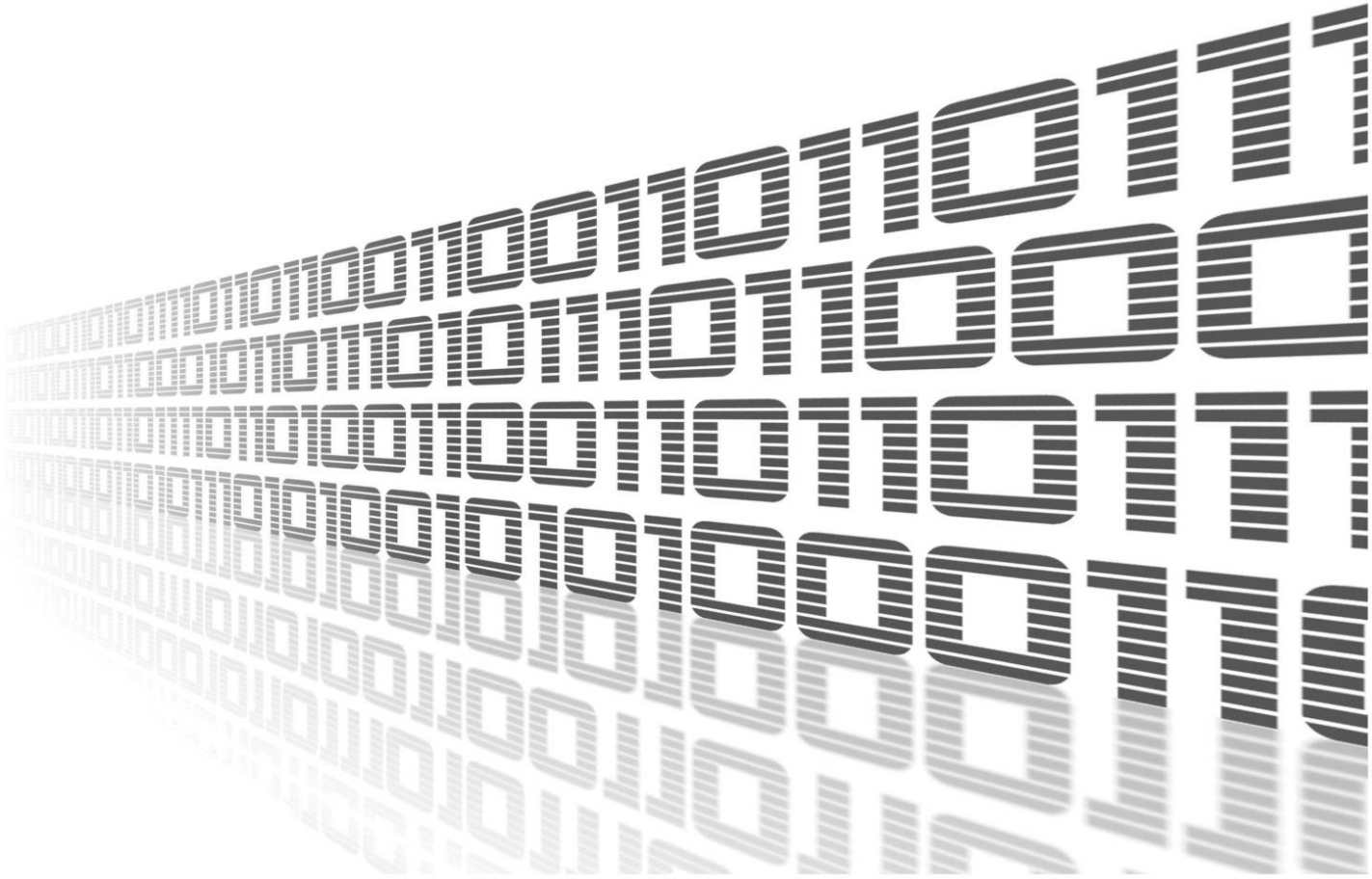
ADVANTECH

RouterApp

DNP3 Outstation



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Used symbols

Danger – Information regarding user safety or potential damage to the router.

Attention – Problems that can arise in specific situations.

Information – Useful tips or information of special interest.

Example – Example of function, command or script.

