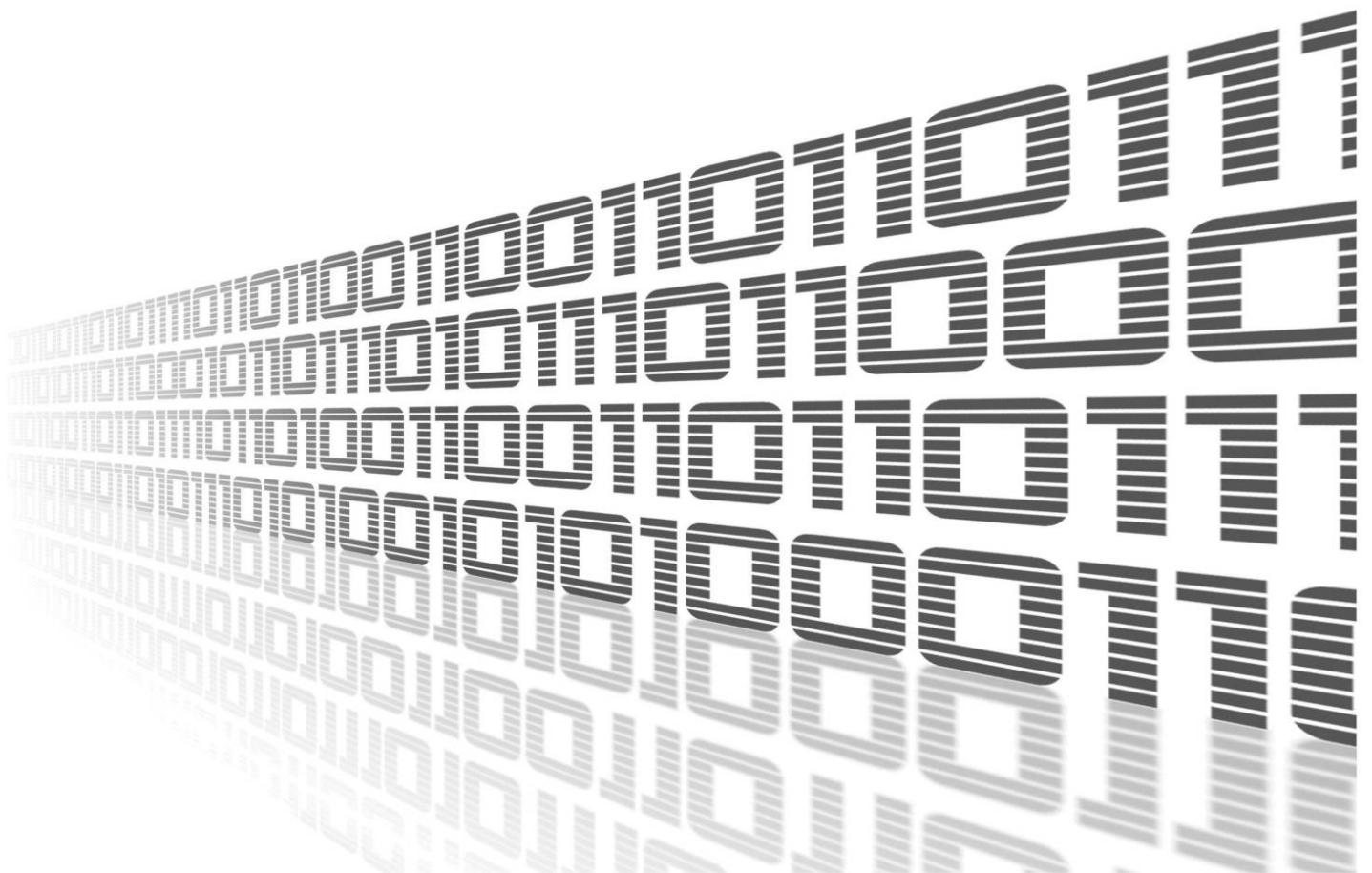


# ADVANTECH



## 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.

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# 1. Description of Router App



- This router app is not included in the standard router firmware. For instructions on how to upload and install router apps, refer to the *Configuration Manual*.
- This router app was tested on firmware version 6.3.10. If you update the router's firmware, please check for a compatible version of this app, as an update may be required.
- This manual is intended for the version of the router app that is not compatible with the v2 router platform.

