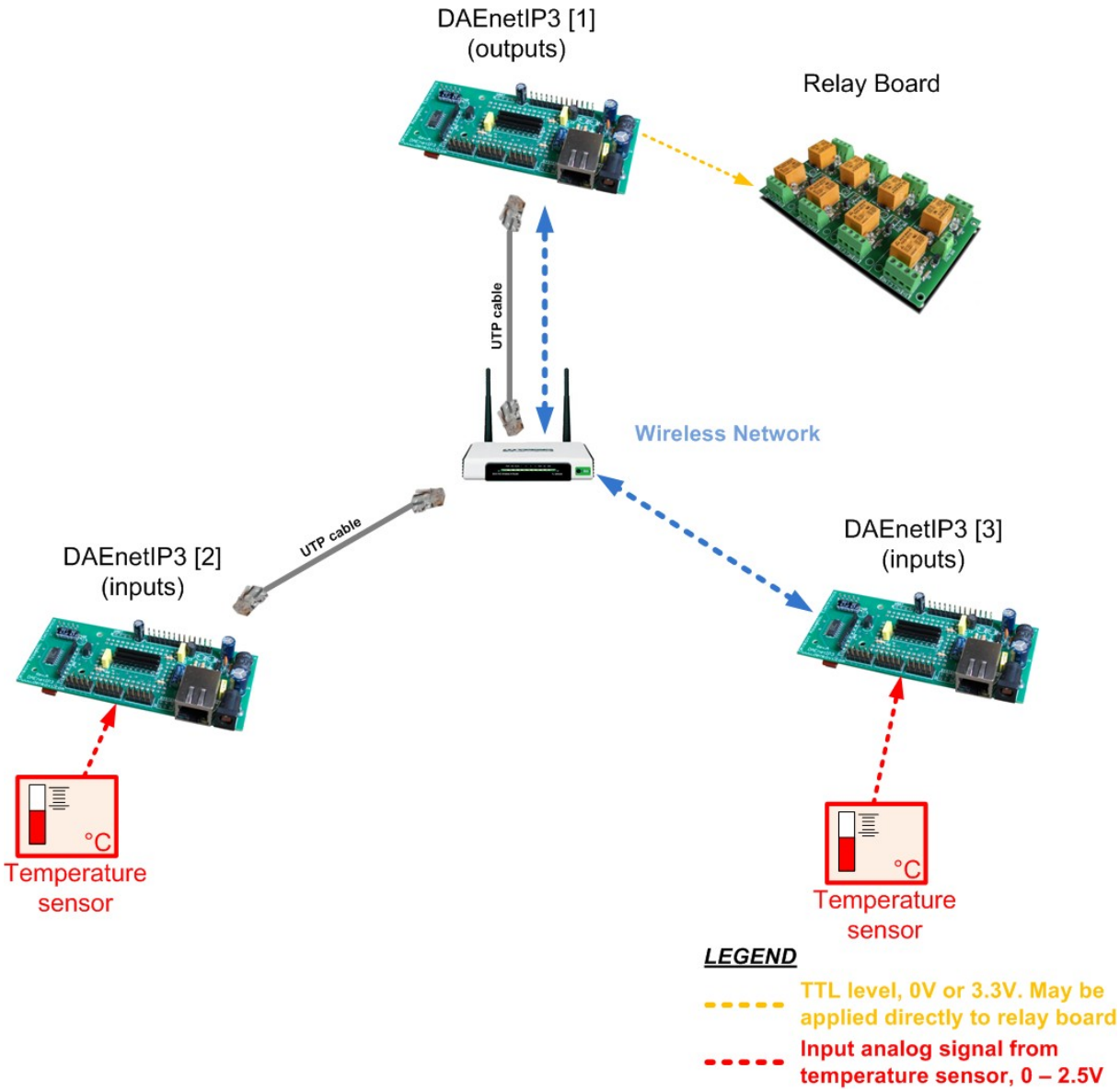


Figure 38. Mixed configuration

This example (figure 38) demonstrates how two client DAEnetIP3 (inputs) control one server (DAEnetIP3 with outputs). DAEnetIP3 [2] communicate over UTP cable and DAEnetIP3 [3] communicate over wireless network.

DAEnetIP3 [1] (the server) can handle the two types of messages (over the UTP cable and over the wireless). Its input sockets are configured so it accepts any incoming connections.

DAEnetIP3 [2] and DAEnetIP3 [3] however must be configured to work with their Ethernet and Wireless interfaces.

The router is the gateway for the LAN and WLAN networks. In this way DAEnetIP3 [1] and DAEnetIP3 [2] are in local area network and DAEnetIP3 [1] and DAEnetIP3 [3] are in another local area network (wireless local area network).

Table 14. Example 6 settings

DAEnetIP3 [1] (outputs) **Network Settings** Wln IP address = 192.168.1.20 Wln Mask = 255.255.255.0 Wln GW = 192.168.1.1 Eth IP address = 192.168.1.10 Eth Mask = 255.255.255.0 Eth GW = 192.168.1.1 Local Port Range = 1005:1009 **Digital Output 1 (Port A - Pin 1)** Mode = On/Off setting and remote **Digital Output 2 (Port A - Pin 2)** Mode = On/Off setting and remote **Wi-Fi Settings** WEP SSID = Network WEP Key = admin	***DAEnetIP3 [2] (inputs)*** **Network Settings** Wln IP address = 192.168.1.21 Wln Mask = 255.255.255.0 Wln GW = 192.168.1.1 Eth IP address = 192.168.1.11 Eth Mask = 255.255.255.0 Eth GW = 192.168.0.1 Remote Server IP:Port = 192.168.1.10:1005 Working mode = Ethernet 10/100 Mbit **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 1, Remote = true **Wi-Fi Settings** WEP SSID = Network WEP Key = admin
DAEnetIP3 [3] (inputs) **Network Settings** Wln IP address = 192.168.1.22 Wln Mask = 255.255.255.0 Wln GW = 192.168.1.1 Eth IP address = 192.168.1.11 Eth Mask = 255.255.255.0 Eth GW = 192.168.1.1 Remote Server IP:Port = 192.168.1.10:1006 Working mode = Wi-Fi 802.11 b/g **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 2, Remote = true **Wi-Fi Settings** WEP SSID = Network WEP Key = admin	***Router Settings*** IP address = 192.168.1.1 WEP SSID = Network WEP Key = admin

8.4.7. Example 7: Ring configuration over WLAN

This example (figure 39) demonstrates how a simple ring configuration with 4 DAEnetIP3 modules can be developed. Each DAEnetIP3 control the next and it is controlled by the previous one. For example DAEnetIP3 [1] control DAEnetIP3 [2] and it is controlled by DAEnetIP3 [4]. Each module works as server/client at the same time. There is no limit of adding modules to this network, because each module has only one input socket reserved.

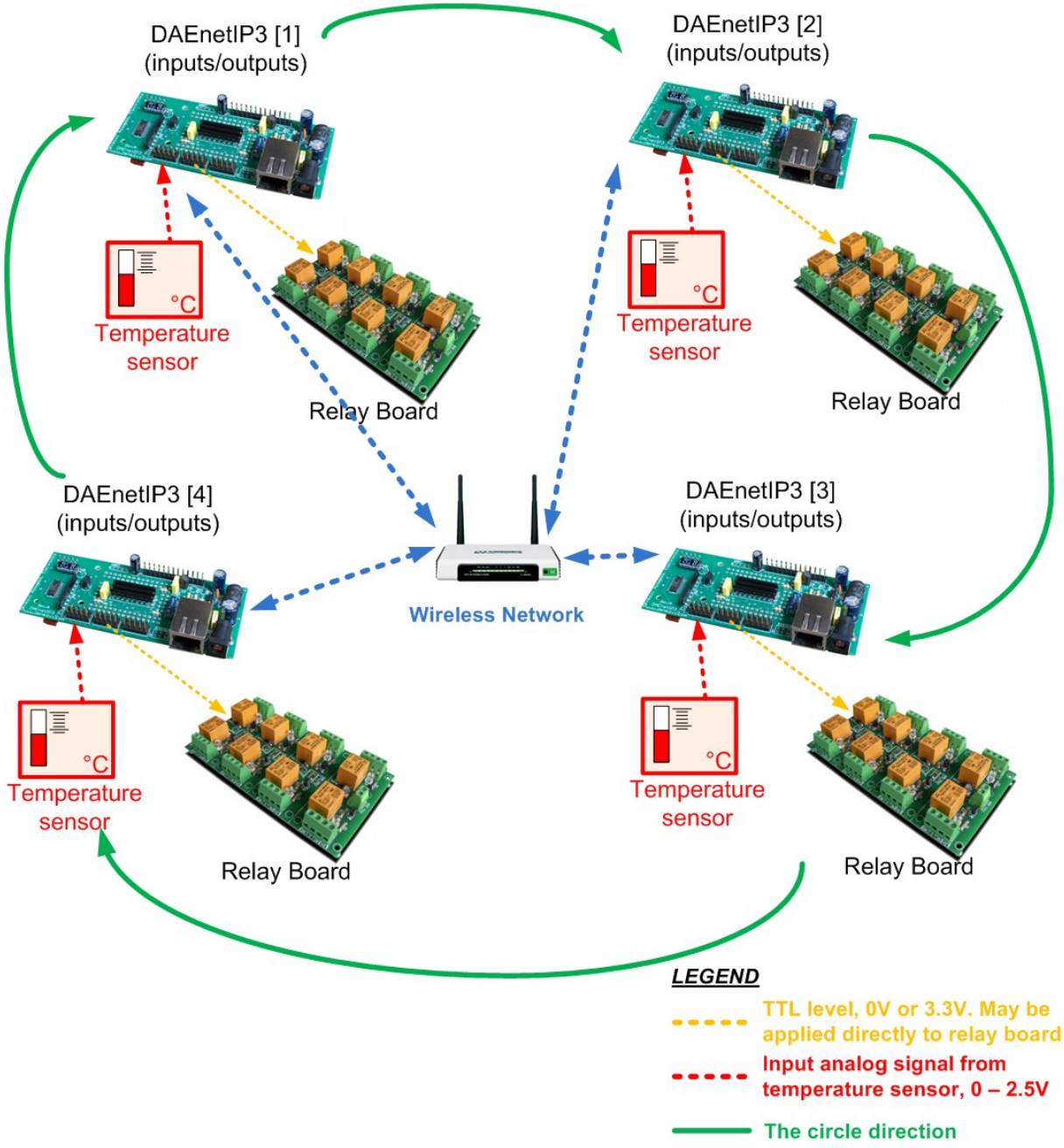


Figure 39. Ring configuration

Table 15. Example 7 settings

DAEnetIP3 [1] (inputs/outputs) **Network Settings** Wln IP address = 192.168.1.100 Wln Mask = 255.255.255.0 Wln GW = 192.168.1.1 Local Port Range = 1005:1009 Remote Server IP:Port = 192.168.1.101:1005 Working mode = Wi-Fi 802.11 b/g **Digital Output 1 (Port A - Pin 1)** Mode = On/Off setting and remote **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 1, Remote = true **Wi-Fi Settings** WEP SSID = Network WEP Key = admin	***DAEnetIP3 [2] (inputs/outputs)*** **Network Settings** Wln IP address = 192.168.1.101 Wln Mask = 255.255.255.0 Wln GW = 192.168.1.1 Local Port Range = 1005:1009 Remote Server IP:Port = 192.168.1.102:1005 Working mode = Wi-Fi 802.11 b/g **Digital Output 1 (Port A - Pin 1)** Mode = On/Off setting and remote **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 1, Remote = true **Wi-Fi Settings** WEP SSID = Network WEP Key = admin
DAEnetIP3 [4] (inputs/outputs) **Network Settings** Wln IP address = 192.168.1.103 Wln Mask = 255.255.255.0 Wln GW = 192.168.1.1 Local Port Range = 1005:1009 Remote Server IP:Port = 192.168.1.100:1005 Working mode = Wi-Fi 802.11 b/g **Digital Output 1 (Port A - Pin 1)** Mode = On/Off setting and remote **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 1, Remote = true **Wi-Fi Settings** WEP SSID = Network WEP Key = admin	***DAEnetIP3 [3] (inputs/outputs)*** **Network Settings** Wln IP address = 192.168.1.102 Wln Mask = 255.255.255.0 Wln GW = 192.168.1.1 Local Port Range = 1005:1009 Remote Server IP:Port = 192.168.1.103:1005 Working mode = Wi-Fi 802.11 b/g **Digital Output 1 (Port A - Pin 1)** Mode = On/Off setting and remote **Analog Input 1 (Port C – Pin 1)** Refresh=1, LT=100,HT=150,LH=10,HH=10, Mode = Low, PortA Pin = Pin 1, Remote = true3, Remote = true **Wi-Fi Settings** WEP SSID = Network WEP Key = admin
Router Settings IP address = 192.168.1.1 WEP SSID = Network WEP Key = admin	

8.4.8. Custom examples

Of course the above examples are only small part of what configurations can be done. It is possible to combine them, to add or remove controllers and so on. It must be only kept some rules regarding the distributed mode:

- Distributed network with DAEnetIP3 controllers are for slow processes (temperature measuring and setting relays for instance). It is not recommend to connect for example 1 kHz generator to some digital input and expect to toggle some relay over the network.
- Note that each DAEnetIP3 controller usually has two interfaces – Wireless and Ethernet. They must be set properly depending on the network that the DAEnetIP3 controllers are used.
- The incoming sockets (for controlled DAEnetIP3 modules) accepts connections over LAN and WLAN.
- The outgoing connections (for controlling DAEnetIP3 modules) can be established either via LAN either via WLAN. This must be set with ***Working Mode*** parameter.

- It is not recommend using distributed mode over the WAN (Internet). The communication is not secured and there may be some significant latency.

9. RC4 Encryption

Communication via TCP/IP socket with DAEnetIP3 controller may be encrypted with RC4 algorithm.

- The RC4 encryption may be activated/deactivated by the user anytime
- The RC4 encryption is used for protection the TCP/IP socket communication.
- The RC4 is not used for Telnet and distributed mode.
- To communicate properly two nodes with RC4 (for example PC and DAEnetIP3) they must have the same RC4 passwords, or the RC4 must be disabled at all.
- RC4 algorithm (if enabled) from PC side is responsibility of the user software.

Below are shown two situations where the RC4 is enabled. The first (figure 40) is "normal conversation" (the both sides have the same passwords). The second (figure 41) is "bad conversation" (the sides have different RC4 passwords).

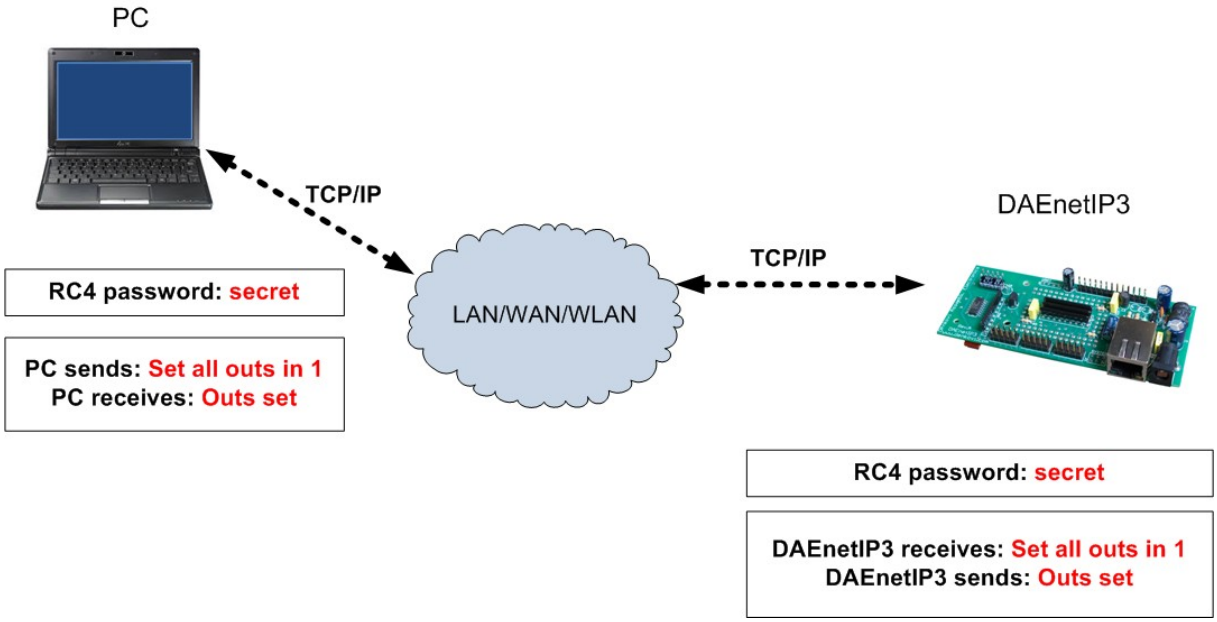


Figure 40. RC4 normal conversation

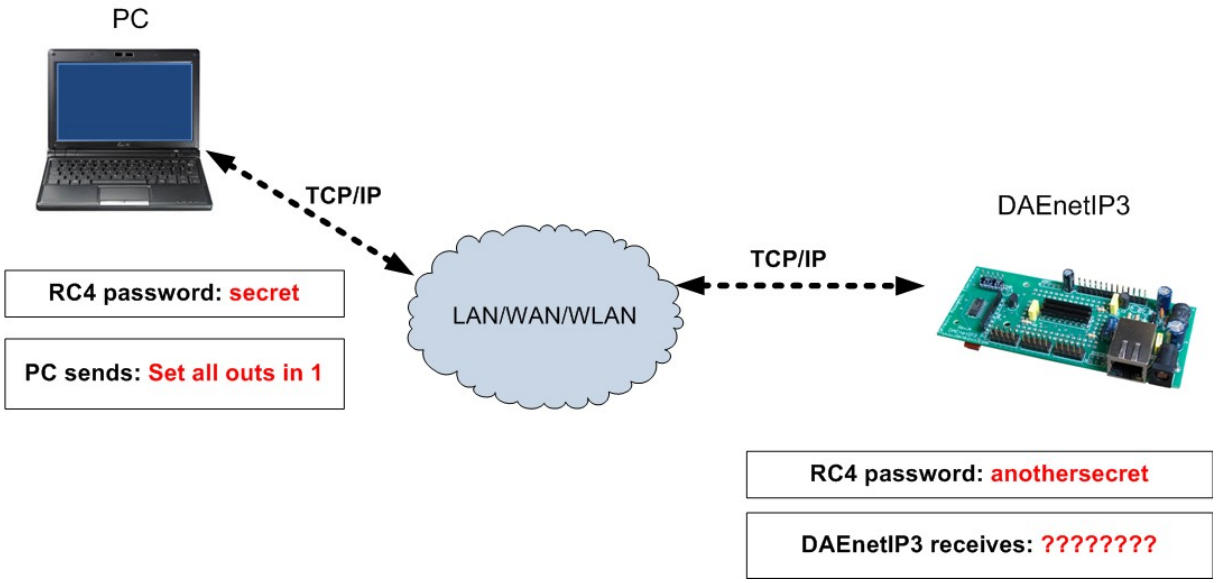


Figure 41. RC4 bad conversation

10. UART

10.1. Overview

DAEnetIP3 has one built-in UART (Universal asynchronous receiver transmitter). It is shown on figure 42.

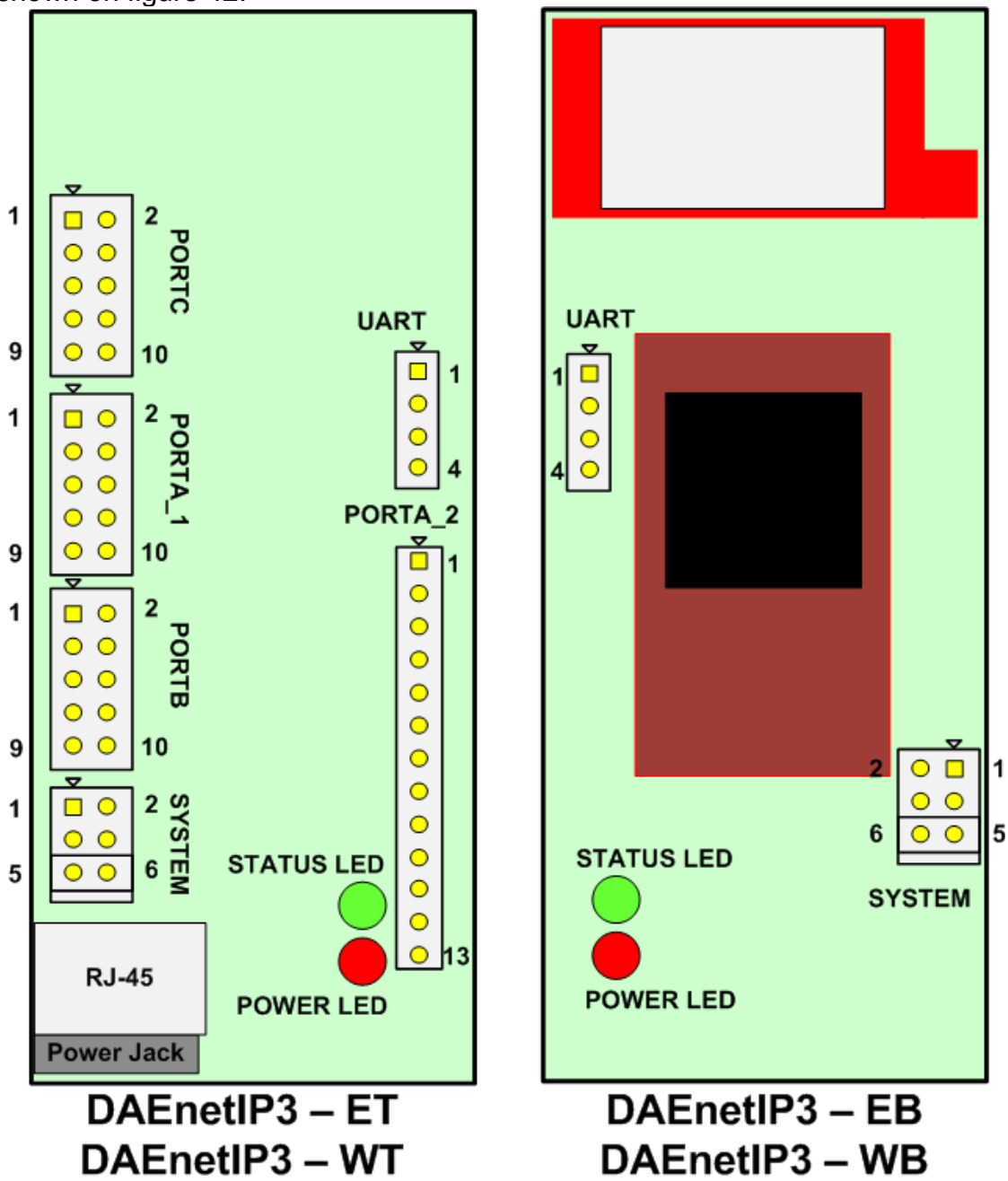


Figure 42. DAEnetIP3 UART port

The UART port lines are:

- Tx – output. This is the transmission UART line.
- Rx – input. This is the receiving UART line.
- Dir – output. This is the RS485 direction line.
- Gnd. This is ground.

10.2. Applications

The main purpose of the UART is creating RS485 network accessed over single IP (figure 43). Each DAEnetIP3 has serial address from 0 up to 254 (00-FE). The address 255 (FF) is reserved for emergency situations. For RS485 network it must be used UART<->RS485 convertor (for example SN75176B).