Contents

1. Changelog **1**

1.1 DNP3 Outstation Changelog . . . 1

2. Description of router app **2**

3. Configuration **3**

3.1 Global . . . 3
3.2 Application Layer . . . 4
3.2.1 Binary inputs . . . 4
3.2.2 Analog values . . . 5
3.2.3 Counter inputs . . . 5
3.2.4 Number of Events . . . 6
3.3 Routing Targets . . . 7
3.4 Routing Table . . . 8

4. Module activity monitoring **10**

4.1 Statistical information . . . 10
4.2 System log . . . 11

5. Related Documents **12**

List of Figures

1 DNP3 frame . . . 2
2 Menu of web interface . . . 2
3 Configuration form *Global* . . . 4
4 Configuration form *Application Layer* . . . 6
5 Configuration form *Routing Targets* . . . 8
6 Configuration form *Routing Table* . . . 9
7 Statistics . . . 10
8 System log . . . 11

List of Tables

1 Connection configuration . . . 3
2 An established TCP connection check . . . 3
3 Device specification . . . 3
4 Binary inputs . . . 4
5 Analog values . . . 5
6 Counter inputs . . . 5
7 Configuration of expansion ports . . . 7
8 Configuration of remote connections . . . 7
9 Configuration form *Routing Table* . . . 8

1. Changelog

This Router App has been tested on a router with firmware version 6.3.10. After updating the router's firmware to a higher version, make sure that a newer version of the Router App has not also been released, as it is necessary to update it as well for compatibility reasons.

1.1 DNP3 Outstation Changelog

v1.0.0 (2013-11-01)

- First release.

v1.0.1 (2013-12-05)

- Added support of FW 4.0.0+.

v1.0.2 (2013-12-10)

- Fixed issue with iptables.

v1.0.3 (2014-07-11)

- Added support of events on inputs.
- Added support of gateway function.
- Added support of sending of unsolicited messages.

v1.1.0 (2017-03-17)

- Recompiled with new SDK.

v1.1.1 (2018-10-31)

- Fixed big CPU load of dnpOut.
- Added TCP reconnection.
- Fixed coding violations to meet coding standarts.

v1.2.0 (2020-10-01)

- Updated CSS and HTML code to match firmware 6.2.0+.

v1.3.0 (2022-11-03)

- Reworked license information.

v1.4.0 (2023-11-10)

- Added support for internal BIN1, BIN2, BIN3.

2. Description of router app

Router app *DNP3 Outstation* is not contained in the standard router firmware. Uploading of this router app is described in the Configuration manual (see Chapter Related Documents). Please note that in case of using v2 routers, this module requires firmware version 3.0.8 or later.

DNP3 Outstation module allows the router to use DNP3 protocol (Distributed Network Protocol v. 3), which is intended for reading data from the router. It follows that the primary purpose of this protocol is the mutual communication between devices in a network. DNP3 supports communication model based on the principle of ISO OSI system, which only specifies the physical parameters of the communication, data link and application layers of this protocol.

DNP3 frame consists of a header with a fixed size of 10 bytes and data part (data payload), which consists of data blocks with a size of 1 to 16 bytes. Each data block is terminated by a Cyclic Redundancy Check (CRC) with a size of 16 bits (2 bytes). The total size of DNP3 frame is maximum of 292 bytes.

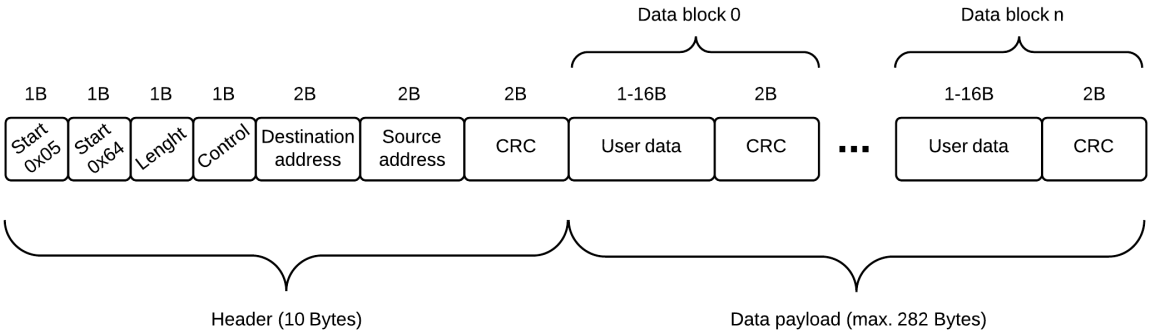

Figure 1: DNP3 frame

For configuration *DNP3 Outstation* router app is available web interface, which is invoked by pressing the module name on the *Router apps* page of the router web interface. The left part of the web interface contains the menu with pages for *Configuration*, monitoring (*Status*) and *Customization* of the module. *Customization* block contains only the *Return* item, which switches this web interface to the interface of the router.

