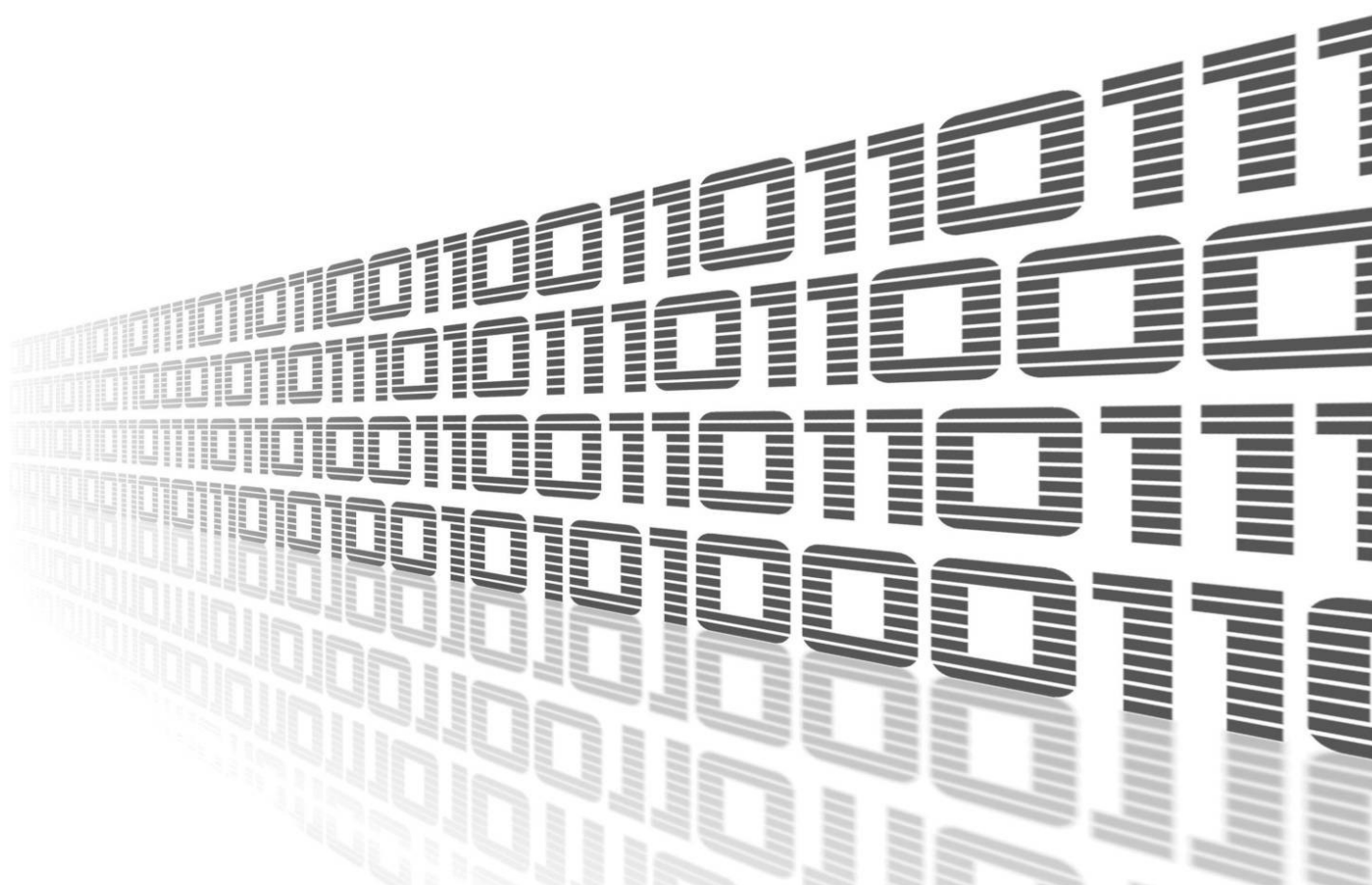




DNP3 Outstation



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Used symbols



Important

Important — Indicates a risk to personal safety or potential damage to the router. Follow these instructions precisely to prevent injury or equipment damage.