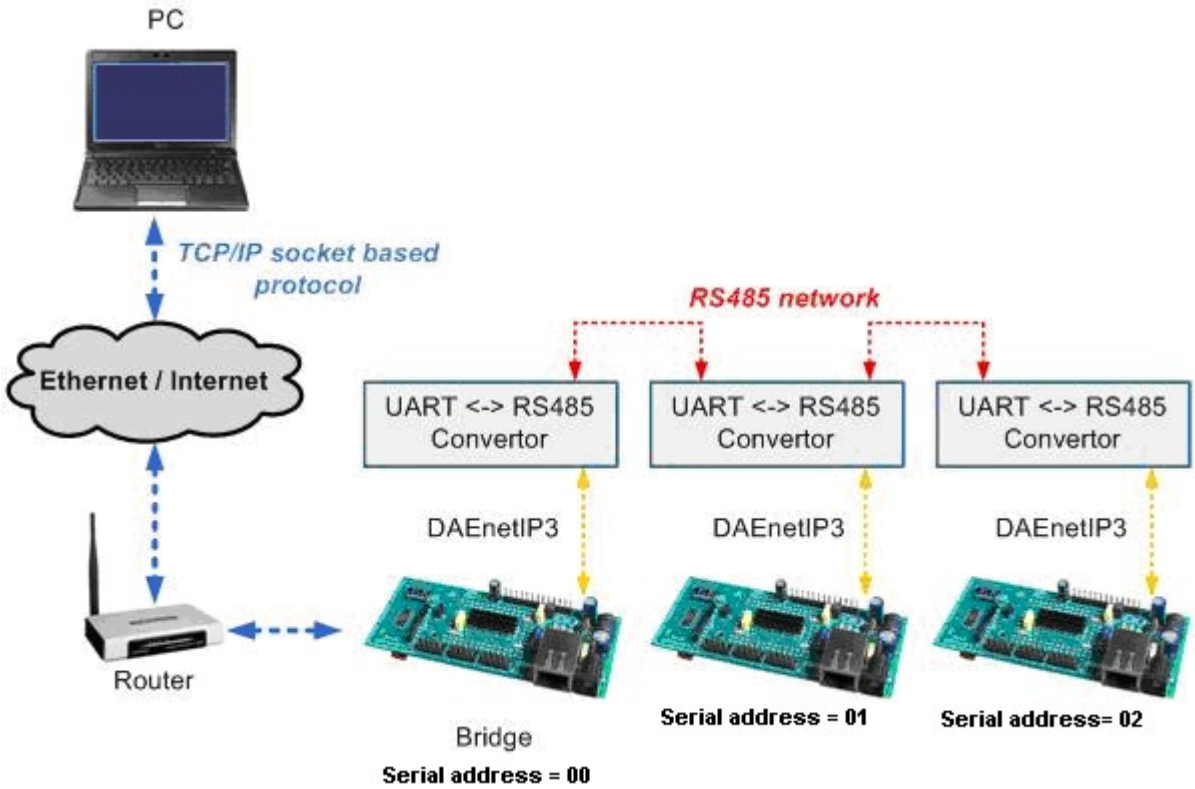


Figure 43. RS485 network with many DAEnetIP3.

Each DAEnetIP3 can be accessed over TCP/IP socket. This may be done over WAN/LAN/WLAN. This controller is used to be said **TCP/IP<->serial bridge**. When TCP/IP packet is received then it is checked if it is valid command and if the serial address is the same and if yes then executes the command. In all cases the data which has come in the TCP/IP socket is retransmitted out to the UART port. Then (over RS485 usually) the data (command) is propagated to the rest DAEnetIP3 controllers in this serial network.

It is true the reverse – when data is coming in to the UART port, it is decoded (eventually) and resend to the TCP/IP socket (no matter if there is established TCP/IP connection or not).

Of course UART port may be used not only with UART<->RS485 converters, but with UART<->RS232 (MAX232), UART<->USB (FT232) and other UART converters.

10.3. Configuration

The UART port must be configured properly before work. The parameters for the UART port may be adjusted over Web,TCP/IP socket, Telnet and UART(itself).

Bellow are described the UART parameters and how they may be adjusted via web.

- **Serial address.** It may be from 00_{hex} to FE_{hex} (0_{dec} – 254_{dec}). This is the serial address of the controller in the serial network. The controller will respond on command that is only with its serial address. There shouldn't be duplicate serial addresses. The serial address FF is reserved and it can not be assigned to any DAEnetIP3 controller.

Web: Serial Port -> Serial address (hex)

- **Baud rate.** It may be 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400, 56000, 57600, 115200, 128000 or 256000.

Web: Serial Port -> Baud rate

- **Parity.** May be None,Even,Mark,Odd,Space.

Web: Serial Port -> Parity

- **Data bits.** 7 or 8.

Web: Serial Port -> Data bits

- **Control line.** This is if the line is low during send or high during send.

Web: Serial Port -> Control line

- **Duplex mode.** Half-duplex (suitable for RS485) or Full-duplex.

Web: Serial Port -> Duplex mode

- **CRC16.** If this parameter is enabled, then DAEnetIP3 UART port will sends (checks during receiving) CRC16 checksum of the data, appended to the end of the data and before the delimiter ";". If this parameter is not enabled, then DAEnetIP3 will not sends (checks during receiving) CRC16 checksum.

Web: Serial Port -> CRC16

11. UART <-> TCP/IP bridge

DAEnetIP3 works as serial bridge between serial network (UART) and TCP/IP network. The algorithm for this bridge is based on several rules:

- When DAEnetIP3 receives command PDU from TCP/IP socket (decrypting or not decrypting RC4), it retransmits always the data over the serial network (with or without CRC16). If the address of the received command is the same, then DAEnetIP3 executes the command and sends the response (or error) only over the TCP/IP (encrypting or not encrypting the RC4), because this is the way that the command was come from.

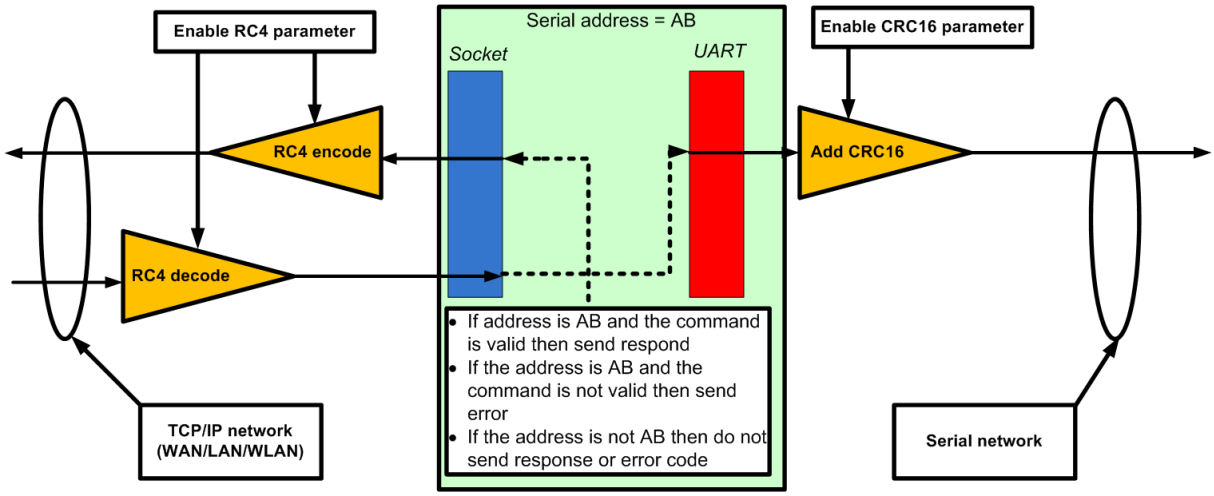


Figure 44. Receiving command over TCP/IP network

- When DAEnetIP3 receives command PDU over the serial network, it checks or doesn't check the CRC16 checksum, retransmits always the data over the TCP/IP (encrypting or not encrypting the RC4). If the command address was the same, the controller executes the command and sends respond (error code) over the serial line (with or without CRC16).

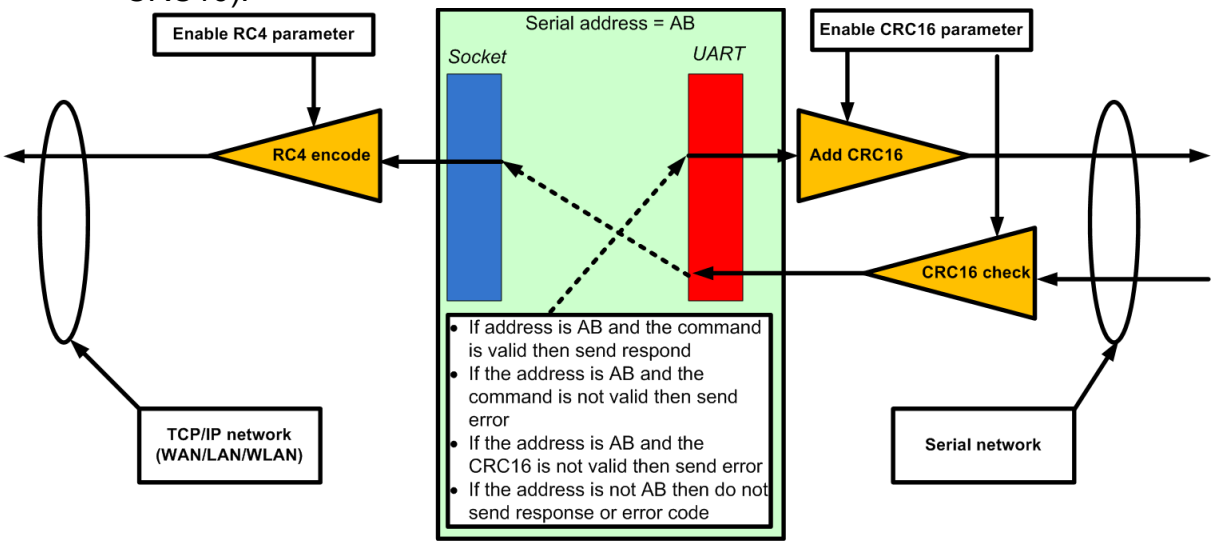


Figure 45. Receiving commands over serial network.

12. Web based access

12.1. Overview

Figure 46. Web access

DAEnetIP3 has built-in web server for configuration (figure 46). All the parameters can be accessed via web browsers like Mozilla, IE and Opera. Some of the pages are refreshed automatically. In this way it is possible to track all the I/O states in real time without manually refreshing the page. The web browser must support JavaScript.

The controller is designed to be in two versions (with Wi-Fi and without Wi-Fi module). It is “smart” and recognizes if there is Wi-Fi add-on module. In this case the web interface will display some extra features for the Wi-Fi 802.11 settings.

12.2. Login page

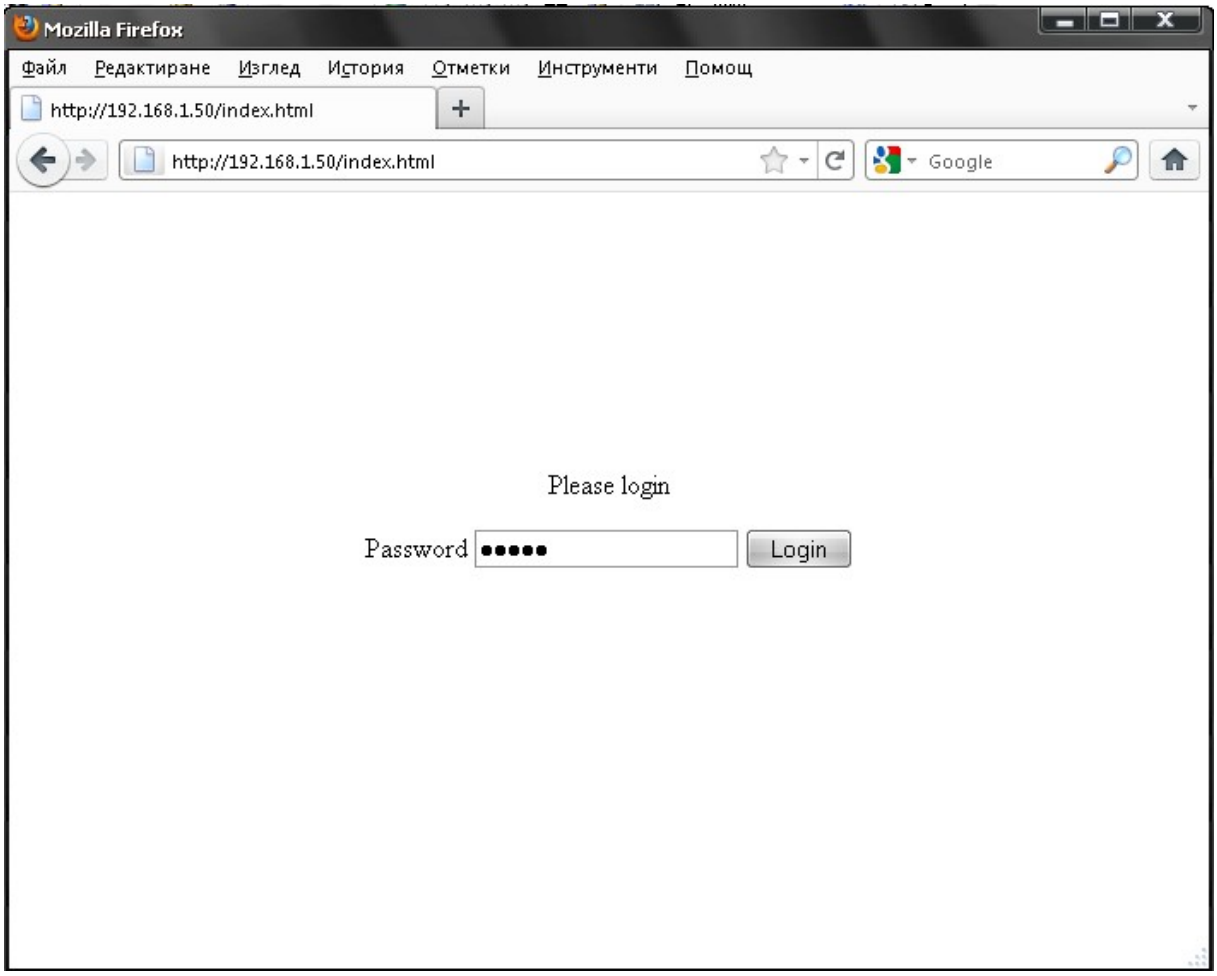


Figure 47. Login page

Initially the web server will require password for login (figure 47). Only one session can be activated at a time. This means if once there is logged user, nobody else will be able to login. If the currently logged user logs out, new user will be able to login. The session has timeout 3 minutes. This means if there is no data transferred over the web 3 minutes, the current session will be stopped and new user will be able to login.

Also it is recommended when the user leaves the web page, firstly to logout.

12.3. Menu

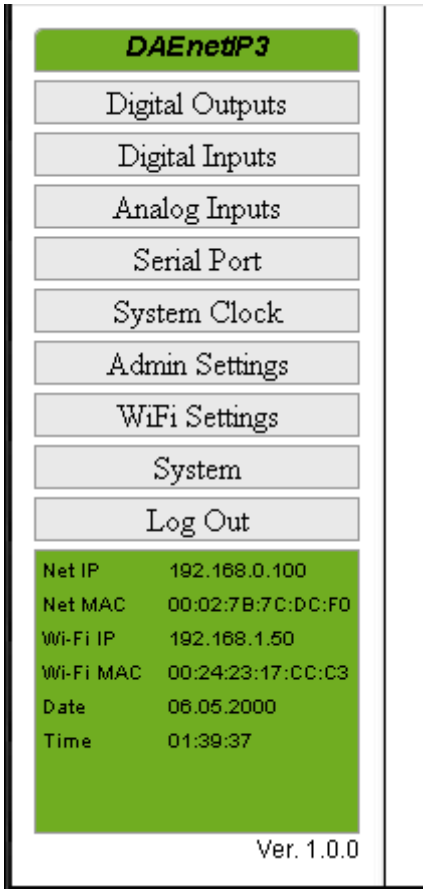
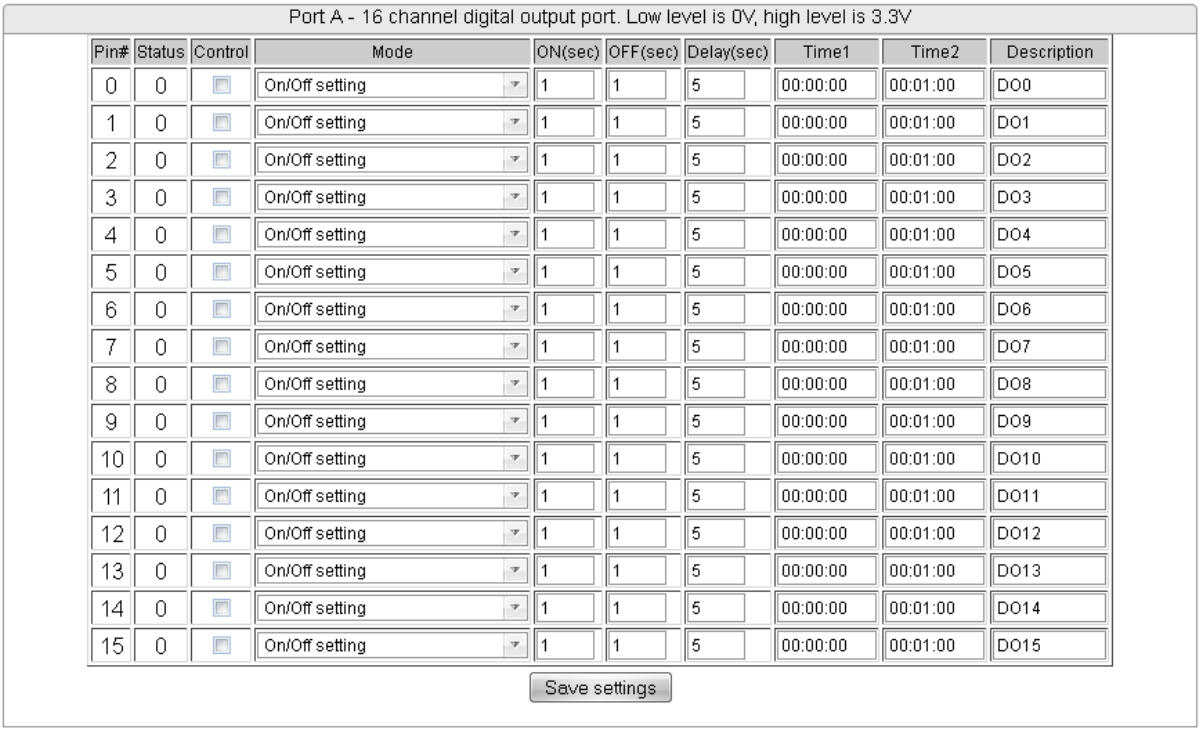


Figure 48. Web navigation

The navigation is organized with frames, because of the limited resources of the controller. On figure 48 they are shown the navigation bars. There is also information about the network settings, RTC date and time and current firmware version.

12.4. Setup page for digital output port (Port A)

Port A has 16 digital outputs. The web page for configuration is shown on figure 49.



Port A - 16 channel digital output port. Low level is 0V, high level is 3.3V

Pin#	Status	Control	Mode	ON(sec)	OFF(sec)	Delay(sec)	Time1	Time2	Description
0	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO0
1	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO1
2	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO2
3	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO3
4	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO4
5	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO5
6	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO6
7	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO7
8	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO8
9	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO9
10	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO10
11	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO11
12	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO12
13	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO13
14	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO14
15	0	☐	On/Off setting	1	1	5	00:00:00	00:01:00	DO15

Save settings

Figure 49. Port A – 16 digital outputs

- Pin number (Pin#) - This is the number of the output. The value of this field can be between 1 and 16.
- Status - This filed shows the actual level of this output. It is refreshed over 2 seconds automatically so it is possible for the user to see if the output level is 0V or 3.3V almost in real time.
- Control - This filed controls the output. When it is checked (value=1) this means that the mode for this output is enabled. In some modes if it is unchecked (value=0), the mode is disabled. The modes that can be enabled and disabled are “On/Off setting”, “Inverting” and “Pulses”. The mode “Timer” can be only started. The rest of the modes are not affected to this checkbox.
- Mode - Determines how the digital output works.
- ON - The “ON” value for the pulses modes: “Pulses”, “Pulses and digital input”, “Pulses and analog input”, “Pulses and schedule” and “Pulses and remote”. Does not affect to other modes. The value is in seconds.
- OFF - The “OFF” value for the pulses modes: “Pulses”, “Pulses and digital input”, “Pulses and analog input”, “Pulses and schedule” and “Pulses and remote”. Does not affect to other modes. The value is in seconds.
- Delay - Determines the delay for one shot pulse (the timer). This is for modes “Timer”, “Timer and digital input”, “Timer and analog input” and “Timer and remote”. The value is in seconds.

- Time 1 - Determines the Time 1 event for the schedule modes. It is for modes “On/Off setting and schedule” and “Inverting and schedule”. The format is in HH:MM:SS.
- Time 2 - Determines the Time 2 event for the schedule modes. It is for modes “On/Off setting and schedule” and “Inverting and schedule”. The format is in HH:MM:SS.
- Description - Description text for each output. It can assume the following chars: ‘a’-‘z’, ‘A’-‘Z’, ‘0’-‘9’, ‘_’ ‘.’

12.5. Setup page for digital input port (Port B)

Port B has 8 digital inputs. The web page for configuration is shown on figure 50.

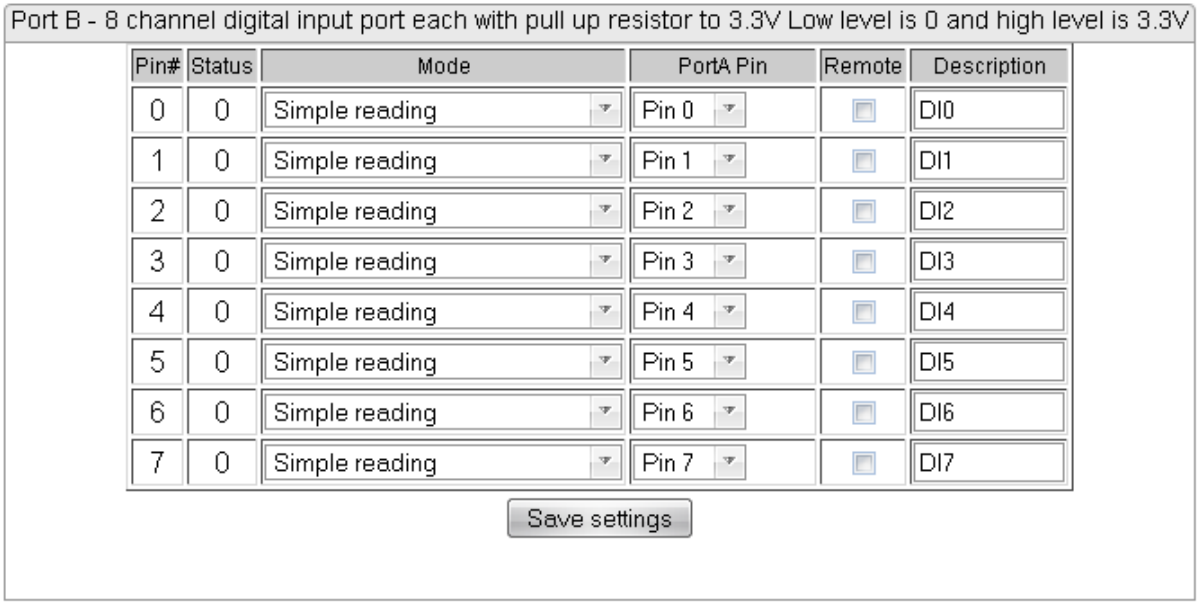


Figure 50. Port B – 8 x digital inputs

- Pin number (Pin#) - This is the number of the input. The value of this field can be between 1 and 8.
- Status - This filed shows the actual input level. It is refreshed over 2 seconds automatically so it is possible for the user to see if the input level is 0V or 3.3V almost in real time. Note that if the input is unconnected the level is 1 (because of the pull-up resistor). On figure 50 all the inputs are supplied with 3.3V input signal.
- Mode - Determines the mode for the digital input.
- PortA pin - Specifies the remote pin of Port A of the remote controller that will (eventually) be controlled by this input.
- Remote - This value determines if this input controls digital output from this controller or from remote controller. If it is checked the input will control output from the controller determined with field ***Remote Server IP*** (from admin settings page).
- Description - Description text for each input. It can assume the following chars: ‘a’-‘z’, ‘A’-‘Z’, ‘0’-‘9’, ‘_’ ‘.’

12.6. Setup page for analog input port (Port C)

Port C has 8 digital inputs. The web page for configuration is shown on figure 51.