The *DNP3 Outstation* router app enables the router to communicate using the DNP3 (Distributed Network Protocol v.3) protocol. The app provides two main functionalities:

- **DNP3 Outstation:** The router acts as an outstation (or slave device), collecting data from its own inputs (e.g., digital inputs, voltage, temperature) and system variables. It reports this data to a DNP3 master, which is typically a SCADA server.
- **DNP3 Gateway:** The router can also function as a gateway, routing DNP3 messages between the IP-based master and other DNP3 devices connected to the router's serial ports.

| Information     |
|-----------------|
| Statistics      |
| System Log      |
| Configuration   |
| Global          |
| Data Points     |
| Routing Targets |
| Routing Table   |
| Administration  |
| Return          |

Figure 1: Menu of Web Interface

The *DNP3 Outstation* router app has a web interface for configuration, which can be accessed by clicking the app's name on the *Router Apps* page of the main router web interface. The left pane of the web interface contains a menu for configuring and monitoring the app. It includes sections for *Information*, *Configuration*, and *Administration*. The *Administration* section contains the *Return* link, which takes you back to the main router web interface.

# 2. Configuration



If you are logged in with the *Usr* role, you will have read-only access to all configuration pages.

The *DNP3 Outstation* app is configured using the *Global*, *Data Points*, *Routing Targets*, and *Routing Table* pages, located in the *Configuration* section of the app's web interface.

## 2.1 Global

The *Global* page contains settings for the primary UDP/TCP connection and for verifying an established TCP connection. The *Enable DNP3 Outstation* checkbox activates the app. The other settings are described below.

DNP3 Outstation Global Configuration

☐ Enable DNP3 Outstation

Protocol

UDP

Port

20000

(default is 20000)

☐ Check TCP connection

Keepalive Time

3600

sec

Keepalive Interval

10

sec

Keepalive Probes

5

Outstation Address

2

Master Address

1

Apply

Figure 2: Configuration Form *Global*

| Protocol   |
|--|
| Selects the communication protocol. <ul style="list-style-type: none"><li>• <b>TCP – The connection-oriented TCP protocol.</b></li><li>• <b>UDP – The connectionless UDP protocol.</b></li></ul> |
| Port   |
| Specifies the port on which the router will listen for connections (default: 20000).   |

Table 1: Connection Configuration

Selecting the *Check TCP connection* checkbox enables keepalive probes to verify that an established TCP connection is still active. The following parameters can be configured:

|   |
|---|
| <b>Keepalive Time</b>   |
| The idle time in seconds before sending the first keepalive probe (default: 3600).                  |
| <b>Keepalive Interval</b>   |
| The time in seconds to wait for a response to a keepalive probe (default: 10).                      |
| <b>Keepalive Probes</b>   |
| The number of unacknowledged probes to send before considering the connection dropped (default: 5). |

Table 2: An Established TCP Connection Check

It is also necessary to specify the master and outstation device addresses:

|   |
|---|
| <b>Outstation Address</b>   |
| The DNP3 address of this router (the outstation).                           |
| <b>Master Address</b>   |
| The DNP3 address of the master device that will connect to this outstation. |

Table 3: Device Specification

## 2.2 Data Points

The *Data Points* page is used to configure which data points are enabled and how they are reported, refer to figure below.