Warning

Warning — Highlights conditions that may cause malfunction, loss of data, or unexpected behavior in specific situations. Read carefully before proceeding.



Info

Info — Provides helpful tips, context, or references that improve understanding but are not strictly required to complete the task.

Contents

1. Description of Router App	1
2. Configuration	2
2.1 Global	2
2.2 Data Points	4
2.2.1 Binary Inputs	5
2.2.2 Binary Outputs	5
2.2.3 Analog Inputs	5
2.2.4 Counters	6
2.2.5 Message Confirmation	6
2.2.6 Number of Events	7
2.3 Routing Targets	8
2.4 Routing Table	10
3. Application Activity Monitoring	11
3.1 Statistics	11
3.2 System Log	12
4. Related Resources	13

List of Figures

1	Menu of web interface	1
2	Configuration form <i>Global</i>	2
3	Configuration form <i>Data Points</i>	4
4	Unsolicited response timing	7
5	Configuration form <i>Routing Targets</i>	8
6	Configuration form <i>Routing Table</i>	10
7	Statistics	11
8	System log	12

List of Tables

1	Connection configuration	2
2	An established TCP connection check	3
3	Device specification	3
4	Time synchronization	3
5	Binary inputs	5
6	Binary outputs	5
7	Analog inputs	5
8	Counters	6
9	Confirmation and resend settings	6
10	Select-before-operate configuration	7
11	Number of events configuration	7
12	Configuration of expansion ports	8

13	Configuration of <i>Remote Connections</i>	9
14	Configuration of <i>Routing Table</i>	10

1. Description of Router App

Warning

- 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.

The router app also supports synchronizing the router's system time from the DNP3 master; see the *Global* section below for details.

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



Warning

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

☐ Synchronize system time from master

Apply

Figure 2: Configuration form *Global*

Protocol
Selects the communication protocol.
• TCP – The connection-oriented TCP protocol. • UDP – The connectionless UDP protocol.
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:

Keepalive Time
The idle time in seconds before sending the first keepalive probe (default: 3600).
Keepalive Interval
The time in seconds to wait for a response to a keepalive probe (default: 10).
Keepalive Probes
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:

Outstation Address
The DNP3 address of this router (the outstation).
Master Address
The DNP3 address of the master device that will connect to this outstation.

Table 3: Device specification

If the router does not otherwise have an accurate system time, the outstation can synchronize it from the DNP3 master:

Synchronize system time from master
When enabled, the outstation requests time synchronization from the DNP3 master and uses the received time to set the router’s system clock. Disabled by default.

Table 4: Time synchronization



Info

When DNP3 time synchronization is enabled, disable NTP synchronization in *Services* to prevent the system time from being changed by two sources at once. Note that an NTP server or GNSS are more precise time sources than DNP3.

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	☐	Digital Input 0	None			
1	☐	Digital Input 1	None			
2	☐	Digital Input 2	None	Not available		
3	☐	Digital Input 3	None	Not available		
Binary Outputs						
Index	Enabled	Name	Default Class	Modifiable		
0	☐	Digital Output 0	None	☐		
1	☐	Digital Output 1	None	☐		
Analog Inputs						
Index	Enabled	Name	Default Class	Low Limit	High Limit	Deadband
0	☐	Voltage	None	0	100	2
1	☐	Temperature	None	0	100	2
2	☐	Signal Strength	None	0	100	2
3	☐	Latitude	None	0	100	2
4	☐	Longitude	None	0	100	2
Counters						
Index	Enabled	Name	Default Class	Limit		
0	☐	WAN Rx	None	1000		
1	☐	WAN Tx	None	1000		
2	☐	Mobile Uptime	None	1000		
3	☐	Serial Number	None	1000		
4	☐	System Uptime	None	1000		
Confirmation Timeout		5		(default is 5 s)		
Message Resend Delay		3		(default is 3 s)		
Message Resend Limit		9		(default is 9)		
Select-Before-Operate Timeout		10		(default is 10 s)		
☐ Hold events until there are multiple						
Class1 Min. Events		5				
Class2 Min. Events		5				
Class3 Min. Events		5				
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 5: 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 6: 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 7: Analog inputs

Warning

- 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 8: Counters

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

2.2.5 Message Confirmation

The outstation requires the master to confirm receipt of unsolicited responses, and of solicited responses that contain events. The following parameters configure the confirmation timeout and resend behavior:

Confirmation Timeout

Time, in seconds, the outstation waits for a confirmation from the master after sending an unsolicited response, or a solicited response that contains events (default: 5).