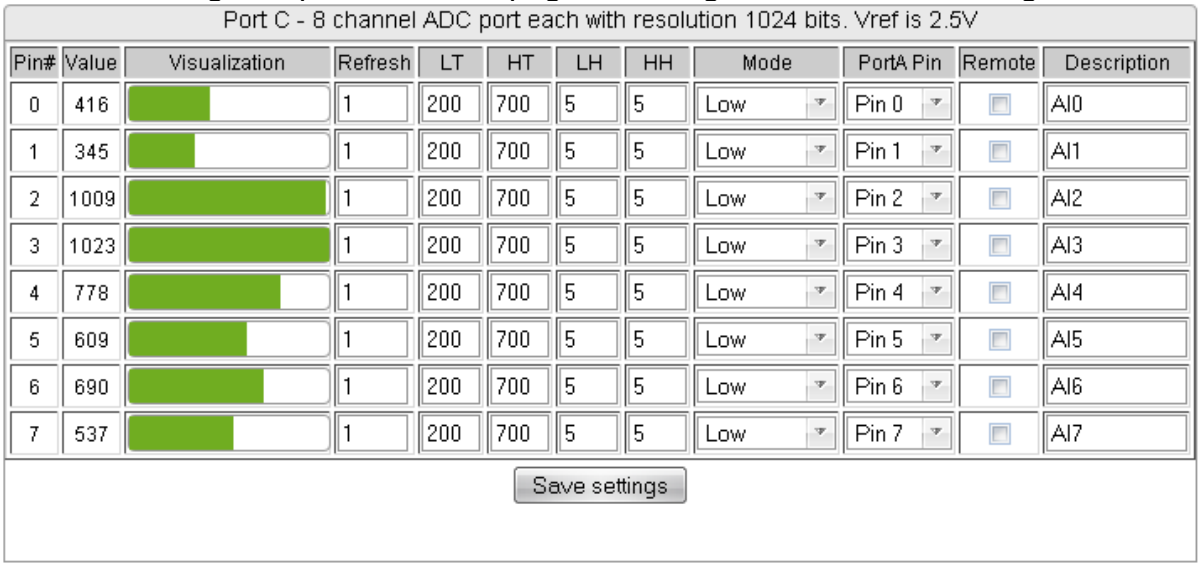


Figure 51. Port C – 8 x analog inputs

- Pin number (Pin#) - This is the number of the analog input. The value of this field can be between 1 and 8.
- Value - The value of the analog input. It can be from 0 up to 1023. It is refreshed over 2 seconds automatically so it is possible for the user to see the input level almost in real time.
- Visualization - The value of the analog input as progress bar. It is refreshed over 2 seconds automatically so it is possible for the user to see the input level almost in real time.
- Refresh - The refresh value for reading the ADC values. To get the time in seconds, the value is multiplied by 0.1. The value is between 1 and 99.
- LT - Determines the low threshold for this analog input. The value may be from 0 to 1023.
- HT - Determines the high threshold for this analog input. The value may be from 0 to 1023.
- LH - Determines the low hysteresis for this analog input. The value may be from 0 to 512.
- HH - Determines the high hysteresis for this analog input. The value may be from 0 to 512.

Required conditions for proper work

(HT-HH)>(LT+LH)

(HT+HH)<1023

(LT-LH)>0

- Mode - Determines the mode for the analog input.
- PortA pin - Specifies the remote pin of Port A of the remote controller that will (eventually) be controlled by this input.
- Remote - This value determines if this input controls digital output from this controller or from remote controller. If it is checked the input will

control output from the controller determined with field ***Remote Server IP*** (from admin settings page).

- Description - Description text for each input. It can assume the following chars: ‘a’-‘z’, ‘A’-‘Z’, ‘0’-‘9’, ‘_’ ‘.’

12.7. Setup page for Serial Port (UART)

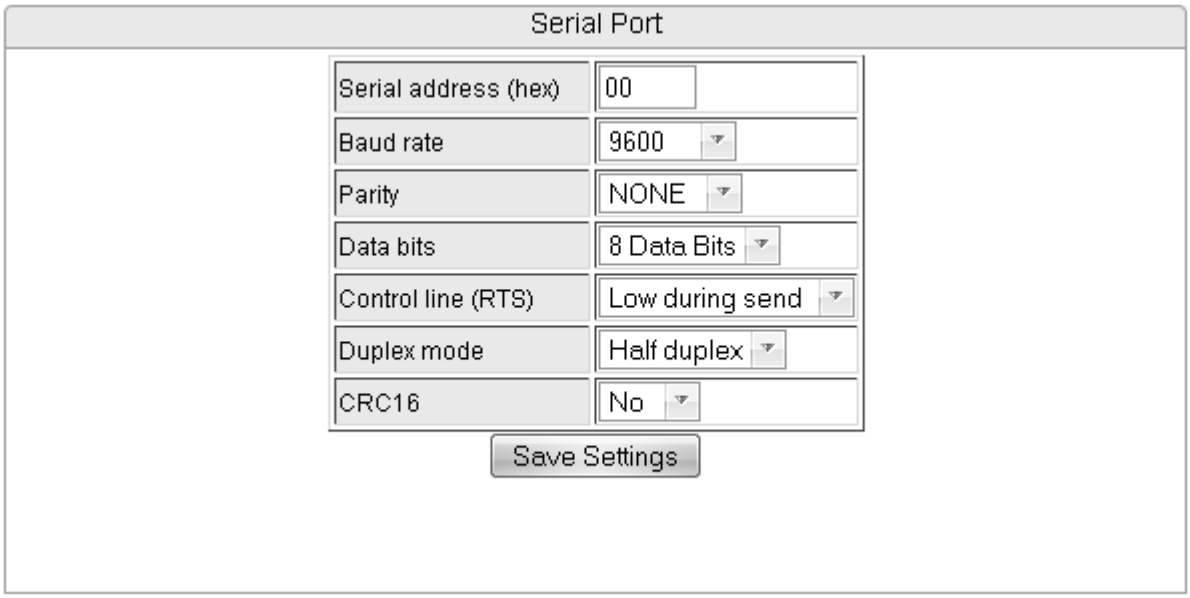


Figure 52. Setup page for Serial Port (UART)

- Serial address - The serial address of the DAEnetIP3 controller. The device will always accept command with this serial address or the address for broadcast (FF). The values may be from 00 to FE.
- Baud rate - Possible baud rates: 110, 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400, 56000, 57600, 115200, 128000, 256000
- Stop bits - Possible stop bits: 1 or 2.
- Parity - Possible parity values: NONE, EVEN, MARK, ODD, SPACE.
- Data bits - Possible data bits: 7 or 8.
- Control line - Determines if the control line is low or high during send.
- Duplex mode - For RS485 must be half duplex. For RS232 must be full duplex.
- CRC16 - Enables/disables CRC16 checksum.

12.8. Setup page for system clock (RTC)

DAEnetIP3 has built in RTC. The date and time may be adjusted from the web page shown on figure 53.

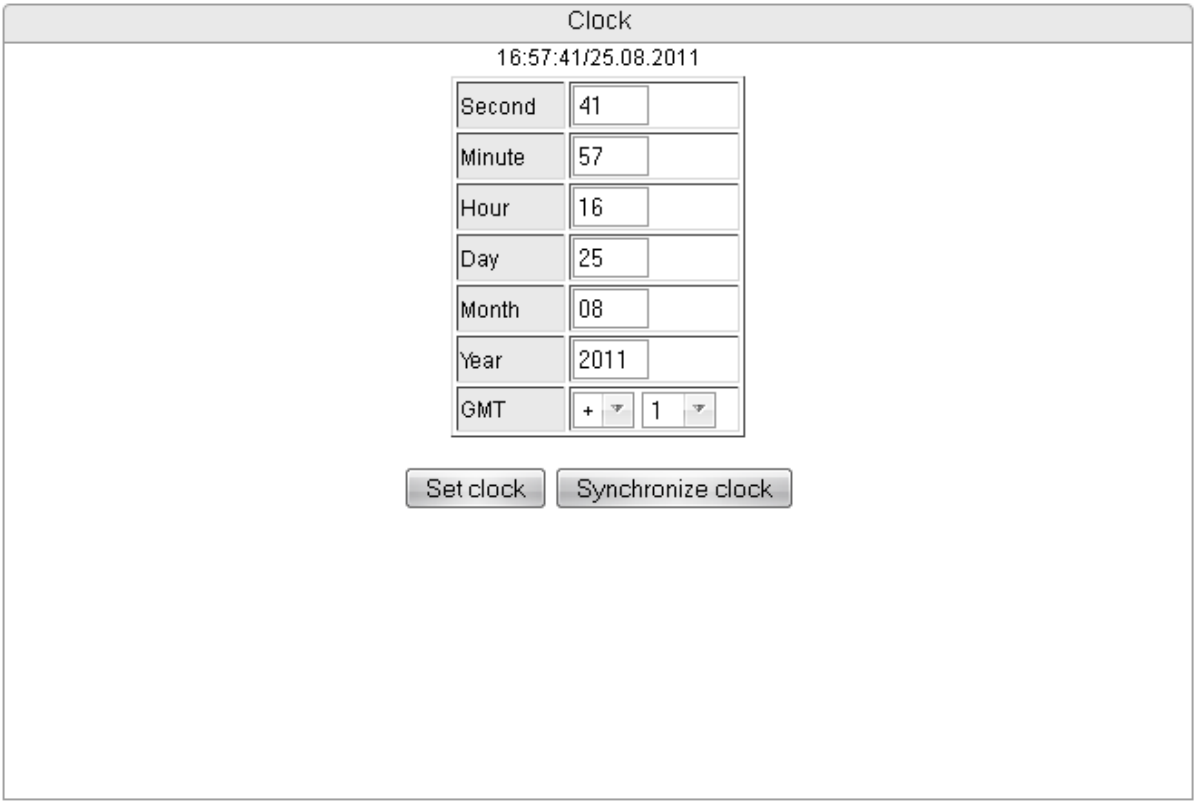


Figure 53. RTC settings

- Set clock - Set the RTC with the given date and time. The date and time must be valid. The **Year** may be from 2000 up to 2099.
- Synchronize clock - DAEnetIP3 will synchronize the RTC with the given NTP server from the administration settings page. If there is no connection with the NTP server, the controller will keep the old time.

12.9. Setup page for admin settings

On figure 54 it is shown admin settings page. Note that to take effect changing the settings, the DAEnetIP3 controller must be rebooted.

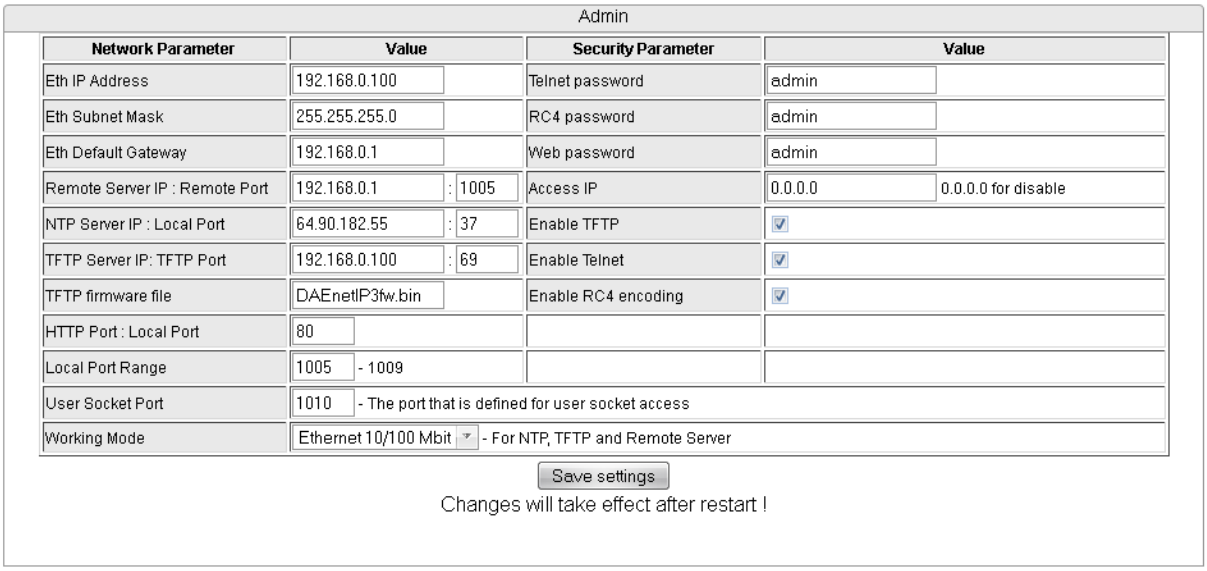


Figure 54. Admin settings page

- Eth IP address - The IP address of the controller. This IP address is for the Ethernet interface (connection via cable)
- Eth subnet mask - The mask of the controller. This mask is for the Ethernet interface (connection via cable)
- Eth default gateway - The gateway of the controller. This gateway is for the Ethernet interface (connection via cable)
- Remote server IP - The remote server IP for the DAEnetIP3 that will (eventually) be controlled by some of the input(s) of the current controller.
- Remote port - The remote port of the remote server.
- NTP server IP - The NTP server for time synchronization.
- NTP port - The NTP server port. Usually it is 37.
- TFTP server IP - The TFTP server for firmware upgrade
- TFTP port - The TFTP server port. Usually it is 69.
- TFTP firmware file - The file for firmware upgrade located on the remote TFTP server.
- HTTP port - The HTTP port for web access.
- Local Port Range - The port range for incoming connections. This is for the distributed network.
- User socket port - The port for accessing the controller via DAEnetIP3 application TCP/IP protocol.
- Working mode - Selects whether the outgoing connections for NTP, TFTP or Remote server will be established via wireless or Ethernet.
- Telnet password - The password for telnet access. It can assume the following chars: ‘a’-‘z’, ‘A’-‘Z’, ‘0’-‘9’, ‘_’ ‘.’

- RC4 password - The RC4 password (key). It can assume the following chars: ‘a’-‘z’, ‘A’-‘Z’, ‘0’-‘9’, ‘_’ ‘.’
- Web password - The web access password. It can assume the following chars: ‘a’-‘z’, ‘A’-‘Z’, ‘0’-‘9’, ‘_’ ‘.’
- Access IP - If this IP is different from 0.0.0.0 then only remote client with this IP can access the module via WEB, Telnet or DAEnetIP3 application protocol. This parameter is not used for distributed network (that’s mean if this field is different with 0.0.0.0 this will not restrict which remote DAEnetIP3 (with inputs) to control this DAEnetIP3).
- Enable TFTP - Enables/disables TFTP firmware upgrade option.
- Enable Telnet - Enables/disables Telnet.
- Enable RC4 encoding - Enables/disables RC4 encoding. Note that the communication over distributed network is always encrypted (the encryption can not be disabled).

12.10. Setup page for Wi-Fi settings

On figure 55 it is shown Wi-Fi settings page. Note that to take effect changing the settings, the DAEnetIP3 controller must be rebooted.

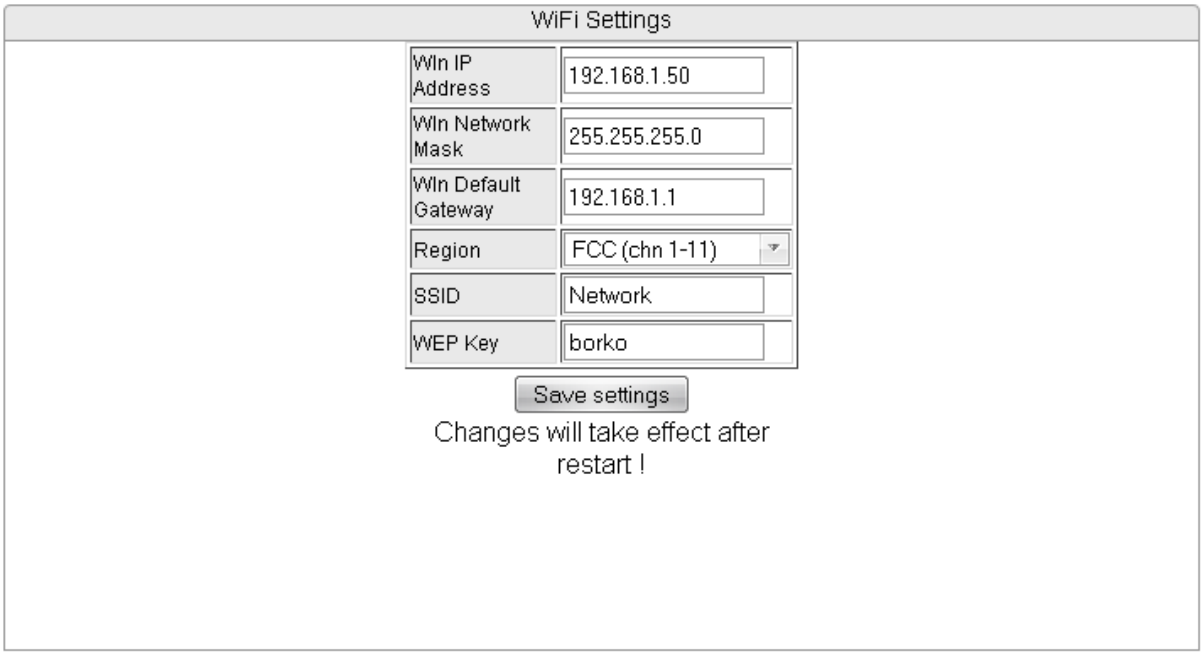


Figure 55. Wi-Fi settings.

- Wln IP address - The IP address of the module. This address is for the wireless interface.
- Wln Network Mask - The mask of the module. This mask is for the wireless interface.
- Wln Default Gateway - The default gateway of the module. This gateway is for the wireless interface.
- Region - The region that is located the DAEnetIP3 controller.
- FCC (chn 1-11) - FCC domain (US, Canada, Taiwan...). Allowed channels: 1-11.
- EU (chn 1-13) - European Union. Allowed channels: 1-13.
- JAPAN (chn 1-14) - Japan. Allowed channels: 1-14.
- Other (chn 1-14) - All other countries. Allowed channels: 1-14.
- SSID - The name of the WEP wireless network that the controller must be connected to.
- WEP Key - The WEP key. Must be 0,5 or 13 symbols.

12.11. System page

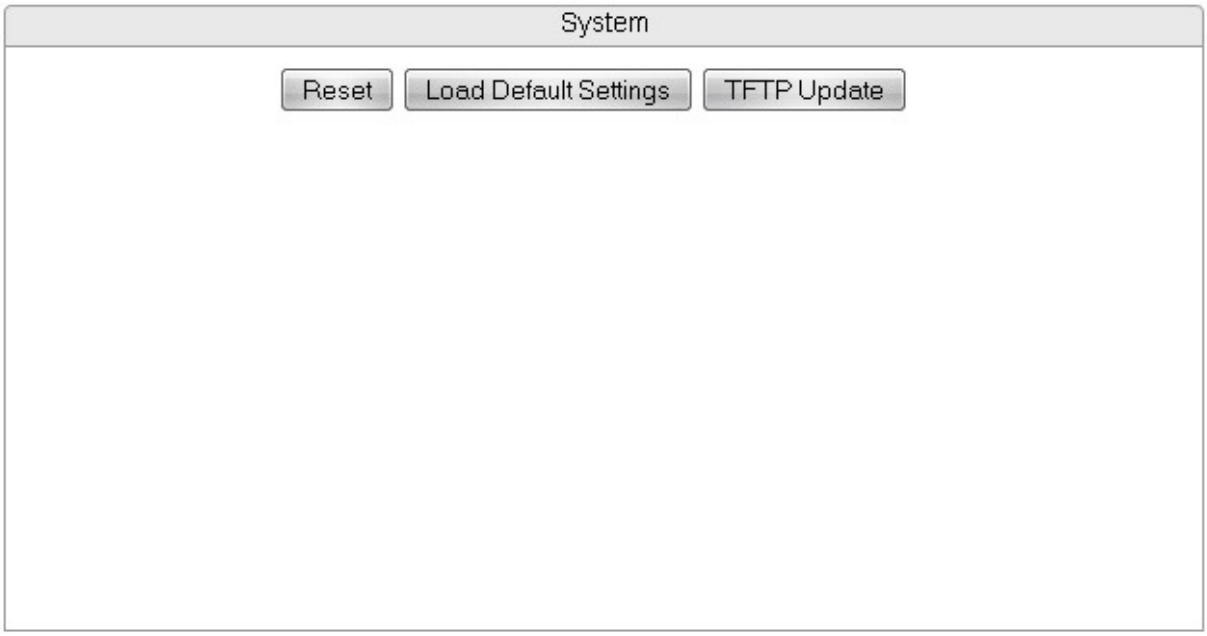


Figure 56. System page

- Reset - System reset.
- Load Default settings - Loads the default settings of the controller and resets the system.
- TFTP update - Starts firmware upgrade and resets the system if the file is correctly uploaded. The TFTP settings must be done properly before that.

13. DAEnetIP3 data application protocol

DAEnetIP3 has several options for access (besides over Web browser). These are TCP/IP protocol, UART (Serial) protocol, Telnet and Virtual Serial Port. Each of these three ways uses **only one ASCII protocol** with small modifications. This means the core of this protocol (the commands/answers/errors) are the same. These PDU (protocol data units) are shown on figure 57.

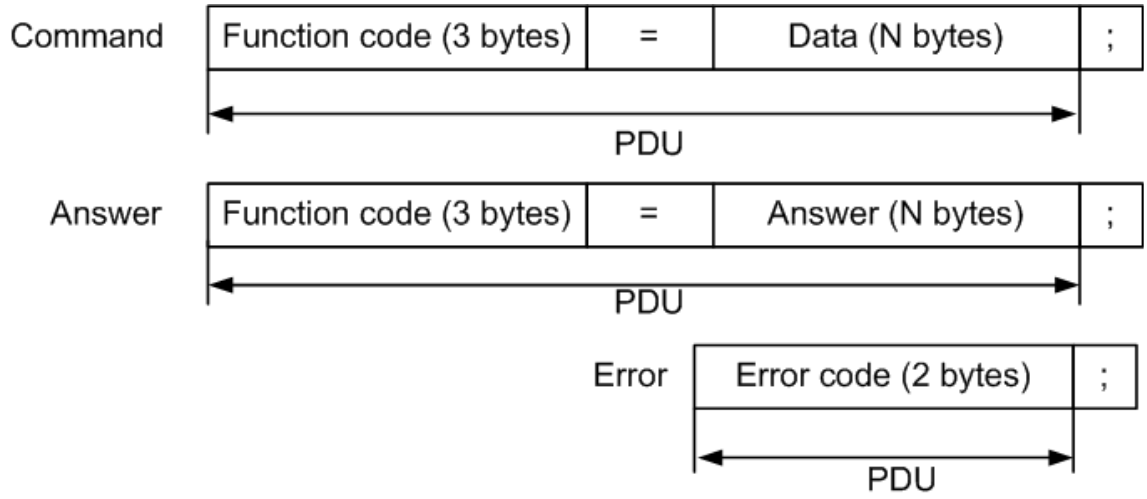


Figure 57. DAEnetIP3 data application protocol

The Command PDU is combination of function code (3 bytes), the char "=" and data (N bytes). The answer PDU begins with function code (3 bytes), the char "=" and the answer data (N bytes). The error PDU is the error code (2 bytes). The command, answer and error finish with the char ";". This is delimiter and it is forbidden char – it is not used in the protocol.

DAEnetIP3 data application protocol is fully ASCII. This means in the protocol exchange data consists of only printable characters.

For example the command received/sent is 01ASG=1111EC86;. This command sets the 16 bit digital output port in state 1111 (0001000100010001). DO 0,4,8,12 are in logical 1, end the rest are in logical 0. Then:

- 01 is the address which consists of two chars – '0' and '1'. It is hex number represented with chars. The maximum may be 'F' and 'E'.
- ASG=1111 is the command PDU. 1111 is hex number represented with chars that is the states of the whole digital outputs. The number may be from 0000 ('0' '0' '0' '0') up to FFFF ('F' 'F' 'F' 'F').
- EC86 is the CRC16 checksum. Its also hex number represented with chars. It's the check sum of 01ASG=1111.
- ";" is char that is the delimiter.

The reason for this is that the controller protocol is more understandable if it works with simple ASCII protocol.

Bellow ***char*** also may be mentioned as ***byte.***

13.1. TCP/IP socket based protocol

DAEnetIP3 controller has possibility for access via TCP/IP protocol. The user may connect with custom software to port that is defined for socket based TCP/IP communication. This port is called ***User Socket Port***.