Figure 2: Menu of web interface

3. Configuration

Configuration of *DNP3 Outstation* router app is performed using pages *Global*, *Application Layer*, *Routing Targets* and *Routing Table* which are available in the *Configuration* part of the module web interface.

3.1 Global

Configuration form on the *Global* page allows user to configure the UDP/TCP connection and check of established TCP connection. The first item – *Enable DNP Outstation* – is used to activate this router app. Meaning of other items is described below.

Item	Description
Protocol	Protocol type: • **TCP** – communication using a linked protocol TCP • **UDP** – communication using a unlinked protocol UDP
Port	Specifies the port on which the router will communicate

Table 1: Connection configuration

If the *Check TCP connection* checkbox is ticked, check of established TCP connection is activated. It is possible to specify the following parameters:

Item	Description
Keepalive Time	Time after which it will carry out verification of the connection
Keepalive Interval	Waiting time on answer
Keepalive Probes	Number of tests

Table 2: An established TCP connection check

Then it is necessary to specify master and outstation devices:

Item	Description
Outstation Address	Address of outstation device
Master Address	Address of master device

Table 3: Device specification

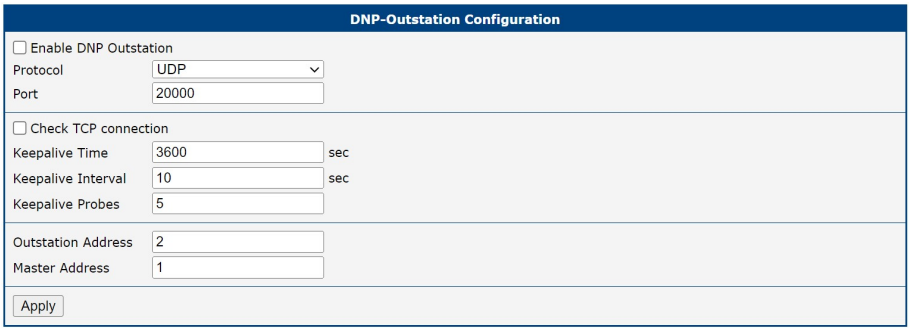

Figure 3: Configuration form *Global*

3.2 Application Layer

Configuration form *Application Layer* is intended to specify reading values. Selecting the value is done using check box in the *Enabled* column. The *Default Class* column allows user to set default class for selected value. This class is used for reading the selected value. The rule is that Class 1 has a higher priority than Class 2 and Class 2 has a higher priority than Class 3. The last column (*Status*) informs about the availability of a value:

- *OK* – It is possible to use this binary input.
- *Not built-in* – The router doesn't have built-in this binary input.
- *Not installed* – The router doesn't have installed the extended board.
- *Not available* – The router has installed the extended board but without this binary input.

3.2.1 Binary inputs

Index	Description
0	Binary input 0 – build in
1	Binary input 1 – build in
2	Binary input 2 – build in
3	Binary input 3 – build in
4	BIN1 XC-CNT board (position – PORT1)
5	BIN2 XC-CNT board (position – PORT1)
6	BIN3 XC-CNT board (position – PORT1)
7	BIN4 XC-CNT board (position – PORT1)
8	BIN1 XC-CNT board (position – PORT2)
9	BIN2 XC-CNT board (position – PORT2)
10	BIN3 XC-CNT board (position – PORT2)
11	BIN4 XC-CNT board (position – PORT2)

Table 4: Binary inputs

Note: The data point indexes were changed from the 1.4.0 version. If you use external BINs on the XC-CNT board and update from an older version, you will need to reconfigure indexes in your SCADA.