Message Resend Delay

Time, in seconds, the outstation waits after a confirmation timeout before resending an unconfirmed unsolicited response (default: 3).

Message Resend Limit

Maximum number of times an unsolicited response is resent without confirmation before the outstation stops sending unsolicited responses, until data is read again (default: 9).

Table 9: Confirmation and resend settings

Info

The *Message Resend Delay* and *Message Resend Limit* parameters apply only to unsolicited responses. If a confirmation timeout occurs for a solicited response (one sent in reply to a request from the master), the outstation does not resend it – the events remain queued and are reported again on the next read. This behavior is required by the DNP3 standard.

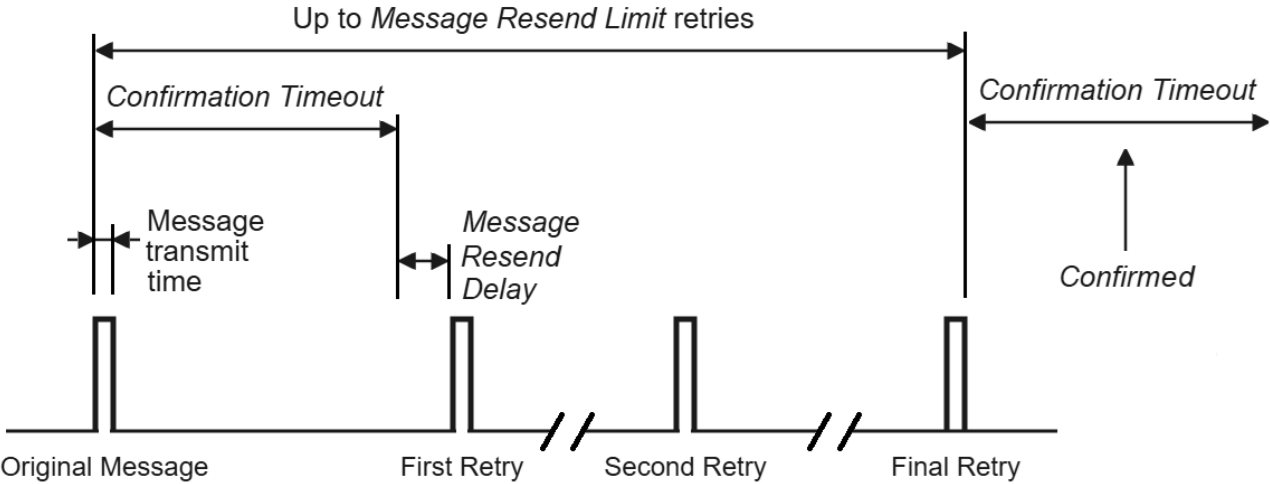


Figure 4: Unsolicited response timing

The figure above shows the worst case, where the master does not confirm receipt until the final retry. If a CONFIRM is received earlier, the outstation stops the retry sequence at that point instead.

The following parameter applies to controlling digital outputs using the select-before-operate sequence (see *Binary Outputs* above):

Select-Before-Operate Timeout

Time, in seconds, the outstation waits for the operate command after receiving a select command for a digital output, before the selection expires (default: 10).

Table 10: Select-before-operate configuration

2.2.6 Number of Events

The following parameters, at the bottom of the page, control when unsolicited event messages are sent:

Hold events until there are multiple

When unchecked, unsolicited event messages are sent immediately. When checked, messages are held until the queue for a given class reaches the number specified by *ClassX Min. Events*.