The communication message format (ADU - application data units) over TCP/IP socket is shown on figure 58. It is added serial address to the command, answer and error messages. The idea is that in this way the user can access over TCP/IP protocol not only the server DAEnetIP3 module, but all the modules connected over the serial network to this DAEnetIP3 controller. These controllers are distinguished by the Address field (2 bytes), which is actually the serial address.

The idea is shown on figure 59. The user connects to DAEnetIP3 with serial address 00, but he can communicate with DAEnetIP3 [serial address = 01] and DAEnetIP3 [serial address 02]. DAEnetIP3 [serial address=00] is actually bridge between TCP/IP network and serial network. When data comes in to DAEnetIP3 [serial address 00] to ***User Socket Port,*** it checks if the address is 00. If yes it decodes the command and executes it or returns error code. In both case it resends the TCP/IP packet data to the serial network. If the address (in this example) is 01 or 02, then DAEnetIP3 [serial address 00] just pass the TCP/IP packet data through the serial network and DAEnetIP3 [serial address 01 or 02] decodes the command executes it and returns answer or error again over the serial network. After that DAEnetIP3 [serial address 00] takes this serial data and sends it over the TCP/IP network.

In this way the user is able to access many serially connected DAEnetIP3 controllers over the WAN/LAN/WLAN only via one IP address with the denkovi protocol.

The serial address FF is reserved and all DAEnetIP3 controllers accept commands with this address.

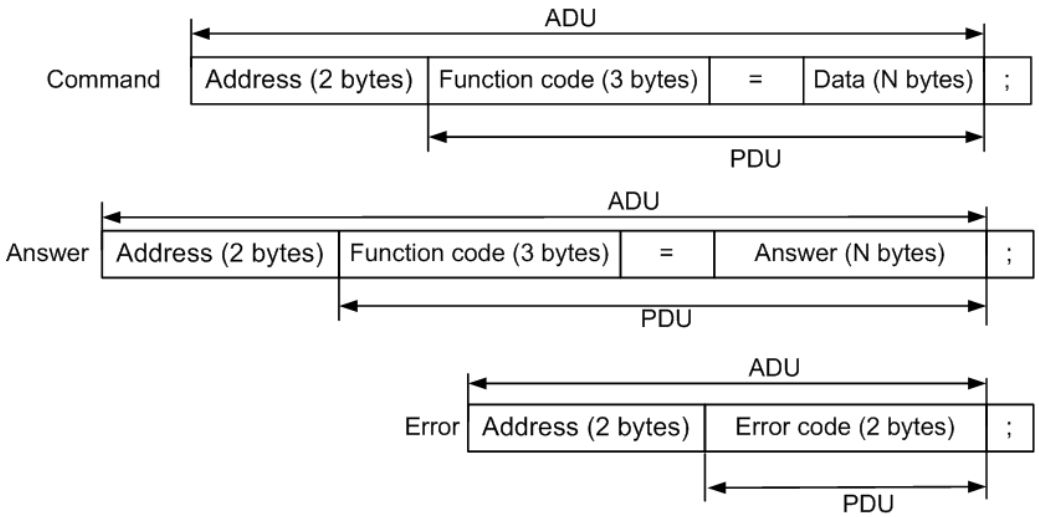


Figure 58. TCP/IP socket based application protocol

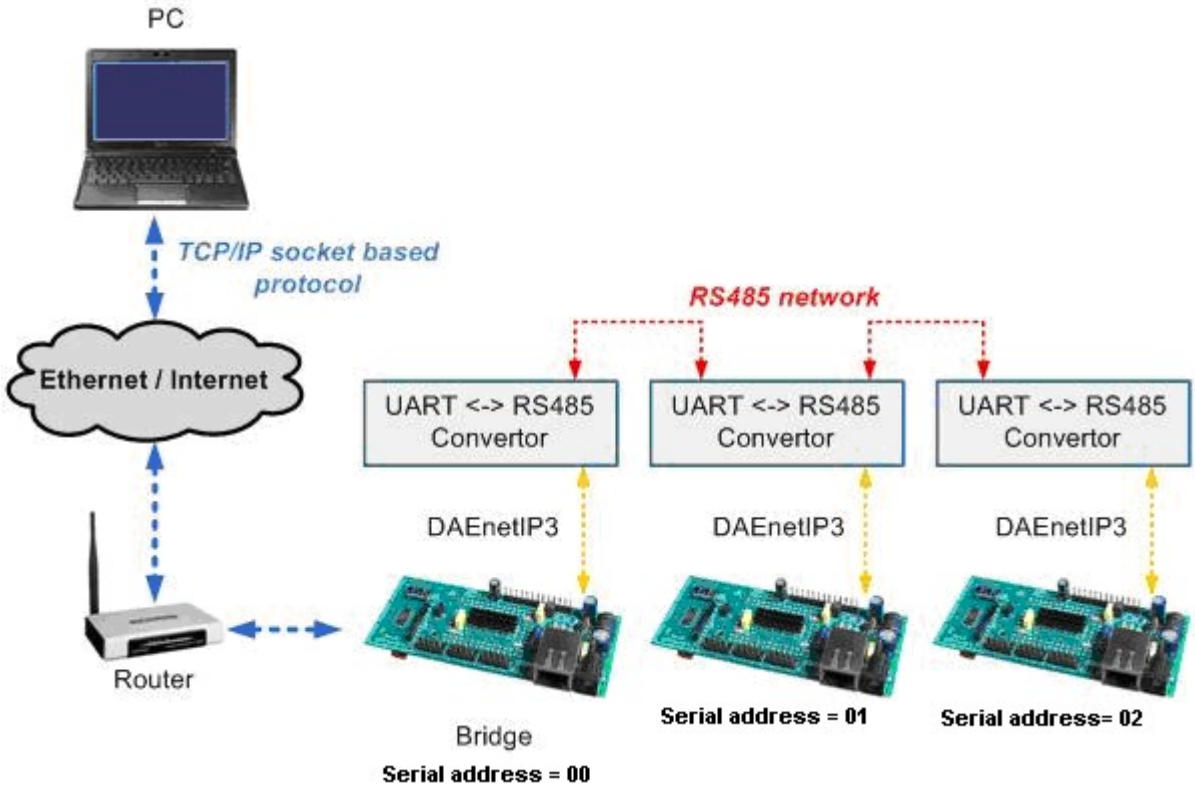


Figure 59. DAEnetIP3 can work as a bridge between TCP/IP network and serial network

13.2. Telnet protocol

The communication over Telnet is based on the command PDU, answer and error codes. Here the user can access only one DAEnetIP3 controller (only the server which is made the telnet connection to). The port for Telnet is always 23.

Telnet command, answer and error ADU (application data unit) are shown on figure 60.

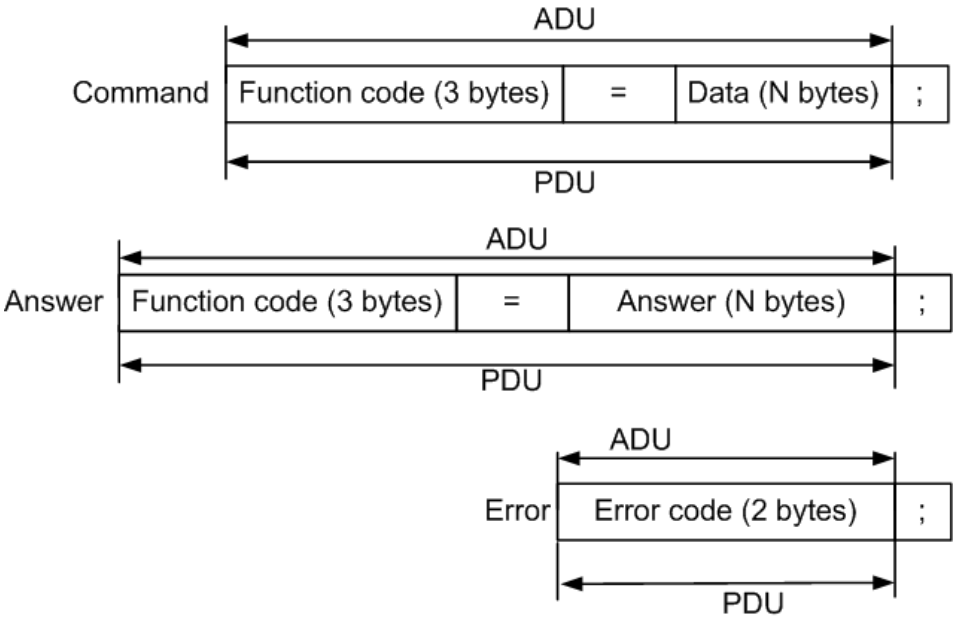


Figure 60. Telnet protocol

13.3. Serial protocol

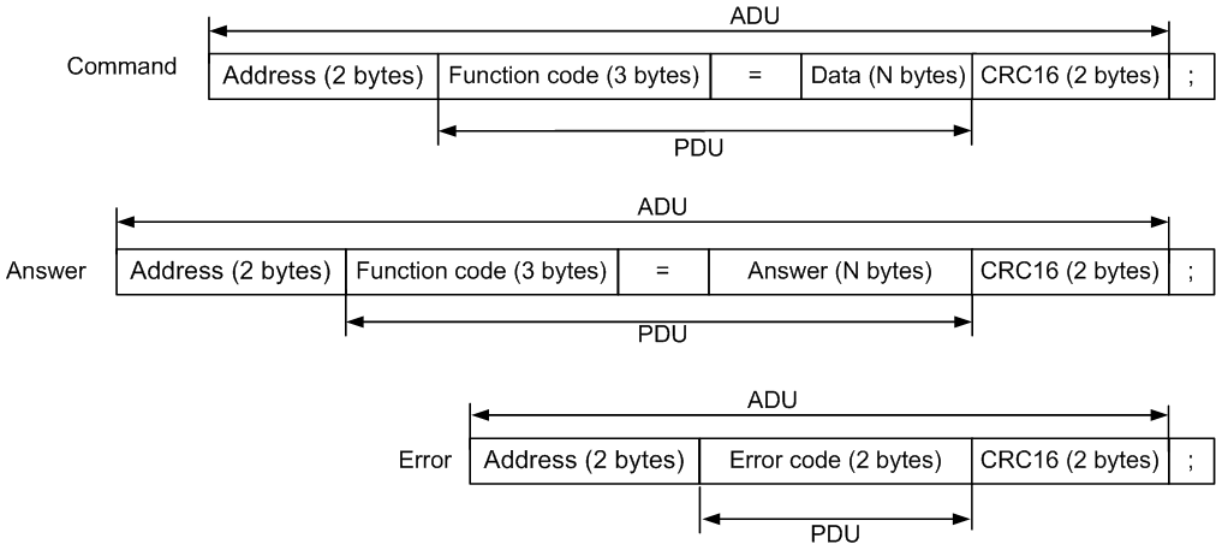


Figure 61. Communication over serial protocol

The communication over serial port is shown on figure 61. To each PDU it are added 2 bytes serial address at the beginning and 2 bytes CRC16 before the ";" char. The CRC16 bytes are actually checksum calculated with ***Modbus CRC16 algorithm***. The check sum is performed over all previous bytes (without ";")

13.4. Virtual Serial Port

This communication way is almost the same like TCP/IP. The data transfer is done also via same TCP/IP network and user defined port. The only difference is that all the communication is done by the Windows Virtual Serial Port driver and in this way the user is able to communicate with DAEnetIP3 via regular COM port.

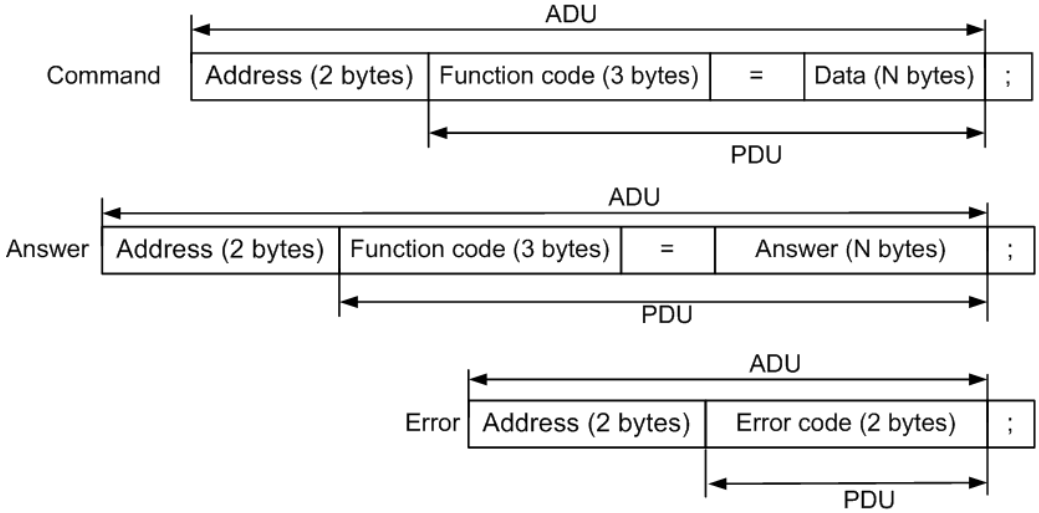


Figure 62. Communication via Virtual Serial Port

13.5. CRC16 (Modbus)

13.5.1. CRC16 case stuidies

DAEnetIP3 supports CRC16 (Modbus modification) algorithm for prevention of errors during serial communications. On figure 63 is shown how DAEnetIP3 encode/decode the CRC16 checksum.

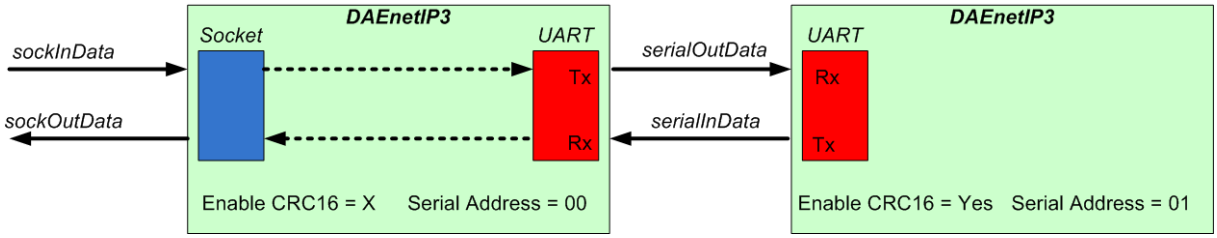


Figure 63. CRC case studies

The sockInData is the data stream that comes in to the user defined socket. sockOutData is the data stream that comes out from the user defined socket. serialOutData is the data stream that comes out to the UART interface. The serialInData is the incoming data in to the UART port. With "X" is marked if the CRC is enabled or disabled. We

On table 22. are shown different situations for CRC16 checking. With brackets [] is marked which is the first, second, third and fourth event. It is used the ASG command, which gets the digital outputs (Port A) states.

Legend:

- o – Serial address.
- o – PDU (command)
- o – CRC16 checksum
- o – Wrong byte (during communication some bit is inverted)
- o – Error code

Table 16. Examples of CRC16 calculation

Example N	sockInData	sockOutData	serialOutData	serialInData	X
1	00ASG=?;[1]	00ASG=0000;[3]	00ASG=0000A9FB;[2]	…	yes
2	00ASG=?;[1]	00ASG=0000;[3]	00ASG=0000;[2]	…	no
3	01ASG=?;[1]	01ASG=0000;[4]	01ASG=000039F6;[2]	01ASG=000039F6;[3]	yes
4	01ASG=?;[1]	01E36E2C;[4]	01ASG=000039F6;[2]	01ASG=000139F6;[3]	yes
5	01ASG=?;[1]	01E36E2C;[4]	01ASG=000139F6;[2]	01E36E2C;[3]	yes
6	01ASG=?;[1]	01E36E2C;[4]	01ASG=?;[2]	01E36E2C;[3]	no
7	…	00ASG=0000;[2]	00ASG=0000A9FB;[3]	00ASG=?2DE3;[1]	yes
8	…	02ASG=?;[2]	…	02ASG=?FCE2;[1]	yes

Comments for the examples:

- Example 1: CRC16 for DAEnetIP3 [00] is enabled. DAEnetIP3 [00] receives TCP/IP data with serial address 00. Data is sent over the serial line to DAEnetIP3 [01] with added CRC16 checksum. DAEnetIP3 [00] performs respond. DAEnetIP3 [00] receives the response over the serial network and send it over the TCP/IP.

- Example 2: CRC16 for DAEnetIP3 [00] is disabled. DAEnetIP3 [00] receives TCP/IP data with serial address 00. Data is sent over the serial line to DAEnetIP3 [01] without added CRC16 checksum. DAEnetIP3 [00] performs respond. DAEnetIP3 [00] receives the response over the serial network and send it over the TCP/IP.
- Example 3: CRC16 for DAEnetIP3 [00] is enabled. DAEnetIP3 [00] receives TCP/IP data with serial address 01. Data is sent over the serial line to DAEnetIP3 [01] with added CRC16 checksum. DAEnetIP3 [01] performs respond. DAEnetIP3 [00] receives the response over the serial network and send it over the TCP/IP.
- Example 4: CRC16 for DAEnetIP3 [00] is enabled. DAEnetIP3 [00] receives TCP/IP data with serial address 01. Data is sent over the serial line to DAEnetIP3 [01] with added CRC16 checksum. DAEnetIP3 [01] performs respond. However when data is sent back to DAEnetIP3 [00] over the serial line, some bit is wrong during serial communication. DAEnetIP3 [00] checks this and the TCP/IP response is error code E3.
- Example 5: CRC16 for DAEnetIP3 [00] is enabled. DAEnetIP3 [00] receives TCP/IP data with serial address 01. Data is sent over the serial line to DAEnetIP3 [01] with added CRC16 checksum. However some bit is wrong during serial communication. DAEnetIP3 [01] checks this and the respond to DAEnetIP3 [00] is error code E3. This error DAEnetIP3 [00] sends back (propagates) to the TCP/IP.
- Example 6: CRC16 for DAEnetIP3 [00] is disabled (but CRC16 for DAEnetIP3 [01] is enabled. DAEnetIP3 [00] receives TCP/IP data with serial address 00. Data is sent over the serial line to DAEnetIP3 [01] without added CRC16 checksum. DAEnetIP3 [01] checks the CRC16 checksum and notice that there is CRC16 error. So the response that DAEnetIP3 [01] performs response over the serial line with error code E3. DAEnetIP3 [00] retransmits this error (E3) response over the TCP/IP network.
- Example 7: CRC16 for DAEnetIP3 [00] is enabled. DAEnetIP3 [00] receives data with serial address 00 from the serial line. It checks the CRC16, remove the checksum and resent the data over the TCP/IP network. The data may be received by remote host application and notification may be indicated. DAEnetIP3 [00] sends answer back to the serial line.
- Example 8: CRC16 for DAEnetIP3 [00] is enabled. DAEnetIP3 [00] receives data with serial address 02 from the serial line. Because the serial address is not 00, but 02, then the data is just passed over the TCP/IP network.

Generally DAEnetIP3 performs/checks CRC16 checksum calculations:

- Only if this is enabled by the user (setting the CRC16 enable parameter from web: Serial Port -> CRC16.
- Only for the serial line (UART).

13.5.2. CRC16 performing

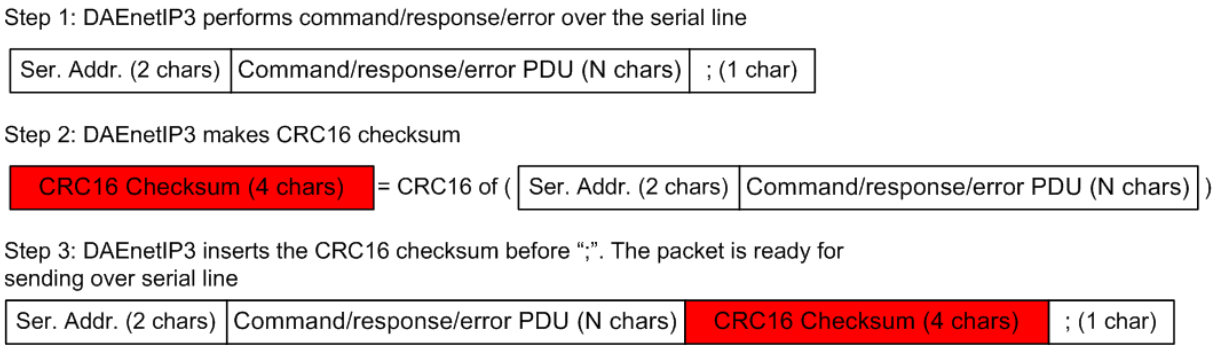


Figure 64. CRC16 performing

- Example 1. Respond CRC16 calculation
  - [1] DAEnetIP3 [00] receives data over serial: 00ASG=?**2DE3**;
  - [2] DAEnetIP3 [00] resends data over TCP/IP: 00ASG=?;
  - [3] DAEnetIP3 [00] sends data over serial: 00ASG=0000**A9FB**;
  - [4] DAEnetIP3 [00] sends data over TCP/IP: 00ASG=0000;

- Example 2. Command CRC16 calculation
  - [1] DAEnetIP3 [00] receives data over TCP/IP: 01ASG=?;
  - [2] DAEnetIP3 [00] resends data over serial: 01ASG=?**FCE2**;
  - [3] DAEnetIP3 [00] receives data from DAEnetIP3 [01]: 01ASG=FF00**AB0D**;
  - [4] DAEnetIP3 [00] resends data over TCP/IP: 01ASG=FF00;

- Example 3. Error CRC16 calculation – function code is wrong.
  - [1] DAEnetIP3 [00] receives data over TCP/IP: 01ASG=?;
  - [2] DAEnetIP3 [00] resends data over serial: 01BSG=?**FCE2**; (a bit is wrong)
  - [3] DAEnetIP3 [00] receives data from DAEnetIP3 [01]: 01E3**6E2C**;
  - [4] DAEnetIP3 [00] resends data over TCP/IP: 01E3;

- Example 4. Error CRC16 calculation – address is wrong.
  - [1] DAEnetIP3 [00] receives data over TCP/IP: 01ASG=?;
  - [2] DAEnetIP3 [00] resends data over serial: 05ASG=?**FCE2**; (address bit is wrong)
  - [3] DAEnetIP3 [00] does not receive any response because there is no such address (05) in the serial network).

13.5.3. CRC16 checking

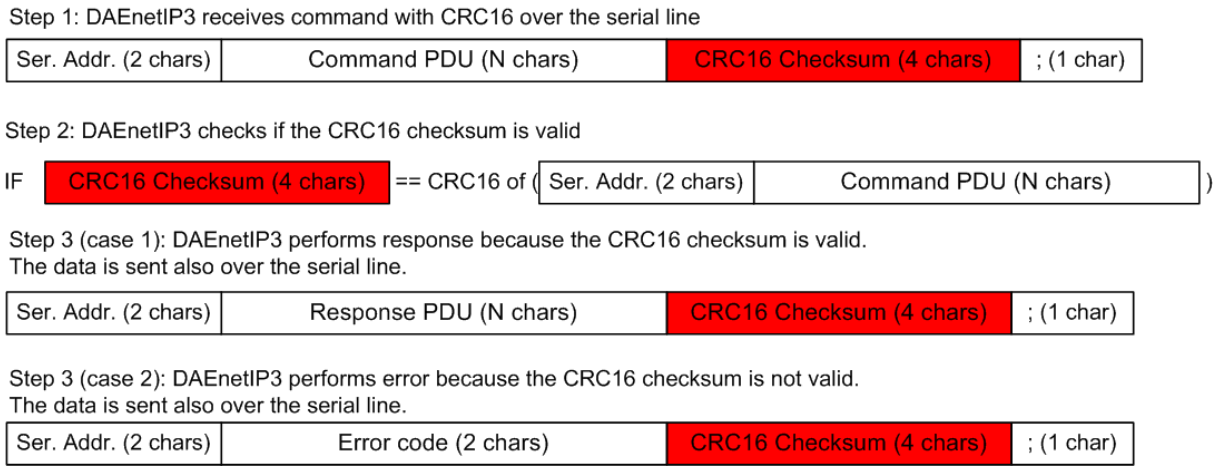


Figure 65.CRC16 checking

- Example 1. Correct communication.
  - [1] DAEnetIP3 [00] receives data over serial line: 00ASG=?**2DE3**;
  - [2] DAEnetIP3 [00] resends the command over TCP/IP serial network: 00ASG=?;
  - [3] DAEnetIP3 [00] checks the CRC16 checksum. It is valid.
  - [4] DAEnetIP3 [00] sends the response over the serial line: 00ASG=0000**A9FB**;

- Example 2. Bit from function code is wrong.
  - [1] DAEnetIP3 [00] receives data over serial line: 00BSG=?**2DE3**; (a bit from function code is wrong)
  - [2] DAEnetIP3 [00] resends the command over TCP/IP serial network: 00BSG=?;
  - [3] DAEnetIP3 [00] checks the CRC16 checksum. It is not valid.
  - [4] DAEnetIP3 [00] sends the error over the serial line: 00E3**AE7D**;

- Example 3. Bit from address is wrong.
  - [1] DAEnetIP3 [00] receives data over serial line: 05ASG=?**2DE3**; (a bit from function code is wrong)
  - [2] DAEnetIP3 [00] resends the command over TCP/IP serial network: 05ASG=?;
  - [3] DAEnetIP3 [00] does not perform response or error over the serial line, because the address is not [00], but [05].