| DNP3 Outstation Data Points Configuration  |                          |                  |               |                          |            |          |
|--|--------------------------|------------------|---------------|--------------------------|------------|----------|
| Binary Inputs  |                          |                  |               |                          |            |          |
| Index  | Enabled                  | Name             | Default Class |                          |            |          |
| 0  | <input type="checkbox"/> | Digital Input 0  | None          |                          |            |          |
| 1  | <input type="checkbox"/> | Digital Input 1  | None          |                          |            |          |
| 2  | <input type="checkbox"/> | Digital Input 2  | None          | Not available            |            |          |
| 3  | <input type="checkbox"/> | Digital Input 3  | None          | Not available            |            |          |
| Binary Outputs   |                          |                  |               |                          |            |          |
| Index  | Enabled                  | Name             | Default Class | Modifiable               |            |          |
| 0  | <input type="checkbox"/> | Digital Output 0 | None          | <input type="checkbox"/> |            |          |
| 1  | <input type="checkbox"/> | Digital Output 1 | None          | <input type="checkbox"/> |            |          |
| Analog Inputs  |                          |                  |               |                          |            |          |
| Index  | Enabled                  | Name             | Default Class | Low Limit                | High Limit | Deadband |
| 0  | <input type="checkbox"/> | Voltage          | None          | 0                        | 100        | 2        |
| 1  | <input type="checkbox"/> | Temperature      | None          | 0                        | 100        | 2        |
| 2  | <input type="checkbox"/> | Signal Strength  | None          | 0                        | 100        | 2        |
| 3  | <input type="checkbox"/> | Latitude         | None          | 0                        | 100        | 2        |
| 4  | <input type="checkbox"/> | Longitude        | None          | 0                        | 100        | 2        |
| Counters   |                          |                  |               |                          |            |          |
| Index  | Enabled                  | Name             | Default Class | Limit                    |            |          |
| 0  | <input type="checkbox"/> | WAN Rx           | None          | 1000                     |            |          |
| 1  | <input type="checkbox"/> | WAN Tx           | None          | 1000                     |            |          |
| 2  | <input type="checkbox"/> | Mobile Uptime    | None          | 1000                     |            |          |
| 3  | <input type="checkbox"/> | Serial Number    | None          | 1000                     |            |          |
| 4  | <input type="checkbox"/> | System Uptime    | None          | 1000                     |            |          |
| <input type="checkbox"/> Hold events until there are multiple<br>Class1 Min. Events <input type="text" value="5"/><br>Class2 Min. Events <input type="text" value="5"/><br>Class3 Min. Events <input type="text" value="5"/> |                          |                  |               |                          |            |          |
| <input type="button" value="Apply"/>   |                          |                  |               |                          |            |          |

Figure 3: Configuration Form *Data Points*

Data points are enabled using the checkbox in the *Enabled* column. In the *Default Class* column, you can assign a class to each data point. This class determines how event data is reported.



The following subsections describe the available data points, grouped by type.

### 2.2.1 Binary Inputs

| Index | Description                                |
|-------|--|
| 0     | Digital Input 0 – The first digital input  |
| 1     | Digital Input 1 – The second digital input |
| 2     | Digital Input 2 – The third digital input  |
| 3     | Digital Input 3 – The fourth digital input |

Table 4: Binary Inputs

### 2.2.2 Binary Outputs

| Index | Description                                  |
|-------|--|
| 0     | Digital Output 0 – The first digital output  |
| 1     | Digital Output 1 – The second digital output |

Table 5: Binary Outputs

When *Modifiable* column is checked, it is possible to change value of the binary output with a control command (selec-operate or direct operate). Only CROB LATCH variation is supported.

### 2.2.3 Analog Inputs

For *Analog Inputs*, you can also configure *Low Limit*, *High Limit*, and *Deadband* values for event generation. *Low Limit* and *High Limit* define the thresholds for the analog value. The *Deadband* value prevents multiple events from being generated when an analog value fluctuates near a limit. After a limit is crossed, the value must return past the limit by the deadband amount before it is considered to have returned to the normal range.

For example, if *Low Limit* is 10 and *Deadband* is 2, an event is triggered when the value drops below 10. The value is considered back to normal only after it rises above 12 (*Low Limit* + *Deadband*). Similarly, if *High Limit* is 50, an event is triggered when the value exceeds 50, and it returns to normal only after dropping below 48 (*High Limit* – *Deadband*).

| Index | Description  |
|-------|--|
| 0     | Input supply voltage. The value must be divided by 1000 to get the voltage in Volts. |
| 1     | Internal router temperature in degrees Celsius (°C).                                 |
| 2     | Signal strength of the cellular connection.  |
| 3     | GPS Latitude in degrees. The value must be divided by 1,000,000.                     |
| 4     | GPS Longitude in degrees. The value must be divided by 1,000,000.                    |

Table 6: Analog Inputs



- Note that the ability to read input voltage and router temperature is not available on all router models.
- GPS values are only available on routers with GNSS hardware. The *GPS* router app must also be installed and running on these devices.