3.2.2 Analog values

In section *Analog Inputs* are additionally available columns *Low limit*, *High Limit* and *Deadband*. *Low limit* and *High Limit* specify the lower and upper limit for the value. *Deadband* item is important for situations where the value fluctuates around the low or high limit. If the value exceeds the low limit, a return to normality is identified at the time when the value is equal to *Low limit* + *Deadband*. This means that if the *Low limit* is set to 10 and *Deadband* is 2, a return to normality (when this low limit is exceeded) is identified at the time when the value is equal to 12.

For *High Limit* is the situation analogous. If the value exceeds the high limit, a return to normality is identified at the time when the value is equal to *High limit – Deadband*.

Index	Description
0	AN1 XC-CNT board (position – PORT1)
1	AN2 XC-CNT board (position – PORT1)
2	AN1 XC-CNT board (position – PORT2)
3	AN2 XC-CNT board (position – PORT2)
4	(Input) supply voltage – value must be divided by 1000
5	Router temperature in °C
6	Signal strength of GSM module
7	GPS Latitude in degrees – value must be divided by 1000000
8	GPS Longitude in degrees – value must be divided by 1000000

Table 5: Analog values

Note: GPS values are available only in routers with GNSS hardware support. GPS router app is necessary to be uploaded and run in these devices.

3.2.3 Counter inputs

Index	Description
0	Counter value CNT1 XC-CNT board (position – PORT1)
1	Counter value CNT2 XC-CNT board (position – PORT1)
2	Counter value CNT1 XC-CNT board (position – PORT2)
3	Counter value CNT2 XC-CNT board (position – PORT2)
4	Rx Data WLAN interface (in bytes)
5	Tx Data WLAN interface (in bytes)
6	Uptime in minutes
7	Router serial number

Table 6: Counter inputs

3.2.4 Number of Events

At the bottom of the *Application Layer* configuration form it is possible to set the number of events within a given class after which information about changing will be sent (items *Number of Class1 Events*, *Number of Class2 Events* and *Number of Class3 Events*).