13.6. Error codes

The possible error codes are:

- E1 – invalid function code
- E2 – invalid data
- E3 – invalid checksum (communication error) - for the serial line. Means that CRC16 checksum is not valid. This error does not apply to Telnet.

13.7. Protocol data units description (PDU)

13.7.1. Function codes for digital output port (Port A)

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
AS	**From 0 (PortA.0) up to F (PortA.15)**	0 – low level, 1 – high level ? – read value	0,1	Set/get single output line state of port A	**command:** AS0=1; 'PortA.0 in 1 **answer:** AS0=1; **command:** ASF=?; read PortA.15 **answer:** ASF=0;
AS	**G**	From 0000 up to FFFF – 4 bytes for 16 lines, ? – read value	From 0000 up to FFFF	Set/get all the 16 output lines states of Port A. The MSB is PortA.15. The LSB is PortA.0	**command:** ASG=FFFF; 'All pins in 1 **answer:** ASG=FFFF; **command:** ASG=?; ' get all pins **answer:** ASG=00FF;
AM	**From 0 (PortA.0) up to F (PortA.15)**	0 - On/Off setting, 1 - On/Off setting & DI, 2 - On/Off setting & AI, 3 - On/Off setting & schedule, 4 - On/Off setting & remote, 5 – Inverting, 6 - Inverting & DI, 7 - Inverting & AI, 8-Inverting & schedule, 9-Inverting & remote, A-Pulses, B-Pulses & DI, C-Pulses & AI, D-Pulses & schedule, E-Pulses & remote, F-Timer, G-Timer & DI, H-Timer & AI, I-Timer & remote, ? – read value	0,1,2,3, 4,5,6,7, 8,9,A,B, C,D,E,F, G,H,I	Set/get Port A line mode	**command:** AM0=1; 'Set PortA.0 in mode On/Off setting and DI **answer:** AM0=0; **command:** AMA=?; 'Get PortA.10 mode. **answer:** AMA=0;

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
AN	**From 0 (PortA.0) up to F (PortA.15)**	From 0 up to 99, ? – read value	From 00 up to 99	Set/get the ON parameter. Value is from 0 to 99 sec.	**command:** AN0=10; 'Set PortA.0 ON parameter in 10 (sec) **answer:** AM0=10; **command:** ANB=?; 'Get PortA.11 ON parameter. **answer:** ANB=10; '10 sec
AF	**From 0 (PortA.0) up to F (PortA.15)**	From 0 up to 99, ? – read value	From 00 up to 99	Set/get the OFF parameter. Value is from 0 to 99 sec.	**command:** AF0=2; 'Set PortA.0 OFF parameter in 2 (sec) **answer:** AF0=10; **command:** AFC=?; 'Get PortA.12 ON parameter. **answer:** AFC=10; '10 sec
AD	**From 0 (PortA.0) up to F (PortA.15)**	From 0 up to 99, ? – read value	From 00 up to 99	Set/get the Delay parameter. Value is from 0 to 99 sec.	**command:** AD1=5; 'Set PortA.1 Delay parameter in 5 (sec) **answer:** AD1=5; **command:** ADC=?; 'Get PortA.12 Delay parameter. **answer:** ADC=10; '10 sec
A1	**From 0 (PortA.0) up to F (PortA.15)**	From 00:00:00 up to 23:59:59, ? – read value	From 00:00:00 up to 23:59:59	Set/get the Time1 parameter. The time value must be in format HH:MM:SS	**command:** A11=12:00:00; 'Set PortA.1 Time1 event at 12 o'clock **answer:** A11=12:00:00; **command:** A11=?; 'Get PortA.1 Time1 parameter. **answer:** A11=01:00:30
A2	**From 0 (PortA.0) up to F (PortA.15)**	From 00:00:00 up to 23:59:59, ? – read value	From 00:00:00 up to 23:59:59	Set/get the Time2 parameter. The time value must be in format HH:MM:SS	**command:** A21=12:00:00; 'Set PortA.1 Time1 event at 12 o'clock **answer:** A21=12:00:00; **command:** A21=?; 'Get PortA.1 Time2 parameter. **answer:** A21=01:00:30
AC	**From 0 (PortA.0) up to F (PortA.15)**	Max 10 symbols 'a'-'z', 'A'-'Z', '0'-'9', '_' and '.', ? – read value	Description string	Set/get the Description parameter.	**command:** AC1=DO1; 'Set PortA.1 Description DO1 **answer:** AC1=DO0; **command:** ACC=?; 'Get PortA.12 Description. **answer:** ACC=DO12;

13.7.2. Commands for digital input port (Port B)

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
BV	**From 0 (PortB.0) up to 7 (PortB.7)**	? – read value	0,1	Get the value of single PortB digital input line.	**command:** BV0=?; **answer:** BV0=1;
BV	**G**	? – read value	00-FF	Get the whole PortB value. The MSB is PortB.7. The LSB is PortB.0	**command:** BVG=?; **answer:** BV0=FF; 'all inputs are in "1"
BM	**From 0 (PortB.0) up to 7 (PortB.7)**	0-Simple reading, 1-Set output during rising slope, 2-Set output during falling slope, ? – read value	0,1,2	Set/get the PortB line mode.	**command:** BM0=1; 'Set PortB.0 mode in "Set output during rising slope" **answer:** BM0=1; **command:** BM1=?; 'Get PortB.1 mode. **answer:** BM1=0;' PortB.1 mode is "Simple reading".
BP	**From 0 (PortB.0) up to 7 (PortB.7)**	From 0 (PortA.0)up to F(PortA.15), ? – read value	0 - F	Set/get the pin of PortA that is attached to this digital input.	**command:** BP0 = F 'attaches DO15 (PortA.15) to DI0 (PortB.0) **answer:** BP0=F; **command:** BP0=?; 'Get the attached PortA pin to this input **answer:** BP0=A;
BR	**From 0 (PortB.0) up to 7 (PortB.7)**	0 – disable 1 - enable, ? – read value	0,1	Set/get the Remote control value of this digital input	**command:** BR0=1; 'Enable remote control for PortB.0 **answer:** BR0=1; **command:** BR1=?; 'Get remote value of PortB.1 **answer:** BR1=0;
BC	**From 0 (PortB.0) up to 7 (PortB.7)**	Max 10 symbols 'a'-'z', 'A'-'Z', '0'-'9', '_' and '.', ? – read value	Description string	Set/get the Description parameter.	**command:** BC1=DI1; 'Set PortB.1 Description DI1 **answer:** BC1=DI1; **command:** BC7=?; 'Get PortB.7 description. **answer:** BC7=DI7;

13.7.3. Commands for analog input port (Port C)

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
CV	**From 0 (PortC.0) up to 7 (PortC.7)**	? – read value	0,1	Get the value of single PortC analog input line.	**command:** CV0=?; **answer:** CV0=1023;
CF	**From 0 (PortC.0) up to 7 (PortC.7)**	From 0 up to 99, ? – read value	1 – 99	Get/Set the refresh time. It is from 0 to 9.9 sec	**command:** CF0=1; 'Set PortC.0 refresh time in 1 **answer:** CF0=1; **command:** CF1=?; 'Get PortC.1 refresh time. **answer:** CF1=1;

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
CL	**From 0 (PortC.0) up to 7 (PortC.7)**	From 0 up to 1023, ? – read value	0 - 1023	Set/get the PortC line low threshold*	**command:** CL0=512; 'Set PortC.0 LT in 512 **answer:** CL0=512; **command:** CL1=?; 'Get PortC.1 LT. **answer:** CL1=100;
CH	**From 0 (PortC.0) up to 7 (PortC.7)**	From 0 up to 1023, ? – read value	0 - 1023	Set/get the PortC line high threshold*	**command:** CH0=900; 'Set PortC.0 HT in 900 **answer:** CH0=900; **command:** CH1=?; 'Get PortC.1 HT. **answer:** CH1=800;
CO	**From 0 (PortC.0) up to 7 (PortC.7)**	From 0 up to 512, ? – read value	0 – 512	Set/get the PortC line low hysteresis*	**command:** CO2=10; 'Set PortC.2 LH in 10 **answer:** CO2=10; **command:** CO3=?; 'Get PortC.3 LH. **answer:** CO3=12;
CG	**From 0 (PortC.0) up to 7 (PortC.7)**	From 0 up to 512, ? – read value	0 – 512	Set/get the PortC line high hysteresis*	**command:** CG2=10; 'Set PortC.2 HH in 10 **answer:** CG2=10; **command:** CG3=?; 'Get PortC.3 HH. **answer:** CG3=12;
CM	**From 0 (PortC.0) up to 7 (PortC.7)**	0 – None, 1 – Low, 2 – High, 3 – Low/High, 4 – Acc, ? – read value	0 – 4	Set/get the PortC line mode	**command:** CM3=1; 'Set PortC.3 mode in Low. **answer:** CM3=1; **command:** CM4=?; **answer:** CM4=4; 'Acc
CP	**From 0 (PortC.0) up to 7 (PortC.7)**	From 0 (PortA.0)up to F(PortA.15), ? – read value	0 - F	Set/get the pin of PortA that is attached to this analog input.	**command:** CP0 = F 'attaches DO15 (PortA.15) to AI0 (PortC.0) **answer:** CP0=F; **command:** CP0=?; 'Get the attached PortA pin to this input **answer:** CP0=A;
CR	**From 0 (PortC.0) up to 7 (PortC.7)**	0 – disable 1 - enable, ? – read value	0,1	Set/get the Remote control value of this analog input	**command:** CR0=1; 'Enable remote control for PortC.0 **answer:** CR0=1; **command:** CR1=?; 'Get remote value of PortC.1 **answer:** CR1=0;
CC	**From 0 (PortC.0) up to 7 (PortC.7)**	Max 10 symbols 'a'-'z', 'A'-'Z', '0'-'9', '_' and '.', ? – read value	Description string	Set/get the Description parameter.	**command:** CC1=AI1; 'Set PortC.1 Description AI1 **answer:** CC1=AI1; **command:** CC7=?; 'Get PortC.7 description. **answer:** CC7=AI7;

*(HT-HH)>(LT+LH), (HT+HH)<1023, (LT-LH)>0

13.7.4. Commands for system clock

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
RT	**C**	From 01.01.2000/00:00:00 up to 31.12.2099/23:59:59, ? – read value	From 01.01.2000/00:00:00 up to 31.12.2099/23:59:59	Get/set the RTC value (system time).	**command:** RTC=08.08.2011/12:30:00; **answer:** RTC=08.08.2011/12:30:00; **command:** RTC=?; 'get time **answer:** RTC=08.08.2011/12:30:05;
RZ	**O**	From -14 up to +14, ? – read value	From -14 up to +14	Get/set the time zone (for NTP synchronization).	**command:** RZO=+2; **answer:** RZO=+2; **command:** RZO=?; 'get GMT **answer:** RZO=-3;
RN	**T**	1	OK	Synchronize the RTC from NTP server	**command:** RNT=1; **answer:** RNT=OK;

13.7.5. Commands for serial port

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
SA	**D**	From 00 up to FF ? – read value	From 00 up to FF	Get/set **serial port address**. The value is two bytes hex.	**command:** SAD=0A; **answer:** SAD=0A; **command:** SAD=?; **answer:** SAD=1E;
SB	**R**	300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400, 56000, 57600, 115200, 128000, 256000 , ? – read value	300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400, 56000, 57600, 115200, 128000 or 256000	Get/set the serial port **baudrate**.	**command:** SBR=9600; **answer:** RZO=9600; **command:** SBR=?; **answer:** SBR=256000;
SP	**T**	1 – None, 2 – Even, 3 – Mark, 4 – Odd, 5 – Space, ? – read value	1 – None, 2 – Even, 3 – Mark,4 – Odd,5 – Space	Get/set the serial port **parity**.	**command:** SPT=1; 'None **answer:** SPT=1; **command:** SPT=?; **answer:** SPT=2; ' Even

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
ST	**T**	7 or 8 (data bits) ? – read value	7,8	Get/set serial port **data bits**.	**command:** SDB=7; **answer:** SDB=7; **command:** SDB=?; **answer:** SDB=8;
SC	**L**	0 – Low during send, 1 – High during send, ? – read value	1,2	Get/set **control (direction) line for serial port** communicatio n	**command:** SCL=1; **answer:** SCL=1; **command:** SCL=?; **answer:** SCL=2;
SD	**M**	0 – Full duplex, 1– Half duplex, ? – read value	1,2	Get/set **duplex mode for serial port** communicatio n	**command:** SDM=1; **answer:** SDM=1; **command:** SDM=?; **answer:** SDM=2;
S1	**6**	0 – disable CRC16, 1 – enable CTC16, ? – read value	0,1	Get/set **CRC16** checksum for serial port communicatio n	**command:** S16=1; **answer:** S16=1; **command:** S16=?; **answer:** S16=0;

The settings will take effect after restart

13.7.6. Commands for admin settings

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
MP	**T**	Max 10 symbols 'a'-'z', 'A'-'Z', '0'-'9', '_' and '.', ? – read value	Telnet passwor d string	Set/Get the **telnet password** (max 10 symbols)	**command:** MPT=admin; **answer:** MPT=admin; **command:** MPT=?; **answer:** MPT=secret;
MP	**W**	Max 10 symbols 'a'-'z', 'A'-'Z', '0'-'9', '_' and '.', ? – read value	Web passwor d string	Set/Get the **web password** (max 10 symbols)	**command:** MPW=admin; **answer:** MPW =admin; **command:** MPW =?; **answer:** MPW =secret;
MP	**4**	Max 10 symbols 'a'-'z', 'A'-'Z', '0'-'9', '_' and '.', ? – read value	RC4 passwor d string	Set/Get the **RC4 password** (max 10 symbols)	**command:** MP4=admin; **answer:** MP4=admin; **command:** MP4=?; **answer:** MP4=secret;
MP	**R**	From 1 to 65535, ? – read value	From 1 to 65535	Set/get the **remote DAEnetIP3 server port**. This is for distributed mode.	**command:** MPR=1005; **answer:** MPR=1005; **command:** MPR=?; **answer:** MPR=1005;
MP	**N**	From 1 to 65535, ? – read value	From 1 to 65535	Set/get the **NTP server port**.	**command:** MPN=37; **answer:** MPN =37; **command:** MPN =?; **answer:** MPN =37;

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
MP	**F**	From 1 to 65535, ? – read value	From 1 to 65535	Set/get the **TFTP server port**.	**command:** MPF=69; **answer:** MPF =69; **command:** MPF =?; **answer:** MPF =69;
MP	**H**	From 1 to 65535, ? – read value	From 1 to 65535	Set/get the **HTTP port**.	**command:** MPH=80; **answer:** MPH =80; **command:** MPH =?; **answer:** MPH =80;
MP	**L**	From 1 to 65535, ? – read value	From 1 to 65535	Set/get the **Local Port Range**.	**command:** MPH=1005; 'Set range 1005-1009 **answer:** MPH =1005; **command:** MPH =?; **answer:** MPH =1005;
MP	**U**	From 1 to 65535, ? – read value	From 1 to 65535	Set/get the **User Socket Port**.	**command:** MPU=1010; **answer:** MPU =1010; **command:** MPU =?; **answer:** MPU =1010;
MI	**P**	From 000.000.000.000 up to 255.255.255.255, ? – read value	From 000.000.000.000 up to 255.255.255.255	Set/get Eth IP address	**command:** MIP=192.168.0.5; **answer:** MIP =192.168.0.5; **command:** MIP =?; **answer:** MIP =192.168.0.10;
MI	**R**	From 000.000.000.000 up to 255.255.255.255, ? – read value	From 000.000.000.000 up to 255.255.255.255	Set/get Eth IP protection address	**command:** MIR=192.168.0.1; **answer:** MIR =192.168.0.1; **command:** MIR =?; **answer:** MIR =192.168.0.2;
MS	**R**	From 000.000.000.000 up to 255.255.255.255, ? – read value	From 000.000.000.000 up to 255.255.255.255	Set/get the IP address of the remote server.	**command:** MSR=192.168.0.10; **answer:** MSR =192.168.0.10; **command:** MSR =?; **answer:** MSR =192.168.0.10;
MS	**N**	From 000.000.000.000 up to 255.255.255.255, ? – read value	From 000.000.000.000 up to 255.255.255.255	Set/get the IP address of the NTP server.	**command:** MSN=192.168.0.10; **answer:** MSN =192.168.0.50; **command:** MSN =?; **answer:** MSN =192.168.0.50;

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
MS	**T**	From 000.000.000.000 up to 255.255.255.255, ? – read value	From 000.000.000.000 up to 255.255.255.255	Set/get the IP address of the TFTP server.	**command:** MST=192.168.0.30; **answer:** MST =192.168.0.30; **command:** MST =?; **answer:** MST =192.168.0.30;
MM	**A**	From 000.000.000.000 up to 255.255.255.255, ? – read value	From 000.000.000.000 up to 255.255.255.255	Set/get the Eth network mask.	**command:** MMA=255.255.255.0; **answer:** MMA=255.255.255.0; **command:** MMA =?; **answer:** MMA=255.255.255.0;
MM	**C**	? – read value	From 00:00:00:00:00:00 to FF:FF:FF:FF:FF:FF	Get the Eth MAC address.	**command:** MMC =?; **answer:** MMC=00:12:34:56:78:90;
ME	**F**	0,1, ? – read value	0,1	Get/Set enabling of TFTP update option.	**command:** MEF=1; ‘Enable TFTP **answer:** MEF=1; **command:** MEF =?; **answer:** MEF=0;
ME	**T**	0,1, ? – read value	0,1	Get/Set enabling of Telnet.	**command:** MET=1; ‘Enable Telnet **answer:** MET=1; **command:** MET =?; **answer:** MET=0;
ME	**4**	0,1, ? – read value	0,1	Get/Set enabling of RC4 encryption.	**command:** ME4=1; ‘Enable RC4 **answer:** ME4=1; **command:** ME4 =?; **answer:** ME4=0;
MW	**M**	0 – Ethernet 10/10 Mbit, 1 – Wi-Fi 802.11, ? – read value	0,1	Get/Set working mode.	**command:** MWM=0; ‘Ethernet 10/10 Mbit **answer:** MWM =0; **command:** MWM =?; **answer:** MWM =1; ‘Wi-Fi 802.11
MG	**W**	From 000.000.000.000 up to 255.255.255.255, ? – read value	From 000.000.000.000 up to 255.255.255.255	Set/get the Eth gateway address.	**command:** MGW=192.168.0.1; **answer:** MGW =192.168.0.1; **command:** MGW =?; **answer:** MGW =192.168.0.1;

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
MF	**V**	5 char string that represents the version	-	Get the firmware version	**command:** MFV =?; **answer:** MFV =1.0.0;

Some of the settings will take effect after restart.

13.7.7. Commands for Wi-Fi settings (optional)

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
WI	**P**	From 000.000.000.000 up to 255.255.255.255, ? – read value	From 000.000 .000.00 0 up to 255.255 .255.25 5	Set/get the **Wi-Fi (WIn) IP address**.	**command:** WIP=192.168.0.1; **answer:** WIP =192.168.0.1; **command:** WIP =?; **answer:** WIP =192.168.0.1;
WN	**M**	From 000.000.000.000 up to 255.255.255.255, ? – read value	From 000.000 .000.00 0 up to 255.255 .255.25 5	Set/get the **Wi-Fi (WIn) Mask**.	**command:** WNM =255.255.255.0; **answer:** WNM =255.255.255.0; **command:** WNM =?; **answer:** WNM =255.255.255.0;
WD	**G**	From 000.000.000.000 up to 255.255.255.255, ? – read value	From 000.000 .000.00 0 up to 255.255 .255.25 5	Set/get the **Wi-Fi (WIn) gateway**.	**command:** WDG =192.168.0.1; **answer:** WDG =192.168.0.1; **command:** WDG =?; **answer:** WDG =192.168.0.1;
WR	**G**	0 – FCC, 1 – EU, 2 – JAPAN, 3 – OTHER, ? – read value	0,1,2,3	Set/get the **Wi-Fi interface region**.	**command:** WRG=0; ‘ FCC **answer:** WRG=0; **command:** WRG=1; ‘ EU **answer:** WRG=1;
WS	**I**	Max 15 symbols 'a'-'z', 'A'-'Z', '0'-'9', '_' and '.', ? – read value	WiFi SSID	Set/get the **Wi-Fi SSID**.	**command:** WSI=Network; **answer:** WSI=Network; **command:** WSI =?; **answer:** WSI = Network;
WE	**P**	Max 15 symbols 'a'-'z', 'A'-'Z', '0'-'9', '_' and '.', ? – read value	WiFi WEP key	Set/get the **Wi-Fi Wep Key**. It may be 0, 5 or 13 symbols	**command:** WEP=admin; **answer:** WEP= admin; **command:** WEP =?; **answer:** WEP = admin;

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
WM	**C**	? – read value	From 00:00:00:00:00:00 to FF:FF:FF:FF:FF:FF	Get the **Wi-Fi (Wln) MAC address**.	**command:** WMC =?; **answer:** MMC=00:12:34:56:78:90;

Some of the settings will take effect after restart.