## 2.2.4 Counters

| Index | Description   |
|-------|---|
| 0     | Received data on the primary WAN interface (in bytes).      |
| 1     | Transmitted data on the primary WAN interface (in bytes).   |
| 2     | Duration of the current mobile WAN connection (in minutes). |
| 3     | Serial number cut to only last 9 digits.                    |
| 4     | Total system uptime since the last reboot (in seconds).     |

Table 7: Counters

The limit, configured in *Limit* column, specifies how much a counter must increase a value to send an event.

## 2.2.5 Number of Events

The settings at the bottom of the page let you control when unsolicited event messages are sent. If the *Hold events until there are multiple* checkbox is unchecked, messages are sent immediately. If the checkbox is checked, messages are held until the queue for a given class reaches the number specified by *ClassX Min. Events*. Setting this value to 1 also causes messages to be sent immediately.

2.3 Routing Targets

The *Routing Targets* page is used to define communication endpoints (targets) for routing DNP3 messages. These targets can be local serial ports or remote IP connections. If the router has a serial expansion port, a section for configuring it will be displayed. This section is hidden if no serial port is available.

DNP3 Outstation Routing Targets

RS-232

Baudrate

9600

Databits

8

Parity

none

Stop Bits

1

Split Timeout

200

msec

RS-485

Baudrate

9600

Databits

8

Parity

none

Stop Bits

1

Split Timeout

200

msec

Remote Connections

| Name                | Description | Type | IP Address | Port  |
|---------------------|-------------|------|------------|-------|
| Remote Connection 1 |             | UDP  |            | 20000 |
| Remote Connection 2 |             | UDP  |            | 20000 |
| Remote Connection 3 |             | UDP  |            | 20000 |
| Remote Connection 4 |             | UDP  |            | 20000 |
| Remote Connection 5 |             | UDP  |            | 20000 |

Apply

Figure 4: Configuration Form *Routing Targets*

The user can specify the following serial port parameters:

|   |
|---|
| <b>Baudrate</b>   |
| Serial communication speed in bits per second (bps).  |
| <b>Databits</b>   |
| The number of data bits per character.  |
| <b>Parity</b>   |
| Parity bit for error checking. <ul style="list-style-type: none"><li>• none – No parity bit is used.</li><li>• even – Even parity is used.</li><li>• odd – Odd parity is used.</li></ul>                                |
| <b>Stop Bits</b>  |
| The number of stop bits to indicate the end of a character.   |
| <b>Split Timeout</b>  |
| The timeout in milliseconds for assembling message fragments. If a pause between received characters on the serial line exceeds this value, the router assumes the message is complete and processes the received data. |

Table 8: Configuration of Expansion Ports

The *Remote Connections* section allows you to define network targets. These defined targets will be available for selection in the DNP3 routing table.

| Description  |
|--|
| A user-friendly name or description for the remote connection.   |
| Type   |
| The network protocol to use for the connection. <ul style="list-style-type: none"><li>• <b>TCP – The connection-oriented TCP protocol.</b></li><li>• <b>UDP – The connectionless UDP protocol.</b></li></ul> |
| IP Address   |
| The IP address of the remote DNP3 device.  |
| Port   |
| The TCP or UDP port number of the remote DNP3 device.  |

Table 9: Configuration of *Remote Connections*

## 2.4 Routing Table

The *Routing Table* page allows you to create static routes for DNP3 messages. Each rule maps a destination *DNP3 Address* to a specific communication *Target* that was configured on the *Routing Targets* page. When the router receives a message for a specific DNP3 address, it forwards it to the corresponding target.