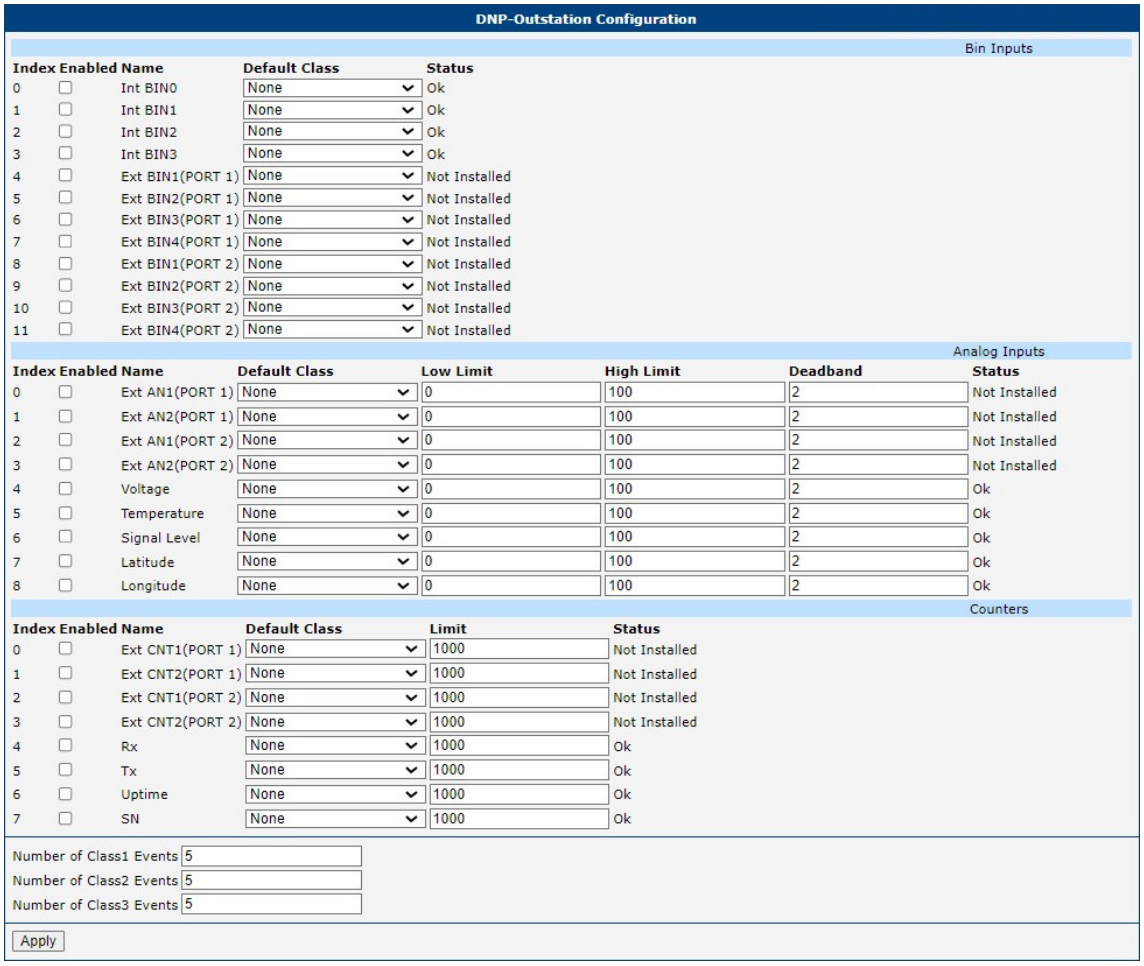

Figure 4: Configuration form *Application Layer*

3.3 Routing Targets

The *Routing Targets* form is used to configure the gateway for sending DNP3 messages. If the router is equipped with an expansion port through which it is possible to send DNP3 messages, form offers the possibility to configure this port (If no expansion port is available, this part of the configuration form is not displayed). The user can specify the following parameters:

Item	Description
Baudrate	Communication rate
Data Bits	Number of data bits
Parity	Control parity bit • **none** – no parity will be sent • **even** – even parity will be sent • **odd** – odd parity will be sent
Stop Bits	Number of stop bits
Split Timeout	Time to rupture report (message). If the gap (between two characters) longer than the value in milliseconds is recognized when receiving, then message from all received data is created and sent.

Table 7: Configuration of expansion ports

In the last section of this form (*Remote Connections*), it is possible to configure individual connections to remote routers. These connections will be used for creating "DNP routing table" on the *Routing Table* page. The user can specify the following parameters:

Item	Description
Description	Name or description of the connection
Type	Protocol type: • **TCP** – communication using a linked protocol TCP • **UDP** – communication using a unlinked protocol UDP
IP Address	Router IP address
Port	TCP/UDP port on which the communication will be effected