ClassX Min. Events

Number of queued events for class X that triggers sending an unsolicited message. Setting this value to 1 also causes messages to be sent immediately. Applicable only if *Hold events until there are multiple* is selected.

Table 11: Number of events configuration

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 5: Configuration form *Routing Targets*

The user can specify the following serial port parameters:

Baudrate
Serial communication speed in bits per second (bps).
Databits
The number of data bits per character.
Parity
Parity bit for error checking.
• none – No parity bit is used. • even – Even parity is used. • odd – Odd parity is used.
Stop Bits
The number of stop bits to indicate the end of a character.
Split Timeout
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 12: 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. • TCP – The connection-oriented TCP protocol. • UDP – The connectionless UDP protocol.
IP Address
The IP address of the remote DNP3 device.
Port
The TCP or UDP port number of the remote DNP3 device.

Table 13: 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			RS-232 ▼
Route 2			RS-232 ▼
Route 3			RS-232 ▼
Route 4			RS-232 ▼
Route 5			RS-232 ▼
Route 6			RS-232 ▼
Route 7			RS-232 ▼
Route 8			RS-232 ▼
Route 9			RS-232 ▼
Route 10			RS-232 ▼

☐ Send all remaining DNP3 messages to RS-232 ▼

Apply

Figure 6: 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 14: Configuration of *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 for the datalink, transport, and application layers of the DNP3 protocol, including the number of frames sent and received, and the count of CRC errors.

DNP3 Outstation Statistics		
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 Unsolicited:	0

Figure 7: 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.

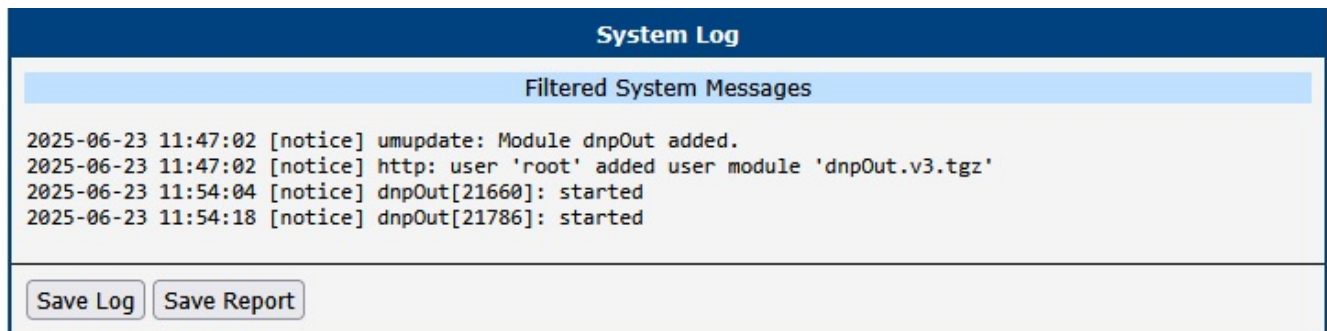


Figure 8: System log

4. Related Resources

You can obtain all product-related documents, software updates, and supplementary materials on the Advantech *Engineering Portal* at icr.advantech.com.

For easy access to specific resources, please refer to the following sections of the portal:

- **Router Support Materials:** To access your router's supporting documents (such as the *Hardware Manual* and *Configuration Manual*), the latest firmware, or other technical resources, navigate to *Support* → [Router Models](#). Locate your specific model and select the appropriate tab under the *Documents to download* section. Available tabs include *Brochures*, *Manuals*, *Certificates*, *Firmware*, *Images/3D Models*, *PCN/SA*, and *Others*.
- **Router Apps:** To extend your router's functionality, installation packages and comprehensive manuals for various extension modules are available by navigating to *Download* → [Router Apps](#).
- **Application Notes:** For detailed guides, configuration examples, and step-by-step instructions for implementing specific networking features and use cases, navigate to *Download* → [Application Notes](#).
- **Development Documents:** If you are interested in custom scripting, programming your own applications, or compiling custom modules, navigate to [Development](#) page.