13.7.8. System commands

function, bytes 1-2	***function, byte 3***	***data***	***answer***	***comment***	***example***
YR	**T**	1	From 000.000.000.000 up to 255.255.255.255	Makes system reset.	**command:** YRT=1; 'Reset **answer:** YRT=1;
YD	**F**	1	From 000.000.000.000 up to 255.255.255.255	Loads the default settings and after 10 seconds makes reset.	**command:** YDF=1; 'Default settings **answer:** YDF=1;
YF	**U**	1	From 000.000.000.000 up to 255.255.255.255	Connects to the TFTP server, downloads the firmware file, makes checking if file is valid and if yes upgrades the firmware and makes system reset.	**command:** YFU=1; 'Firmware update started. **answer:** YFU=1;

14. Appendix 1. Connectors and LED indicators

14.1. DAEnetIP3 ports view

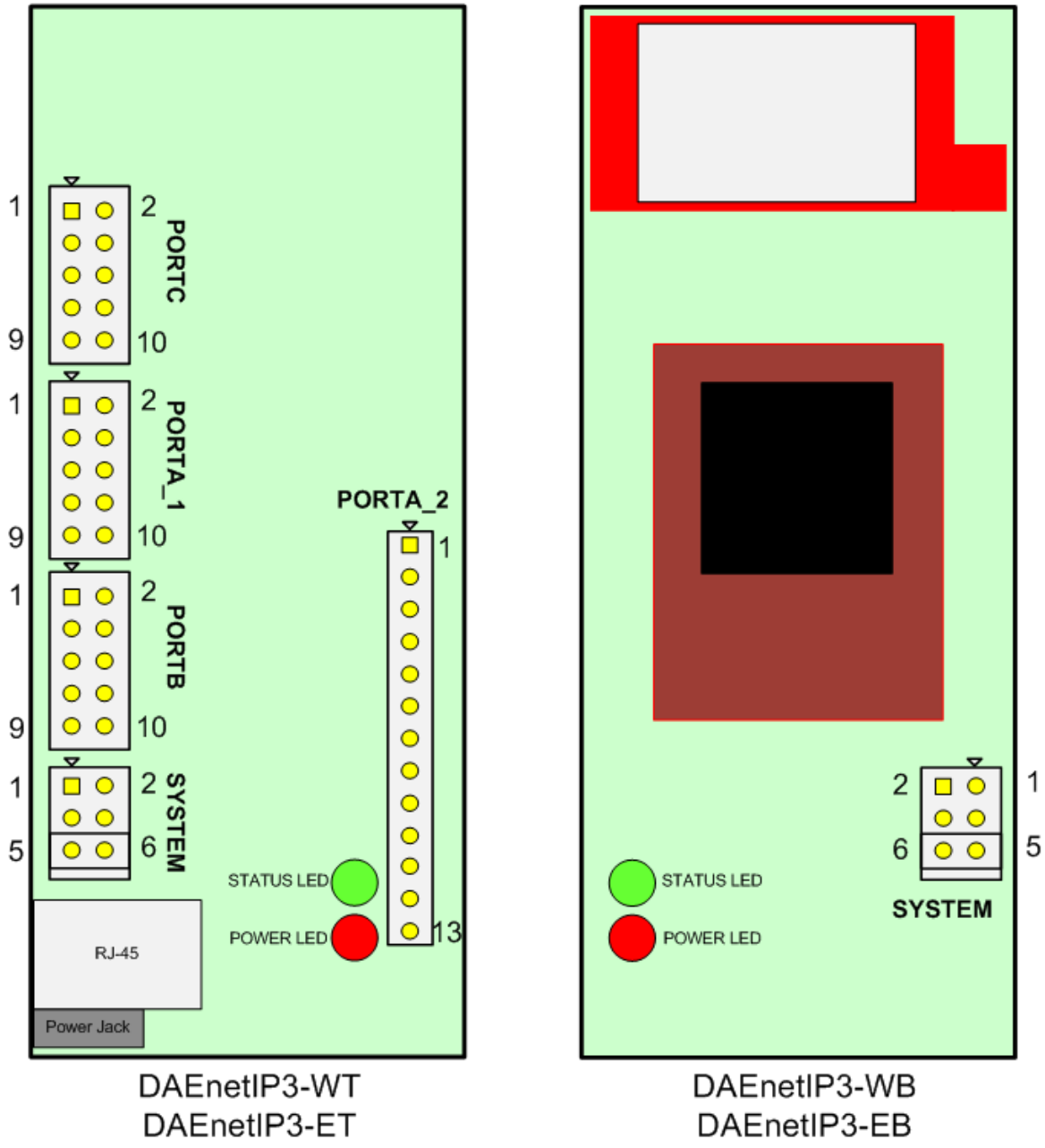


Figure 66. DAEnetIP3 ports

14.2. DAEnetIP3 ports description

Table 17. Port A_1

	PortA_1 (digital outputs)		
Pin N	**Bit**	**Function**	**Dir**
1	0	Free	Out
2	1	Free	Out
3	2	Free	Out
4	3	Free	Out
5	4	Free	Out
6	5	Free	Out
7	6	Free	Out
8	7	Free	Out
9	-	GND	PWR
10	-	+3.3V DC	PWR

Table 18. Port A_2

	PortA_2 (digital outputs)		
Pin N	**Bit**	**Function**	**Dir**
1	8	Free	Out
2	9	Free	Out
3	10	Free	Out
4	11	Free	Out
5	12	Free	Out
6	-	+12V DC	PWR
7	-	+12V DC	PWR
8	-	GND	PWR
9	-	GND	PWR
10	-	GND	PWR
11	13	Free	Out
12	14	Free	Out
13	15	Free	Out

Table 19. Port B

	PortB (digital inputs)		
Pin N	**Bit**	**Function**	**Dir**
1	0	Free	In
2	1	Free	In
3	2	Free	In
4	3	Free	In
5	4	Free	In
6	5	Free	In
7	6	Free	In
8	7	Free	In
9	-	GND	PWR

10	-	+3.3V DC	PWR

Table 20. Port C

	PortC (analog inputs)		
Pin N	**Bit**	**Function**	**Dir**
1	0	Free	Ain
2	1	Free	Ain
3	2	Free	Ain
4	3	Free	Ain
5	4	Free	Ain
6	5	Free	Ain
7	6	Free	Ain
8	7	Free	Ain
9	-	GND	PWR
10	-	+3.3V DC	PWR

Table 21. UART

	UART		
Pin N	**Bit**	**Function**	**Dir**
1	-	TX	Out
2	-	RX	In
3	-	DIR	Out
4	-	GND	PWR

Table 22. SYSTEM

	SYSTEM		
Pin N	**Bit**	**Function**	**Dir**
1	-	Reset	In
2	-	+3.3V DC	PWR
3	-	Reserved	In
4	-	GND	PWR
5	-	Default	In
6	-	GND	PWR

Legend:

- “Free” – the pin is free to be used by user.
- “XXXXXX” - the pin is reserved for special function – can not be accessed.
- “In” – the pin is digital input
- “Out” – the pin is digital output
- “Ain” – the pin is analog input

14.3. DAEnetIP3 power jack and RJ-45 port

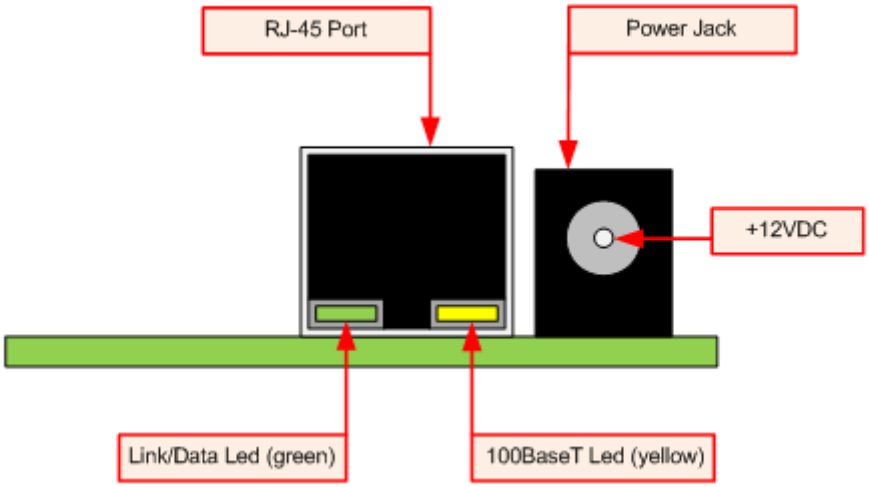


Figure 67. DAEnetIP3 RJ-45 Port and Power Jack

The power jack is for 12VDC power supply. **The middle pin of the power jack is +12VDC!**
THERE IS NOT PROTECTION AGAINST REVERSE VOLTAGE !!!
REVERSE VOLTAGE WILL DAMAGE THE DEVICE !!!
RJ-45 Port is for Ethernet cable connection. The devices recognize straight or cross-over UTP cable (auto-MDIX).
The RJ-45 Port has two leds (green and yellow). The green led is turned on when "live" Ethernet cable is plugged into the device. The LED blinks whenever an Ethernet packet is received. The yellow is turned on when the device links with the hub at 100Mb. The LED is off when the link is established at 10Mb.

14.4. DAEnetIP3 Led indicators

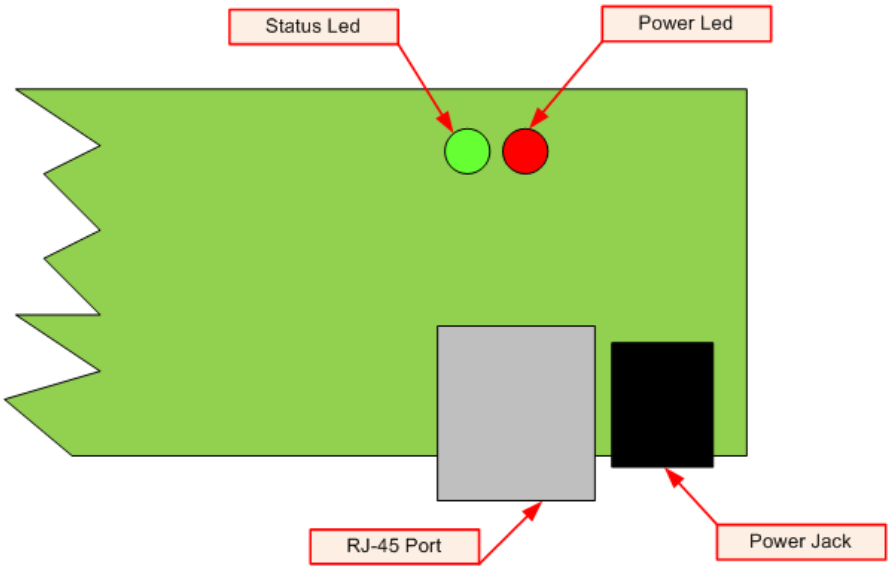


Figure 68. Led indicators

DAEnetIP3 has two extra led indicators:

- Power Led. It is red and if it is on then the controller is powered up. It is connected to +3.3V source. This led is marked on the PCB as “POW”.
- Status Led. It is green and shows the status of the connection with other DAEnetIP3 (when the controllers works in distributed mode). This led is marked on the PCB as “STAT”. There are 3 modes
    - Remote DAEnetIP3 controller is found – the status led is constantly ON.

Figure 69. Indication for connected state to remote host

    - Remote DAEnetIP3 controller is found, but the port is wrong – the status led is ON/OFF with 0.2 second period.

Figure 70. Indication for no port found state to remote host

    - Remote DAEnetIP3 controller is not found at all – the status led is ON/OFF with 1 second period.

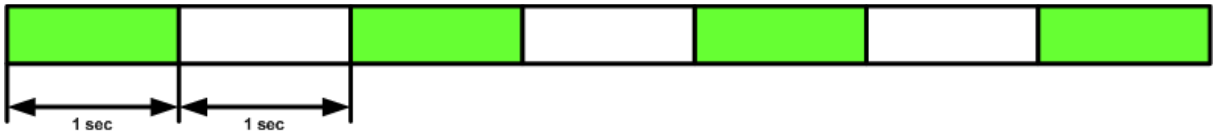


Figure 71. Indication for no IP address found state to remote host

14.5. DAEnetIP3 Wi-Fi led indicator and external antenna connector

Note that this is only for DAEnetIP3-TW and DAEnetIP3-BW

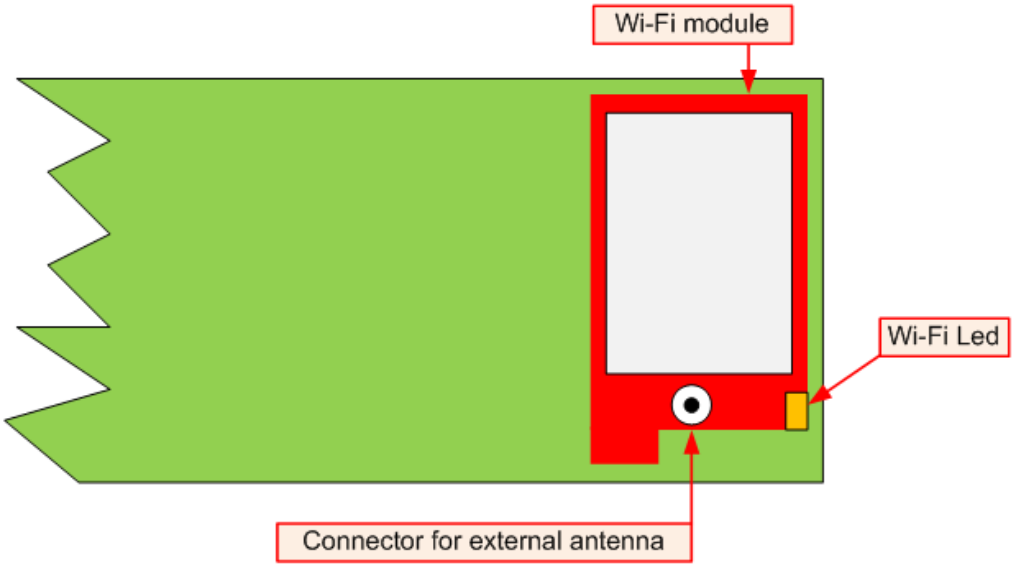


Figure 72. DAEnetIP3 Wi-Fi led indicator an external antenna socket.

DAEnetIP3 Wi-Fi module has orange led for wireless connection status. If the led is on, then the connection is established. If it is off DAEnetIP3 is not connected via wireless. If the led is flashing, then the connection is being established. DAEnetIP3 has external antenna socket (I-PEX MHF).

15. Appendix 2. Connections

15.1. UTP cable connection with PC for first time

Steps for connection with PC for first time:

1. Connect DAEnetIP3 RJ45 port with UTP (doesn't matter crossover or straight) cable.
2. Connect the PC with the other side of the UTP cable.
3. Change the IP of the PC. It may be for example 192.168.0.1. (DAEnetIP3 is with 192.168.0.100)
4. Supply DAEnetIP3 with power supply 12 VDC (the middle pin of DAEnetIP3 power jack is +12VDC). The power led (with red color) must be on.
5. Open your browser (IE, Firefox, Opera) and type 192.168.0.100 in the address bar.
6. Use ***admin*** for password.

15.2. UTP cable connection with router

Steps for connection with router:

1. Connect DAEnetIP3 RJ45 port with UTP (doesn't matter crossover or straight) cable.
2. Connect PC with the other side of the UTP cable.
3. Remember the IP of the PC (for example we accept it is 192.168.1.2).
4. Change the IP of the PC. It may be for example 192.168.0.1. (DAEnetIP3 is with 192.168.0.100).
5. Supply DAEnetIP3 with power supply 12 VDC (the middle pin of DAEnetIP3 power jack is +12VDC). The power led (with red color) must be on.
6. Open your browser (IE, Firefox, Opera) and type 192.168.0.100 in the address bar.
7. Use ***admin*** for password.
8. Open admin settings.
9. Change the Eth IP address of DAEnetIP3. Make it to be in one network with your router and PC. For example if your router is with IP 192.168.1.1 and PC with 192.168.1.2, make DAEnetIP3 with 192.168.1.100. Eth mask must be 255.255.255.0 and Eth gateway 192.168.1.1 (router IP)
10. Click "Save" button.
11. Unplug the power supply.
12. Disconnect the UTP cable from PC and connect it to the router.
13. Supply again the DAEnetIP3
14. Give back the old IP of the PC (192.168.1.2)
15. Open browser and type 192.168.1.100.
16. Now you may access the DAEnetIP3 controller with router via router from PC.

15.3. Wi-Fi connection with PC for first time

Steps for connection with PC for first time:

1. Create ad-hoc Wi-Fi network with your PC. Your OS must support this. For example Microsoft Windows 7 supports this function. We accept the name of Ad-Hoc (SSID) is ***Network***, the encryption type is **WEP – 64** and the password is **admin**.
2. Make the IP of this wireless interface of your PC for example 192.168.1.1 and mask 255.255.255.0
3. Connect DAEnetIP3 RJ45 port with UTP (doesn't matter crossover or straight) cable.
4. Connect PC with the other side of the UTP cable.
5. Change the IP of LAN card of the PC. It may be for example 192.168.0.1. (DAEnetIP3 is with 192.168.0.100).
6. Supply DAEnetIP3 with power supply 12 VDC (the middle pin of DAEnetIP3 power jack is +12VDC). The power led (with red color) must be on.
7. Open your browser (IE, Firefox, Opera) and type 192.168.0.100 in the address bar.
8. Use ***admin*** for password.
9. Open Wi-Fi settings.
10. Change the Wln IP address of DAEnetIP3. Make it to be in one network with your PC Ad-Hoc network. We accepted the IP of the PC Ad-Hoc is 192.168.1.1. So the Wln IP of the DAEnetIP3 Wi-Fi interface may be 192.168.1.2. Wln Mask = 255.255.255.0 and Wln gateway is 192.168.1.1.
11. Click "Save" button.
12. Unplug the power supply.
13. Remove the UTP cable from the PC and controller.
14. Supply again the DAEnetIP3.
15. The orange Wi-Fi status led of DAEnetIP3 must blink initially and then must be on constantly. This means the controller is connected to the Wireless network. If the led is off then DAEnetIP3 is not connected to the Wireless network because some settings are not correct. If so you need to check out the settings again.
16. If the DAEnetIP3 is connected properly, open browser and type 192.168.1.2.
17. Now you may access the DAEnetIP3 controller over Wi-Fi.

15.4. Wi-Fi connection with router

1. Connect DAEnetIP3 RJ45 port with UTP (doesn't matter crossover or straight) cable.
2. Connect PC with the other side of the UTP cable.
3. Change the IP of LAN card of the PC. It may be for example 192.168.0.1. (DAEnetIP3 is with 192.168.0.100).
4. Supply DAEnetIP3 with power supply 12 VDC (the middle pin of DAEnetIP3 power jack is +12VDC). The power led (with red color) must be on.
5. Open your browser (IE, Firefox, Opera) and type 192.168.0.100 in the address bar.
6. Use admin for password.
7. Open Wi-Fi settings.
8. Change the Wln IP address of DAEnetIP3. Make it to be in one network with your Wi-Fi network. We accepted the IP of the Wi-Fi network is 192.168.1.X. So the Wln IP of the DAEnetIP3 Wi-Fi interface may be 192.168.1.2. Wln Mask = 255.255.255.0 and Wln gateway is 192.168.1.1 (The IP of your router). Set the SSID and WEP password.
9. Click "Save" button.
10. Unplug the power supply.
11. Remove the UTP cable from the PC and controller.
12. Supply again the DAEnetIP3 with 12VDC.
13. The orange Wi-Fi status led of DAEnetIP3 must blink initially and then must be on constantly. This means the controller is connected to the Wireless network. If the led is off then DAEnetIP3 is not connected to the Wireless network because some settings are not correct. If so you need to check out the settings again. Also you may restart your router (just in case).
14. If the DAEnetIP3 is connected properly, open browser and type 192.168.1.2.
15. Now you may access the DAEnetIP3 controller over Wi-Fi.

WARNING !

- Do not touch DAEnetIP3 while it is powered up – this may damage the DAEnetIP3.
- Do not reverse the polarity of the power supply – this will damage the DAEnetIP3.

16. Appendix 3. I/O Ports

16.1. Digital outputs

DAEnetIP3 has 16 digital outputs port. This port is called Port A. Each output line has pull-down resistor 10 Kohm to GND (figure 73). The low level is 0V. The high level is 3.3V. **Be carful, the outputs are connected directly to the MCU pins. Incorrect connections or overvoltage may damage the DAEnetIP3 controller !**

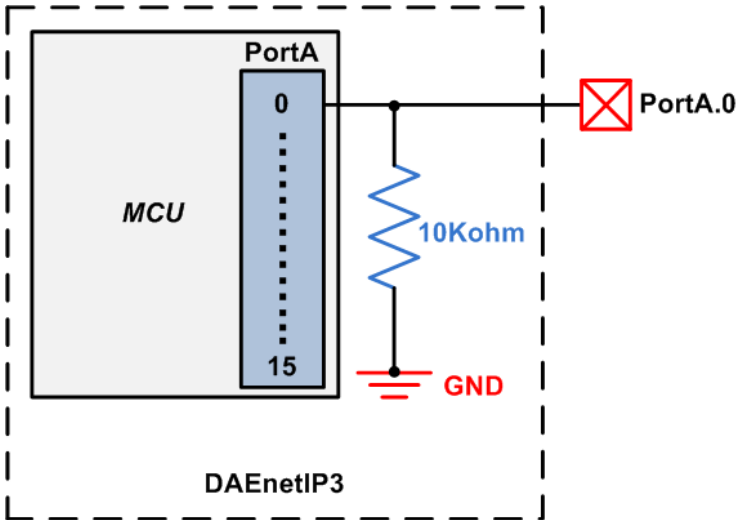


Figure 73. Port A – 16 x digital output lines

Bellow on figure 74 is given example how a 12V relay may be connected to PortA output channel.

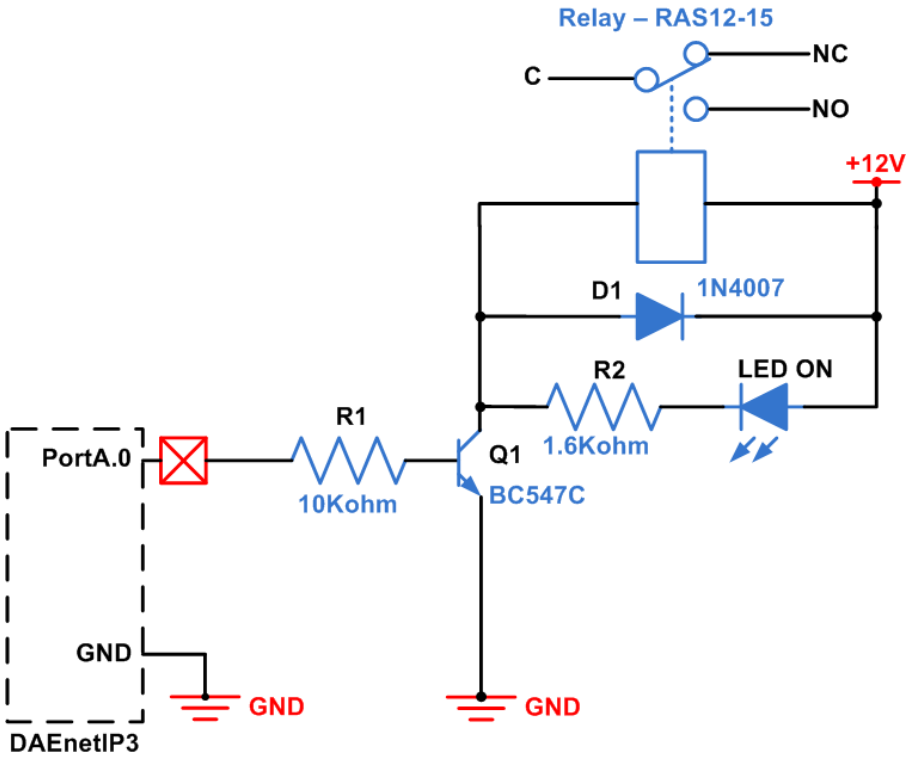


Figure 74. Connecting 12V relay to DO line

16.2. Digital inputs

DAEnetIP3 has 8 digital inputs port. This port is called Port B. Each output line has pull-up resistor 10 Kohm to 3.3V (figure 75). When the input is not connected, its state is high (1). **Be carful, the inputs are connected directly to the MCU pins. Incorrect connections or overvoltage may damage the DAEnetIP3 controller !**

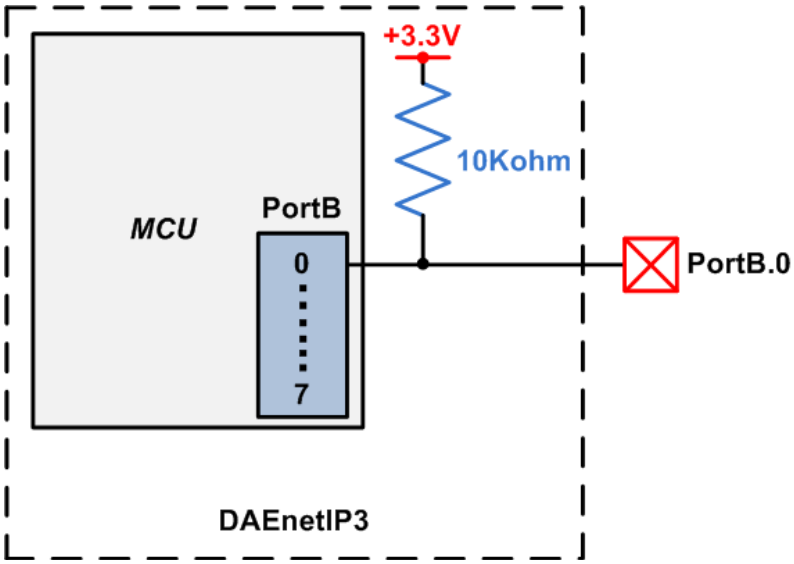


Figure 75. Port B – 8 x digital input lines

Bellow on figure 76 is given example how a switch button may be connected to PortB input line. When the switch is opened, the input level is low (0), when the switch is closed the input level is high (1).