Table 8: Configuration of remote connections

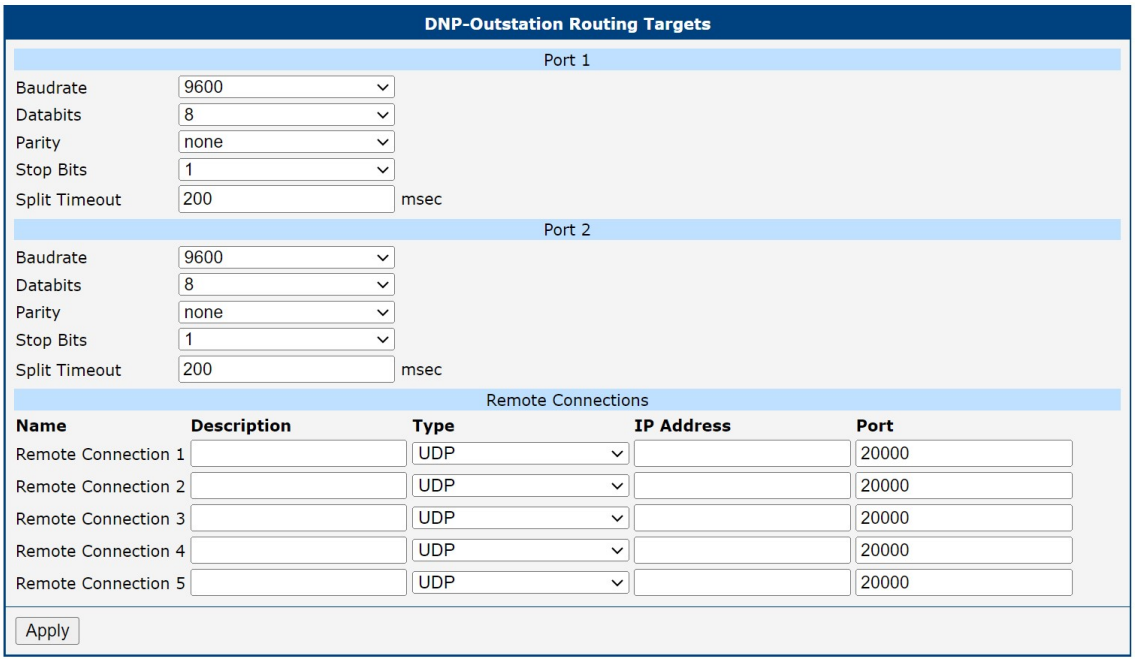

Figure 5: Configuration form *Routing Targets*

3.4 Routing Table

The *Routing Table* form defines "DNP routing table". This simply means that every *DNP Address* has been assigned to a specific connection defined on the *Routing Targets* page. Messages intended for specified DNP address are sent and received within this connection. The individual columns have the following meaning:

Item	Description
Name	Designation of the route (Route 1 – Route 10 by default)
Description	Name or description of the route (can be blank)
DNP Address	DNP Address
Target	Connection which is used for the selected DNP address. There are connections defined on the *Routing Targets* page (i.e. *Port 1*, *Port 2* and connections from the *Remote Connections* table).

Table 9: Configuration form *Routing Table*

At the bottom of this configuration form is *Send all remaining DNP3 messages to* _____ item using which it is possible to specify connection which is used for sending DNP3 messages in case that none of the above routes oblige.

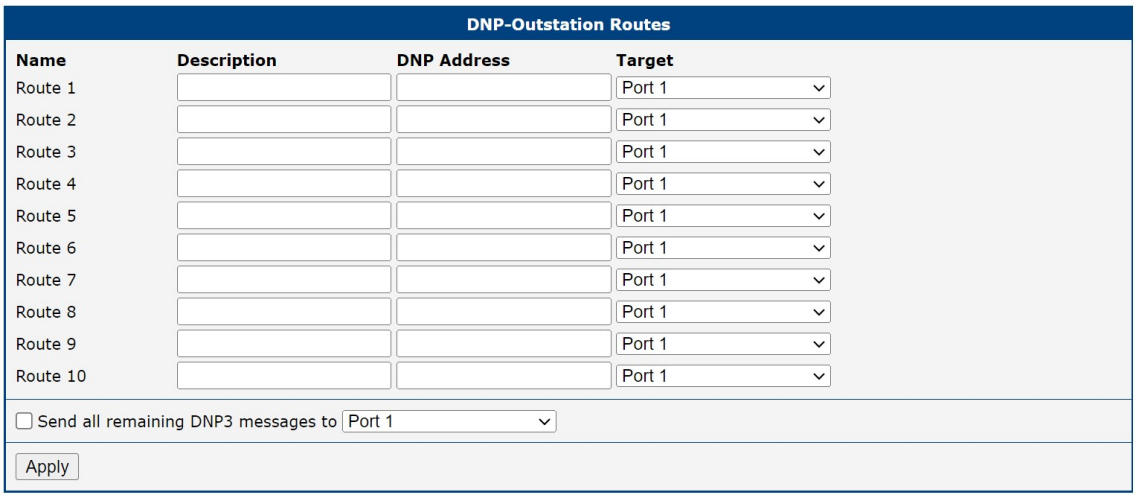

Figure 6: Configuration form *Routing Table*

4. Module activity monitoring

4.1 Statistical information

Page with statistical information can be invoked by clicking on the *Stats* item in the *Status* section of the module web interface. There is information such as number of sent and received frames, number of CRC errors and so on.