DNP3 Outstation Routing Table

| Name     | Description          | DNP3 Address         | Target   |
|----------|----------------------|----------------------|----------|
| Route 1  | <input type="text"/> | <input type="text"/> | RS-232 ▾ |
| Route 2  | <input type="text"/> | <input type="text"/> | RS-232 ▾ |
| Route 3  | <input type="text"/> | <input type="text"/> | RS-232 ▾ |
| Route 4  | <input type="text"/> | <input type="text"/> | RS-232 ▾ |
| Route 5  | <input type="text"/> | <input type="text"/> | RS-232 ▾ |
| Route 6  | <input type="text"/> | <input type="text"/> | RS-232 ▾ |
| Route 7  | <input type="text"/> | <input type="text"/> | RS-232 ▾ |
| Route 8  | <input type="text"/> | <input type="text"/> | RS-232 ▾ |
| Route 9  | <input type="text"/> | <input type="text"/> | RS-232 ▾ |
| Route 10 | <input type="text"/> | <input type="text"/> | RS-232 ▾ |

☐ Send all remaining DNP3 messages to RS-232 ▾

Apply

Figure 5: Configuration Form *Routing Table*

The individual columns have the following meaning:

| Name  |
|---|
| The name of the route (e.g., <i>Route 1</i> ).  |
| Description   |
| An optional description for the route.  |
| DNP3 Address  |
| The destination DNP3 address for this route.  |
| Target  |
| The communication endpoint for this route. The dropdown list contains all serial ports and remote connections defined on the <i>Routing Targets</i> page. |

Table 10: Configuration Form *Routing Table*

The *Send all remaining DNP3 messages to* option defines a default route. Any message for a DNP3 address not explicitly defined in the routing table will be sent to this selected target.

# 3. Application Activity Monitoring

## 3.1 Statistics

To view communication statistics, navigate to *Information* → *Statistics* in the app's web interface. This page displays low level statistics, including the number of frames sent and received, and the count of CRC errors.

### DNP3 Outstation

| Information           | DNP3 Outstation Statistics |                            |   |
|-----------------------|----------------------------|----------------------------|---|
| Statistics            | Datalink:                  | Rx Frames:                 | 0 |
| System Log            | Datalink:                  | CRC Errors:                | 0 |
| <b>Configuration</b>  |                            |                            |   |
| Global                | Datalink:                  | Rx Acks:                   | 0 |
| Data Points           | Datalink:                  | Rx Link Status:            | 0 |
| Routing Targets       | Datalink:                  | Rx Reset Link:             | 0 |
| Routing Table         | Datalink:                  | Rx Test Link:              | 0 |
| <b>Administration</b> |                            |                            |   |
| Return                | 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 Unsolicited:            | 0 |

Figure 6: Statistics

## 3.2 System Log

For troubleshooting, you can view detailed log messages by navigating to the *Information* → *System Log* page within the app's interface. This log is filtered to show only messages from the *DNP3 Outstation* app. To view the complete, unfiltered system log, navigate to *Status* → *System Log* in the main router web interface.

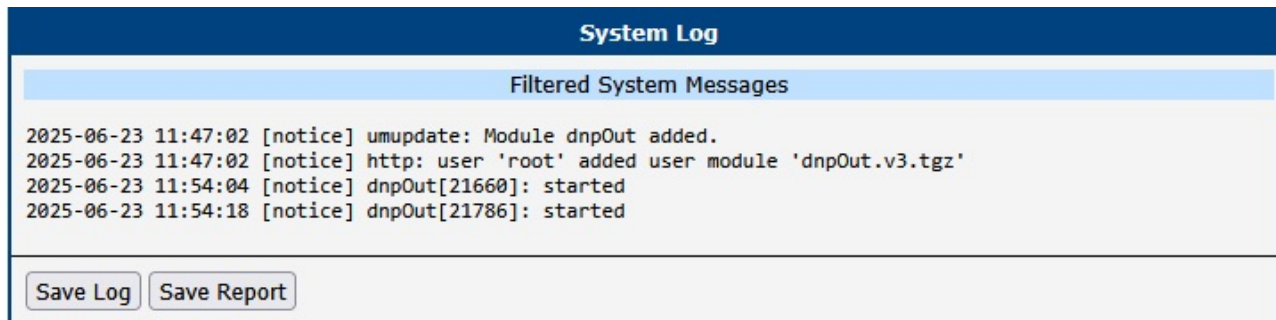


Figure 7: System Log

## 4. Related Documents

You can obtain product-related documents on the *Engineering Portal* at [icr.advantech.com](http://icr.advantech.com).

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 *Development Documents*, go to the [Development](#) page.