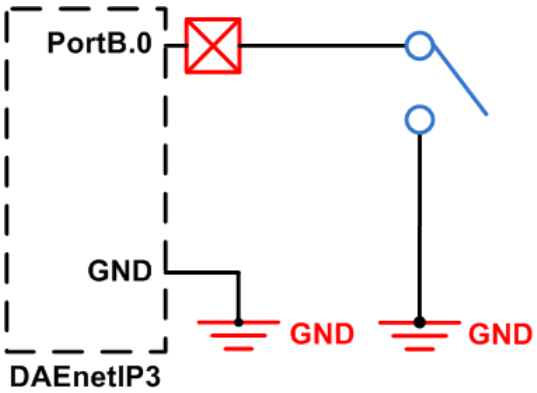


Figure 76. Connecting switch to DI line

16.3. Analog inputs

DAEnetIP3 has 8 analog inputs port. This port is called Port C. Each output line has pull-down resistor 100 Kohm to GDN (figure 77). The resolution of the used ADC is 10 bit. The reference voltage is 2.5VDC. The input voltage for each ADC channel is from 0 up to 2.5V – approx. 25mV/div. **Be carful, the inputs are connected directly to the MCU pins. Incorrect connections or overvoltage may damage the DAEnetIP3 controller !**

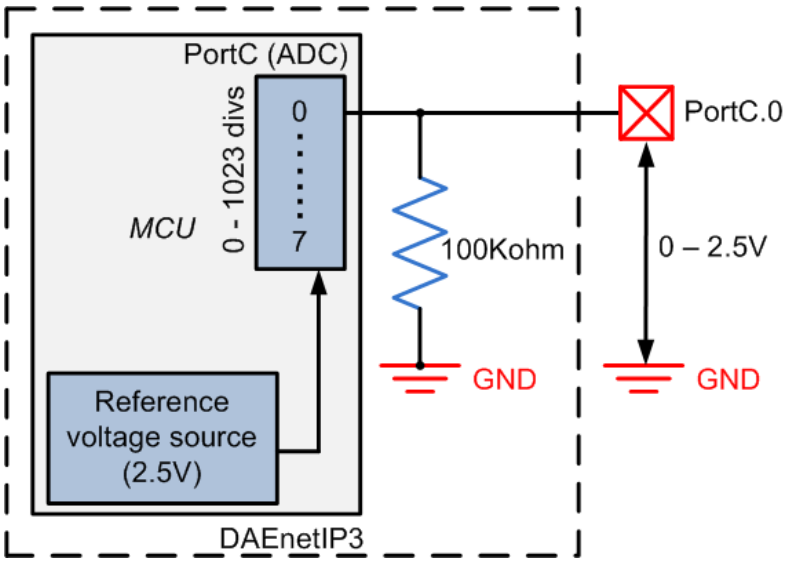


Figure 77. Port C – 8 x analog input lines

17. Appendix 4. Reset the controller

17.1. Hardware (1)

1. Unplug the power supply carefully.
2. Wait 10 seconds.
3. Plug the power supply.

17.2. Hardware (2)

1. Connect Pin 1 and Pin 2 of system port. It is recommended connecting these pins with switch or button, avoiding the possibility of touching DAEnetIP3 tracks while working.
2. Disconnect the Pin 1 and Pin 2 of system port.

17.3. Reset via Web

Web browser -> System -> Reset

17.4. Reset via UART command

Send to UART port: AA**YRT=1**; Where the AA is the serial address, YRT=1 is the function code for default settings and ";" is the delimiter.

17.5. Reset via Telnet command

Send to UART port: **YRT=1**; Where YRT=1 is the function code for default settings and ";" is the delimiter.

17.6. Reset via DAEnetIP3 socket command

Send to UART port: AA**YRT=1**; Where the AA is the serial address, YRT=1 is the function code for default settings and ";" is the delimiter.

18. Appendix 5. Loading the default settings

18.1. Hardware loading default settings

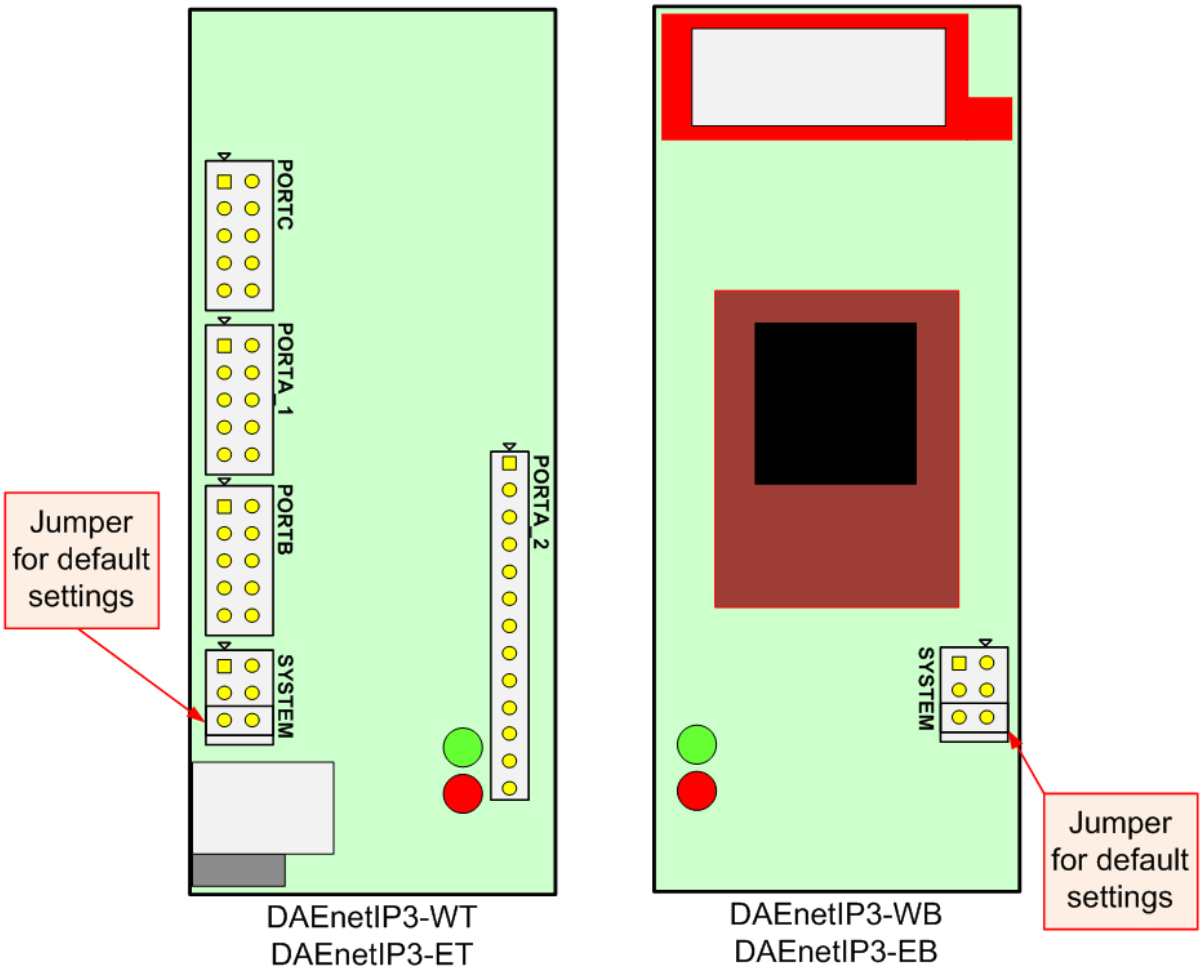


Figure 78. Jumper for default (factory) settings

3. Turn off the power supply of the IP controller
4. Remove the jumper for default settings
5. Turn on the power supply of the IP controller
6. Wait 10 seconds
7. Turn off the power supply
8. Put the jumper again on the position shown on the figure above
9. Turn on the power supply

18.2. Web loading default settings

Web browser -> System -> Load default settings.

18.3. Loading default settings via UART command

Send to UART port: AA**YDF=1**; Where the AA is the serial address, YDF=1 is the function code for default settings and ";" is the delimiter.

18.4. Loading default settings via Telnet command

Send to UART port: **YDF=1**; Where YDF=1 is the function code for default settings and ";" is the delimiter.

18.5. Loading default settings via DAEnetIP3 socket command

Send to UART port: AA**YDF=1**; Where the AA is the serial address, YDF=1 is the function code for default settings and ";" is the delimiter.

19. Appendix 6. Firmware upgrade

19.1. Firmware upgrade via *DAEnetIP Burner*

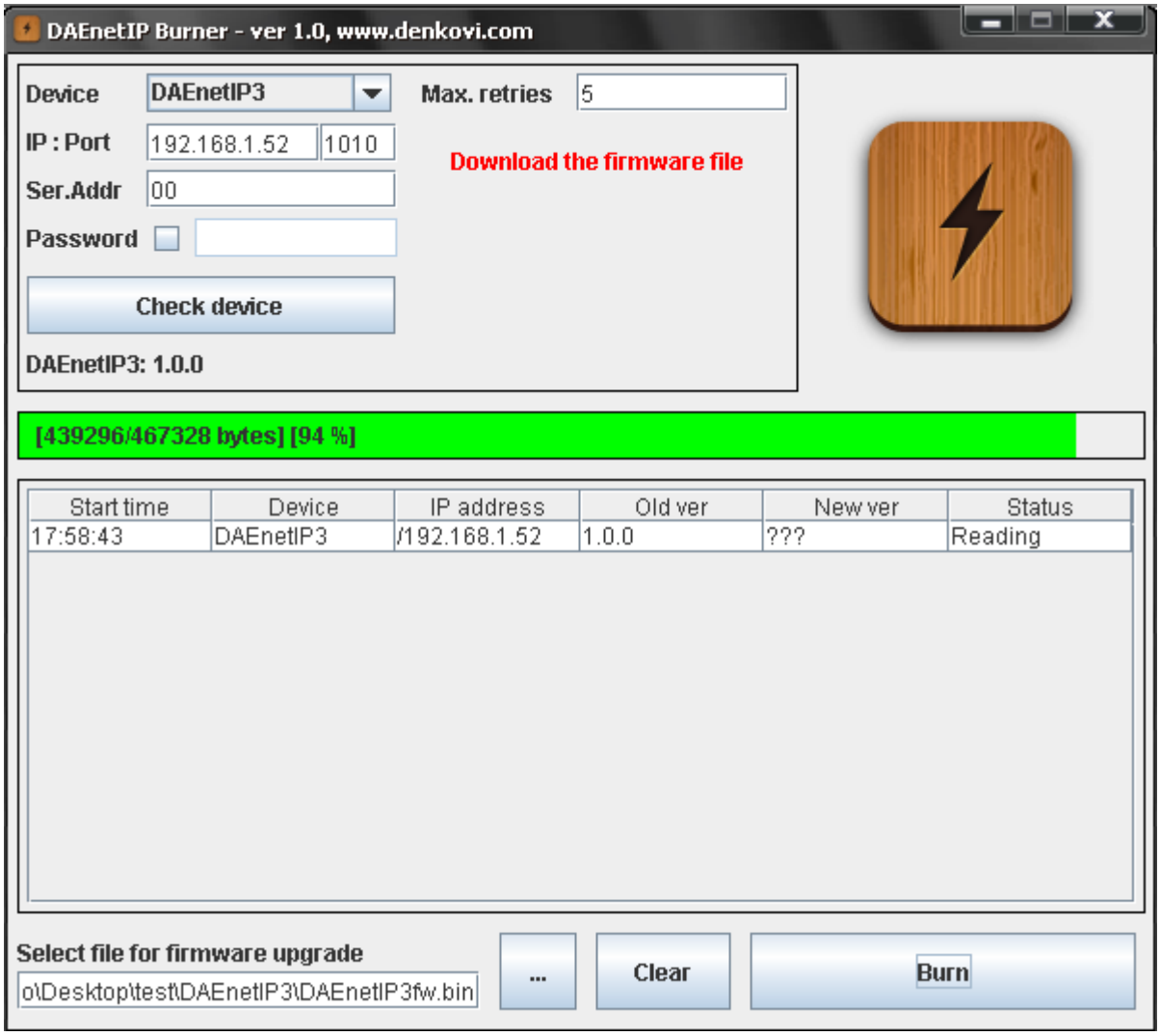


Figure 79. *DAEnetIP Burner* Screenshot

DAEnetIP3 burner (figure 79) is Java based software for Windows OS for firmware upgrade of the controllers DAEnetIPX. It is developed by Denkovi Assembly Electronics LTD and allows easily to upgrading each DAEnetIP controller to the latest version just in several minutes. It combines simple TFTP server and special client with communication protocol depending on the used controller.

DAEnetIP3 firmware can be also easily updated with *DAEnetIP Burner.* Below are given the options that must be entered before firmware upgrade.

The last version of DAEnetIP3 Burner may be downloaded from this link - http://denkovi.com/Software/DAEnetIPBurner/Current-Version/ DAEnetIPBurner.exe.

Full documentation for the software may be found here - http://www.denkovi.com/page/31/daenetip-burner.html

Steps for DAEnetIP3 firmware upgrade with *DAEnetIP3 Burner*

1. Download and save the version you need for upgrading the DAEnetIP3 controller. The binary (.bin) file must be downloaded from www.denkovi.com. It may be downloaded from the link in the application or directly from this link. Support for firmware file also may be received by e-mail b_denkov@abv.bg.
2. Navigate the application to this file by clicking button with label "…".
3. From the **Device list** select DAEnetIP3.
4. In the **IP address field** type the IP address of the DAEnetIP3 controller that must be upgraded.
5. In the **Port field** type the port on that DAEnetIP3 can be reached. This is the port that is named as **User Socket Port**. It may be adjusted in the admin settings page.
6. Set the serial address of the DAEnetIP3.
7. If RC4 password is used check the **Password check box**. This may be checked-out in the admin settings page.
8. In the **Password field** type the RC4 password used in this DAEnetIP3 controller. This may be checked-out in the admin settings page.
9. Check if the settings are correct by clicking button "**Check device**". After successful connection under this button it must appears text DAEnetIP3: X.Y.Z (for example DAEnetIP3: 1.0.0, which means DAEnetIP3 controller with version 1.0.0 is found). In any other cases it means the connection is not successful and you must repeat again steps 3-9.
10. Set the **maximum retries field.** This field shows how many times the *DAEnetIP3 Burner* will try to reconnect with the DAEnetIP3 controller if the connection is lost for a moment. A value of 5-10 is reasonable.
11. Open web browser and select the **Admin settings page.** If you have plans to upgrade the firmware over LAN cable (using the Ethernet interface of the controller), then you must select for Ethernet mode 10/100 Mbit. If you want to upgrade it over Wi-Fi (using the Wi-Fi interface) select Wi-Fi 802.11 b/g. Reset the controller.
12. Start update by clicking **Burn button.** If everything is correct, a new line must appear in the event log and the progress bar must starts moving on. If this doesn't happen, then repeat again steps 10-12.
13. Wait until the file is uploaded. This will be indicated when the **New version** field is not ??? but some value – form example 3.0.0. Old version value 2.0.0 and New version value 3.0.0 means that the DAEnetIP3 controller is upgraded from version 2.0.0 to 3.0.0. Then the **Status field** must be with value "File is uploaded successfully".
14. Your DAEnetIP3 controller is upgraded successfully with the desired firmware version. Now when you click button "**Check device**", the new version must appear.

19.2. Firmware upgrade via DAEnetIP3 application protocol requests

This method is based on sending request for TFTP update via some of the supported methods: Telnet, socket or Serial communication. All the TFTP necessary

settings must be set before this. A TFTP server also must be started and listening for DAEnetIP3 TFTP update request. Such TFTP server is the software named 3CServer.

Bellow are given the settings and steps that must be done for successful TFTP firmware upgrade:

1. Download and install 3CServer software – from here http://www.denkovi.com/Software/Other-software/3CServer.zip.
2. Start the application (figure 80)

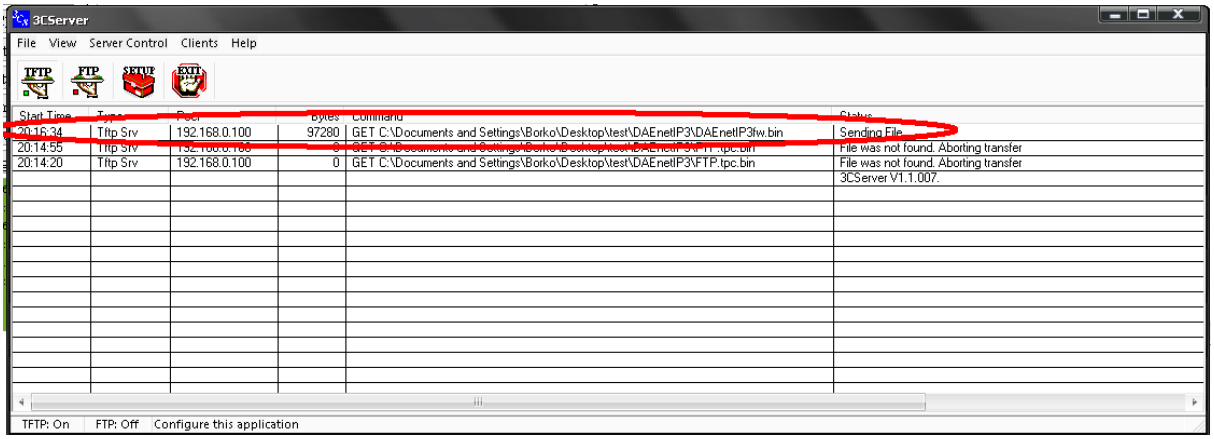


Figure 80. 3CServer

3. Open browser and type the address of the DAEnetIP3 controller.
4. Click on the admin settings page.
5. In the field **TFTP Server IP** write the IP address of the server (PC) that is started the 3CServer application (figure 80).
6. Make sure TFTP server is started.
7. Click “SETUP”. Click TFTP configuration tab and select the Upload/Download directory where is the DAEnetIP3 firmware file. Click OK.
8. **TFTP Port** must be 69.
9. **TFTP firmware file** must be the name of the file that is pointed by the 3CServer.
10. Select the interface (Working Mode). This means if the controller will be updated over cable or Wi-Fi.
11. Click save settings and reset the DAEnetIP3 controller.
12. Enter in the **System page** and click **button TFTP Update**.
13. Wait until the update is finished. The update is finished when the status of the TFTP request (figure 80) is with “***TFTP successful…”*** message.

19.3. Recommendations during firmware upgrade

1. Be sure the file you are using for firmware upgrade is correct. Incorrect file may damage the DAEnetIP3 controller. Download the file only from this link - http://www.denkovi.com/Firmware/DAEnetIP3/Current-Version/DAEnetIP3fw.bin.
2. Do not shut off the power supply during firmware upgrade. This may damage the DAEnetIP3 controller.
3. Do not touch the DAEnetIP3 controller with hands during firmware upgrade.
4. Do not disconnect the firmware upgrade process. This may damage the DAEnetIP3 controller.
5. If you loose access to DAEnetIP3 controller, then do not upgrade the firmware. You must load the default settings or simply contact with us via email b_denkov@abv.bg.
6. If you downgrade the firmware (upgrade it with lower version), then it may be necessary to load the default settings.

20. Appendix 7. How to create Virtual Serial Port for DAEnetIP3

1. Download and install this Windows application. With this tool you will be able to create and configure Virtual Serial Ports on your PC.
2. When you start the application you will have to create your Virtual Serial Port that will be used in your project. So when you start the software you should see the window bellow. Click Add button:

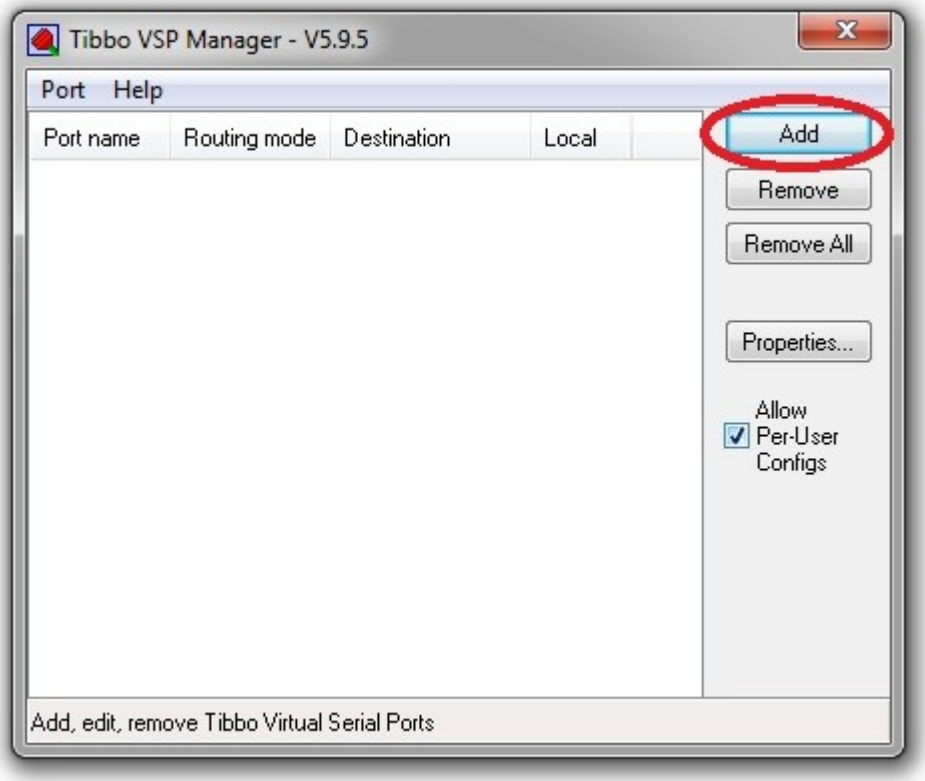


Figure 81. VSP Manager

3. After that you will have to adjust the VSP settings. The VSP name is **COM1.** IP address is your DAEnetIP3 device IP address (in this case it is the default **192.168.0.100**). We chose port to be **1010** but may be any free of your network.