DNP-Outstation Stats

Datalink:	Rx Frames:	0
Datalink:	CRC Errors:	0
Datalink:	Rx Acks:	0
Datalink:	Rx Link Status:	0
Datalink:	Rx Reset Link:	0
Datalink:	Rx Test Link:	0
Datalink:	Rx User Data (Confirm):	0
Datalink:	Rx User Data (No Confirm):	0
Datalink:	Rx Request Link Status:	0
Datalink:	Rx FCB Incorrect:	0
Datalink:	Rx FCV Incorrect:	0
Datalink:	Tx Frames:	0
Datalink:	Tx Acks:	0
Datalink:	Tx Nacks:	0
Datalink:	Tx Link Status:	0
Datalink:	Tx User Data (No Confirm):	0
Transport:	Rx Rouge Seg:	0
Transport:	Rx Segment:	0
Transport:	Rx Bad Sequence number:	0
Transport:	Rx Bad CRC:	0
Application:	Tx Confirm:	0
Application:	Rx Unknown function code:	0
Application:	Tx Response:	0
Application:	Tx Unsoliced:	0

Figure 7: Statistics

4.2 System log

In case of any problems it is possible to view the system log by pressing the *System Log* menu item. In the window are displayed detailed reports from individual applications running in the router including possible reports relating to the *DNP3 Outstation* module.

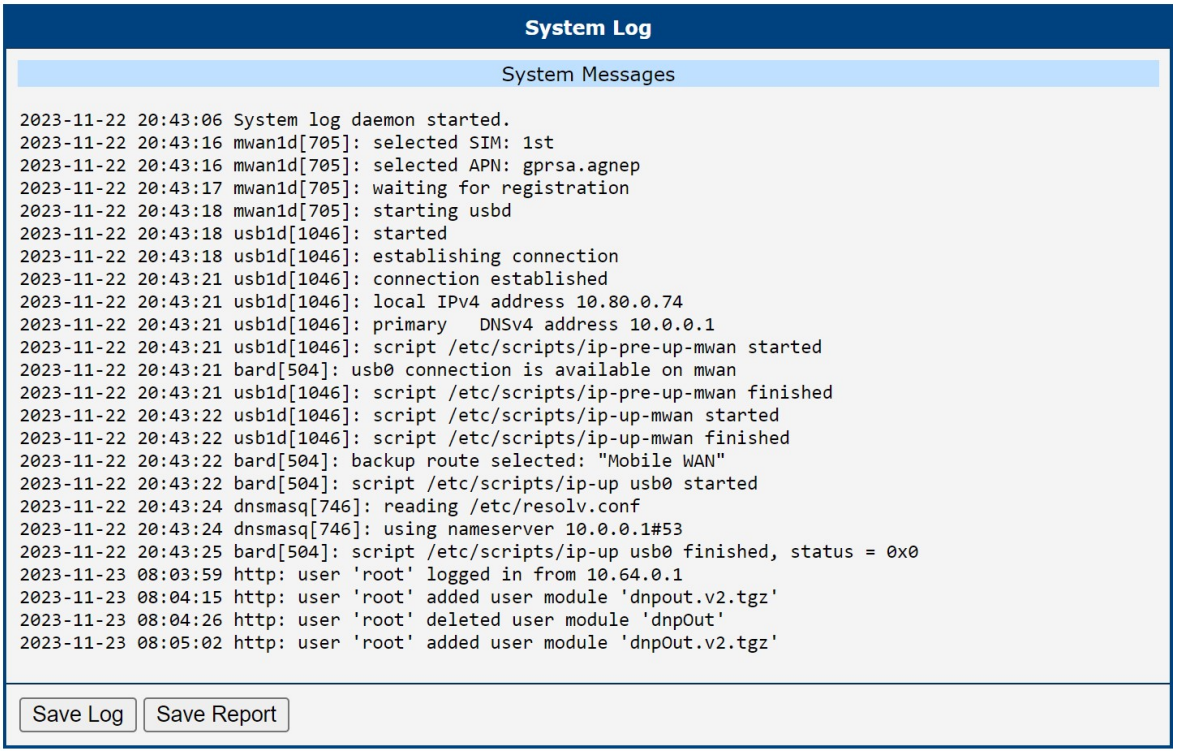

Figure 8: System log

5. Related Documents

You can obtain product-related documents on *Engineering Portal* at *icr.advantech.com* address.

To get your router's *Quick Start Guide*, *User Manual*, *Configuration Manual*, or *Firmware* go to the *Router Models* page, find the required model, and switch to the *Manuals* or *Firmware* tab, respectively.

The *Router Apps* installation packages and manuals are available on the *Router Apps* page.

For the *Development Documents*, go to the *DevZone* page.