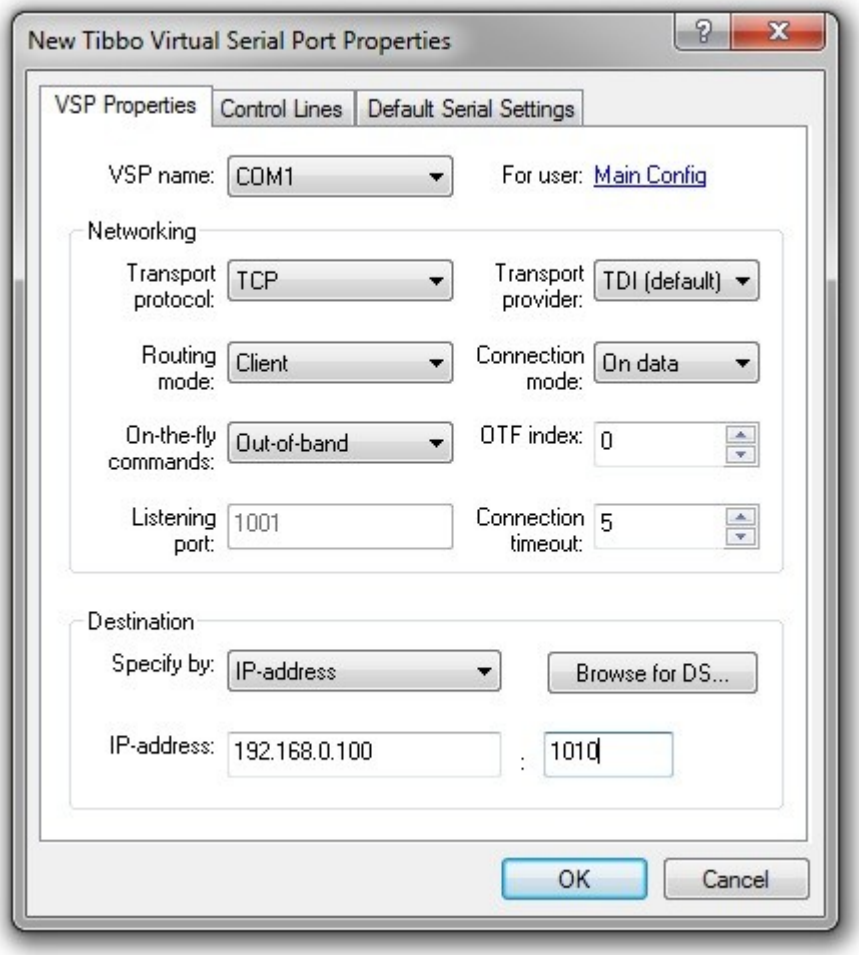


Figure 82. Properties

4. When you are sure for all settings just create the VSP.

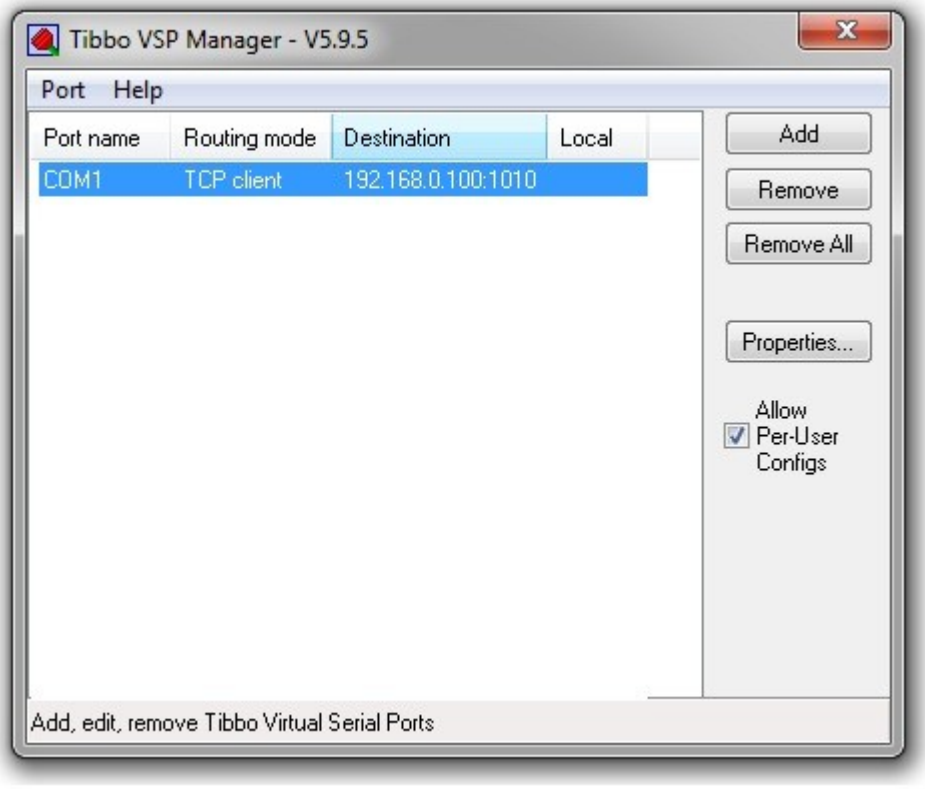


Figure 83. VSP created

5. The Virtual Serial Port now is created. You may see it in the Device Manager.

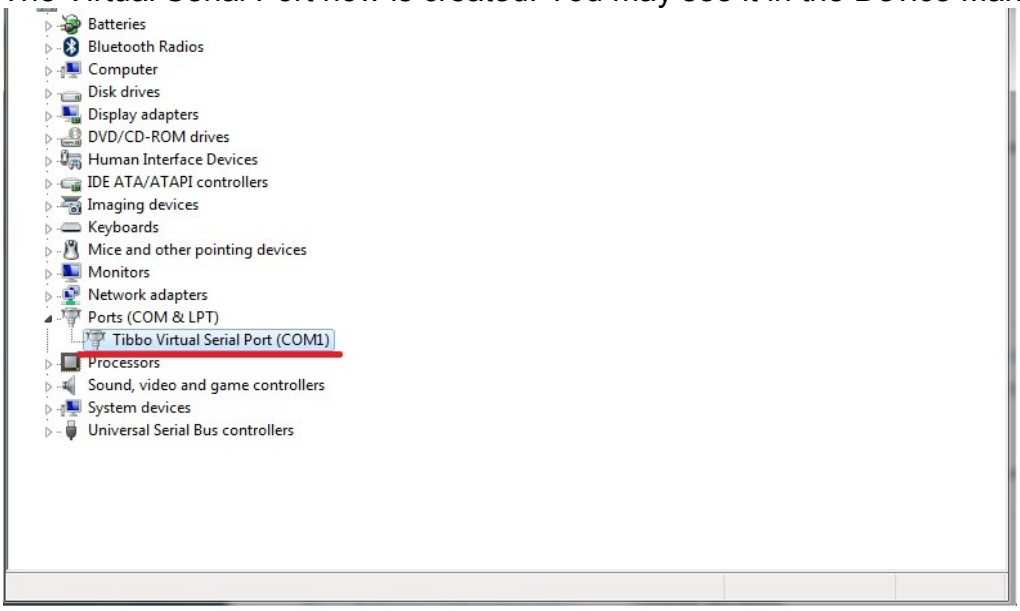


Figure 84. Device Manager

21. Appendix 8. Mechanical draw

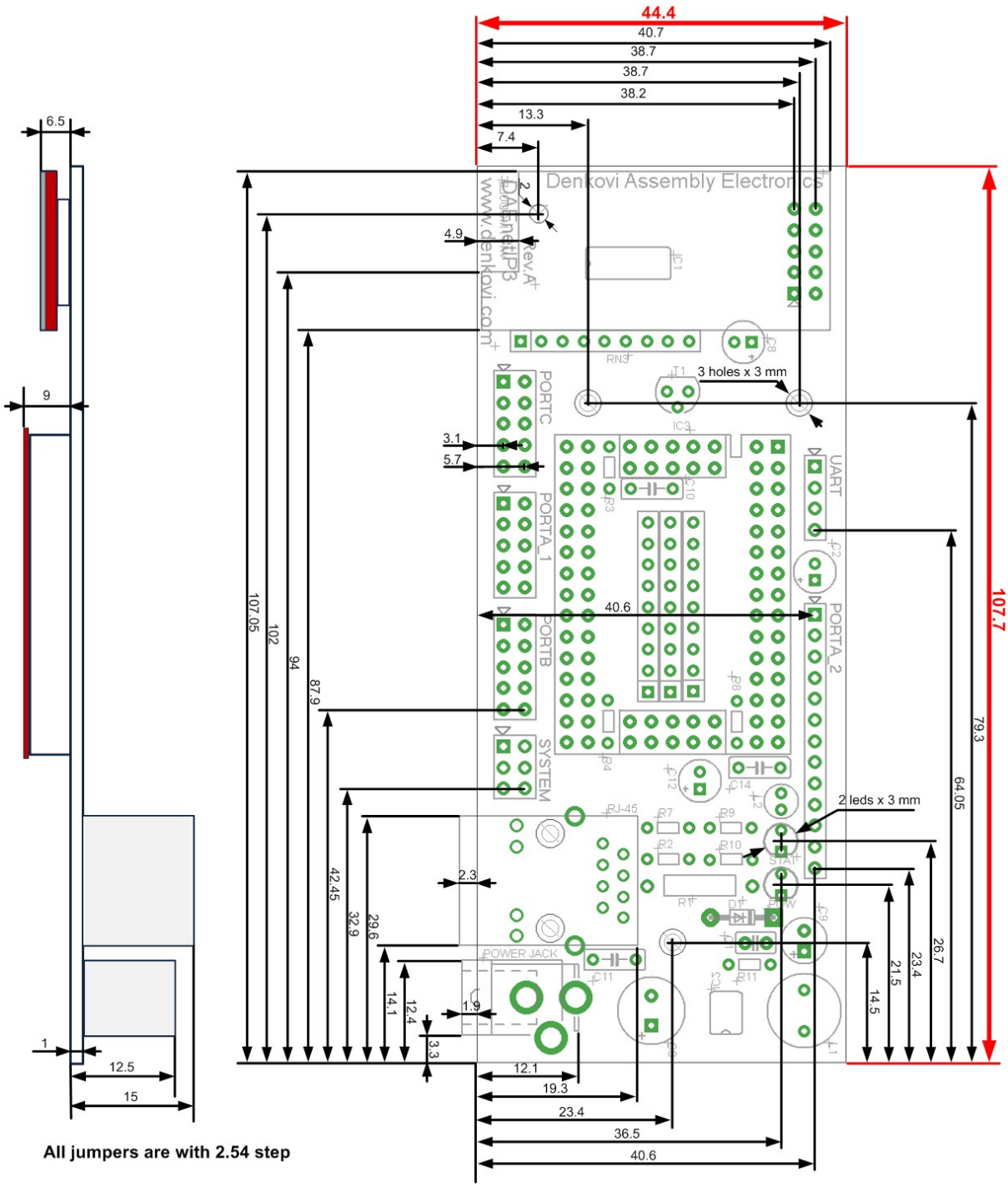


Figure 85. DAEnetIP3 PCB dimensions

22. Appendix 8. Ordering codes

22.1. DAEnetIP3 – ET

This is DAEnetIP3 controller without Wi-Fi interface. The UART port, SYSTEM Port and leds are soldered on the top side (Figure 86).

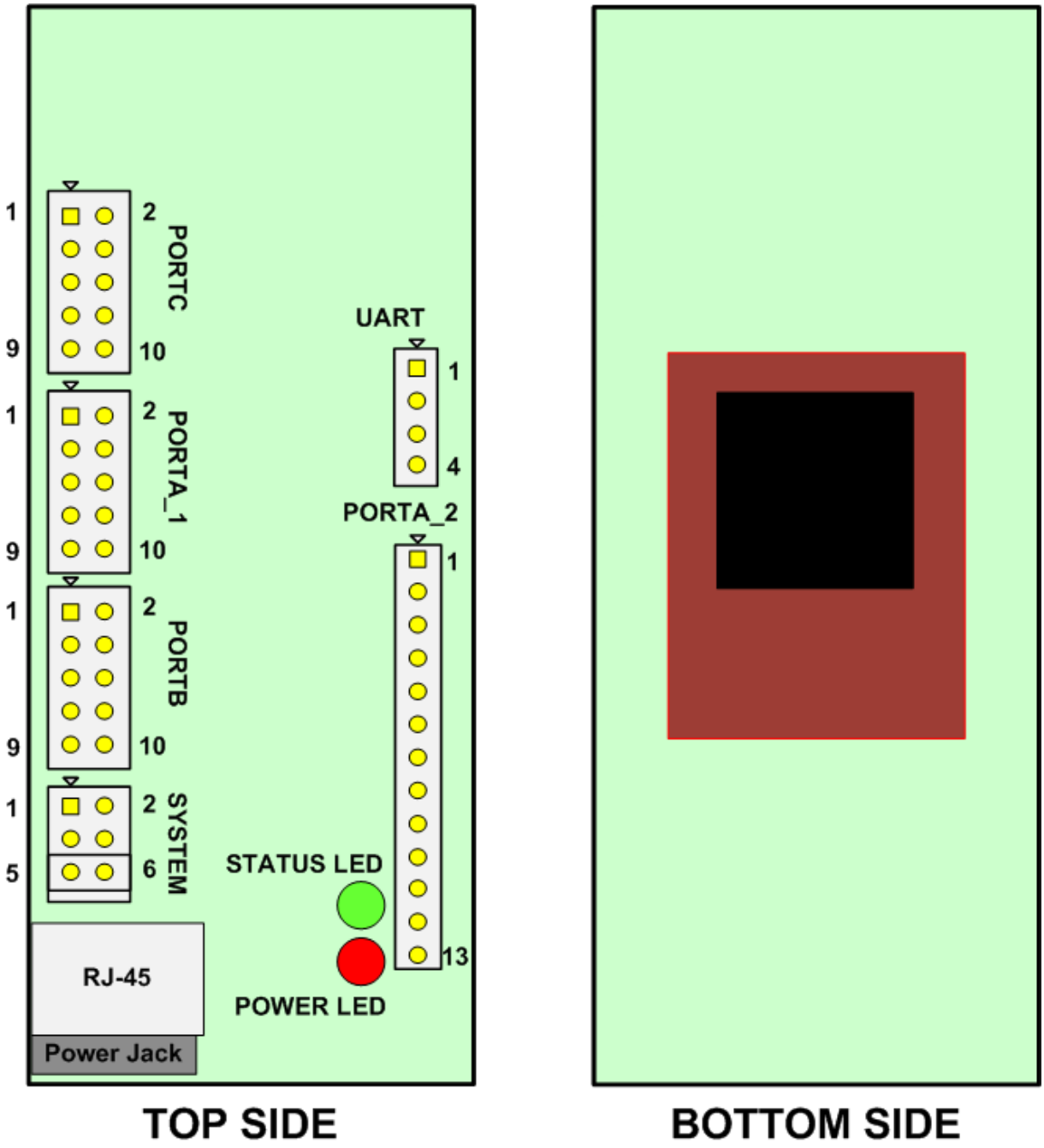


Figure 86. DAEnetIP3 – ET

22.2. DAEnetIP3 – WT

This is DAEnetIP3 controller with Wi-Fi interface. The UART port, SYSTEM Port and leds are soldered on the top side (Figure 87).

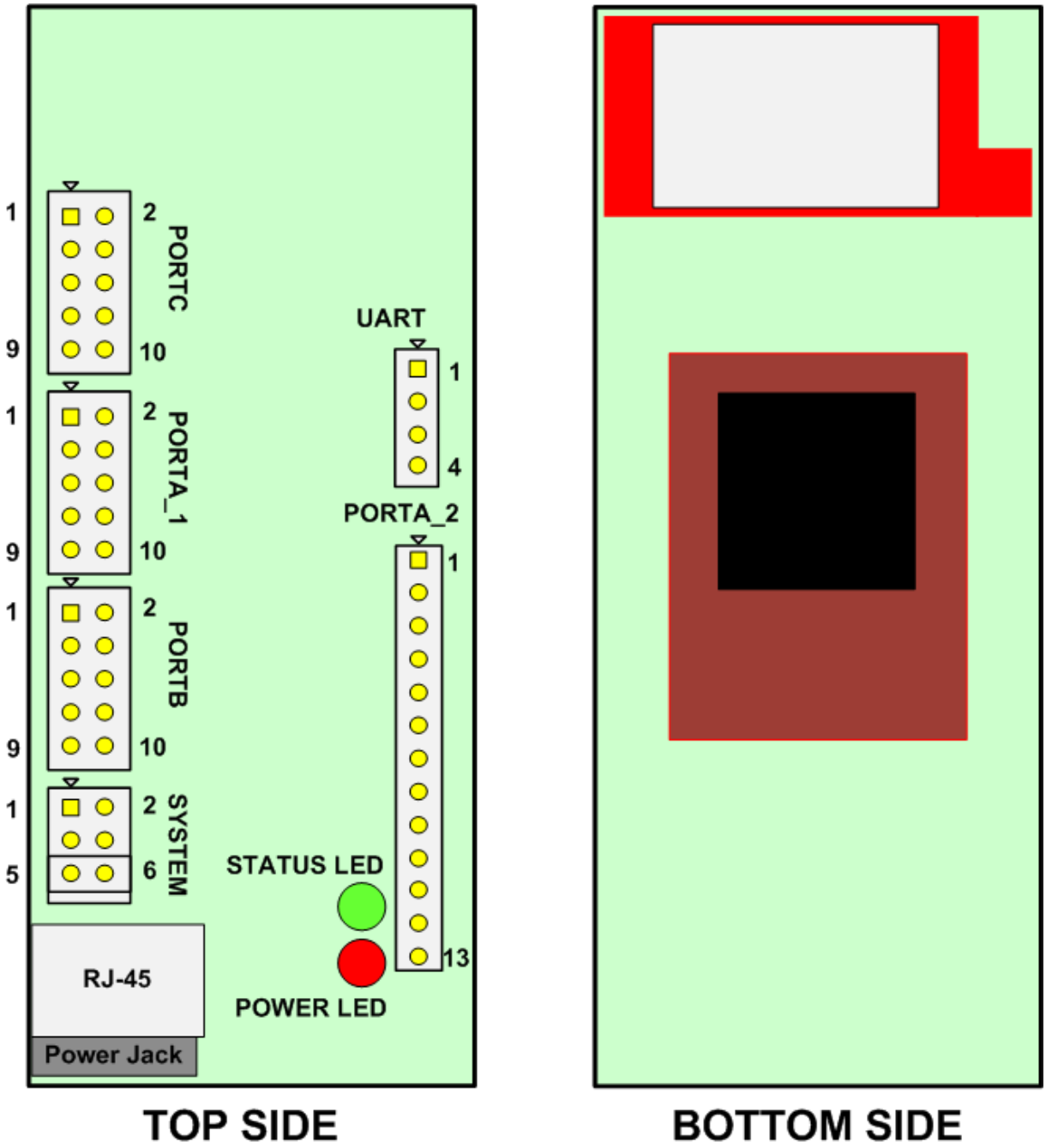


Figure 87. DAEnetIP3 - WT

22.3. DAEnetIP3 – EB

This is DAEnetIP3 controller without Wi-Fi interface. The UART port, SYSTEM Port and leds are soldered on the bottom side (Figure 88).

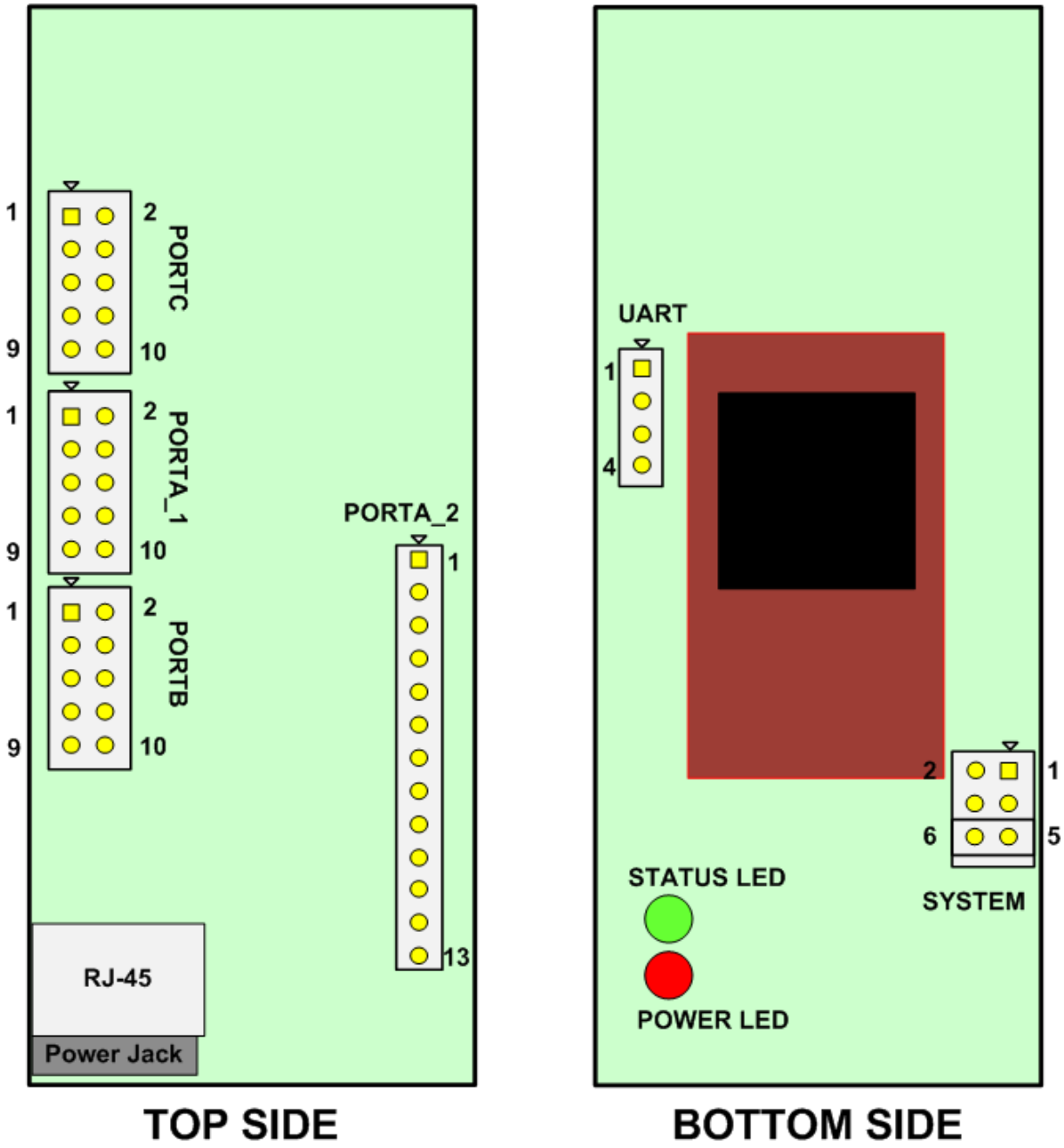


Figure 88. DAEnetIP3 – EB

22.4. DAEnetIP3 – WB

This is DAEnetIP3 controller with Wi-Fi interface. The UART port, SYSTEM Port and leds are soldered on the bottom side (Figure 89).

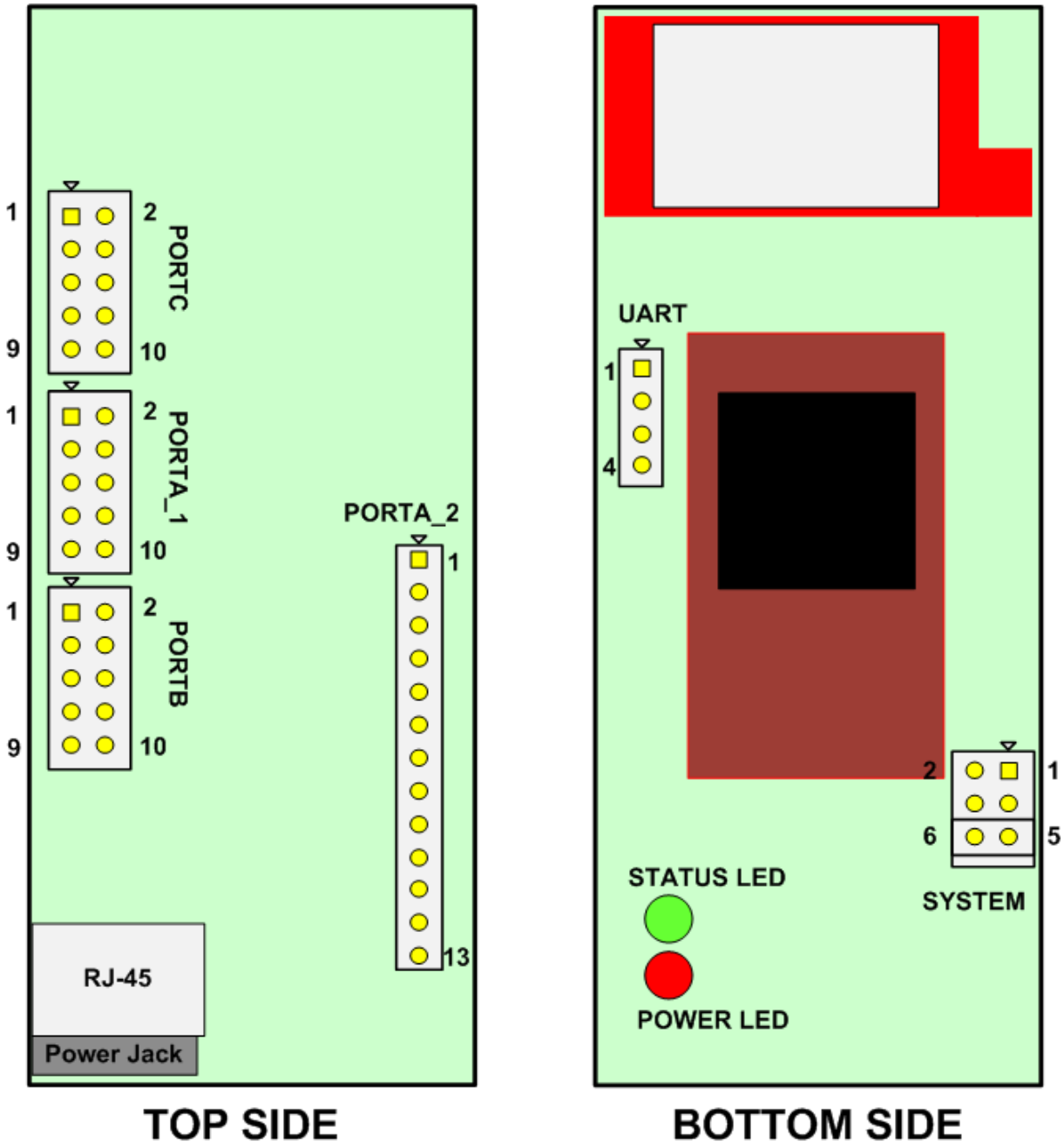


Figure 89. DAEnetIP3 – WB