12.2 DNP 3.0 Master

Default groups and variation sets are used to send commands. If slave devices support different groups and variations, they can be adjusted in Excel configuration. For more information check section Excel configuration.

Configuring data points

To use DNP3 Master in WCC Lite, it has to be configured via an Excel configuration. This configuration contains two Excel sheets where parameters have to be filled in Devices and Signals.

DNP3 Master parameters for Devices tab

Parameter	Type	Description	Required		Default Value (when not specified)	Range	
			TCP/ TLS	Serial ◀ ▶		Min	Max
name	string	User-friendly device name	Yes	Yes			
description	string	Description of a device	No	No			
device_alias	string	Alphanumeric string to identify a device	Yes	Yes			
enable	boolean	Enabling/disabling of a device	No	No	1	0	1
protocol	string	Protocol to be used ("dnp3 serial"/"dnp3 tcp" (case insensitive))	Yes	Yes		DNP3 TCP, DNP3 serial	
mode	string	Choosing between TCP, TLS and SERIAL modes. If the protocol provided DNP3 TCP mode defaults to tcp and if DNP3 serial is provided mode defaults to serial	No	No	TCP (for DNP3 TCP) SERIAL (for DNP3 serial)	TCP, TLS (for DNP3 TCP) SERIAL (for DNP3 serial)	
host	string	The IP address of the TCP slave device	Yes	-			
bind_address	string	The IP address of the network adapter used to connect to the slave device	No	No	0.0.0.0		
port	integer	TCP communication port	No	No	20000		
device	integer	Communication port ("PORT1" or "PORT2")	-	Yes			
baudrate	integer	Communication speed, bauds/s	-	No	9600	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600,115200	

databits	integer	Data bit count for communication	-	No	8	6	9
stopbits	integer	Stop bit count for communication	-	No	1	1	2
parity	string	Communication parity option	-	No	none	none, even, odd	
flowcontrol	string	Communication device flow control option.	-	No	none	none	
tls	boolean	Enable/disable the use of TLS	Yes (for TLS)	-	0	0	1
tls_local_certificate	string	Local certificate for TLS connection	Yes (for TLS)	-			
tls_peer_certificate	string	Certificate authority file for TLS connection	No (for TLS)	-			
tls_private_key	string	A file consisting of the private key for TLS connection	No (for TLS)	-			
max_rx_frag_size	integer	Maximum size of a received fragment.	No	No	2048	0	2048
destination_address	integer	Address of a master station	No	No	1	0	65535
source_address	integer	Address of a slave (local) station.	No	No	1	0	65535
unsol_classes	string	Defines which classes will have unsolicited actions on startup. (Example: "1,3,2")	No	No	no class	1	3
unsol_disable	bool	Disables unsolicited messages on startup. The parameter is going to be ignored if the unsol_classes parameter has any values assigned.	No	No	0	0	1

groups_scan_mask	integer	Bitmask for enabling separate group scans with x06 qualifier (all objects). The parameter value is converted into a binary number where each bit stands for a separate group. Bits indexes and the groups that they represent: 0 - Binary, 1 - Doublebit Binary, 2 - Binary Output Status, 3 - Counter, 4 - Frozen Counter, 5 - Analog, 6 - Analog Output Status, 7 - Octet String (Example: 115 (0111 0011) will trigger data polls for signals whose types are - Binary, Double-bit Binary, Frozen Counter, Analog, Analog Output Status)	No	No	0	0	255
groups_scan_interval	integer, string	The time between separate groups scans intervals in seconds. Set to 0 to disable.	No	No	0	0	
exception_scan_interval	integer, string	The time between exception scan (classes 1,2,3) intervals in seconds. Set to 0 to disable.	No	No	0	0	
integrity_scan_interval	integer, string	Time between integrity scan (classes 0,1,2,3) intervals in seconds (general interrogation). Set to 0 to disable.	No	No	0	0	
timesync_mode	string	Will override the master default setting for choosing the time sync procedure	No	No	NON-LAN (for Serial) LAN (for tcp)	LAN, NON-LAN	
time_sync_interval_sec	integer, string	Periodic time sync interval in seconds. If > 0 - time syncs are forced and periodic. If = 0 - time syncs react to IIN bits from the slave. If < 0 - time syncs are disabled.	No	No			
select_ms	integer	Select command timeout. Valid for all signals.	No	No	10000		
timeout_ms	integer	Response timeout in milliseconds	No	No	2000		
keep_alive_timeout	integer	The time interval for sending a keep-alive packet in milliseconds.	No	-	60		
use_local_time	boolean	if enabled (1) communication uses system time instead of UTC.	No	No	0	0	1

DNP3 Master parameters for the Signals tab

Parameter	Type	Description	Required		Default Value (when not specified)	Range	
			TCP	RTU		Min	Max
signal_name	string	User-friendly signal name	Yes	Yes			
device_alias	string	Device alias from a Devices tab	Yes	Yes			
signal_alias	string	Unique alphanumeric name of the signal to be used	Yes	Yes			
enable	boolean	Enabling/disabling a device	No	No	1	0	1
index	integer	Index of a signal.	Yes	Yes		0	65535
log	boolean	Enable logging in the event log	No	No	0	0	1
signal_type	string	DNP3 signal type. (case insensitive)	Yes	Yes		"binary", "doublebitbinary", "binaryoutputstatus", "binaryoutputcommand", "counter", "frozencounter", " analogue", "analogoutputstatus", "analogoutputcommand", "timeandinterval", "octetstring"	
command_variation	integer	DNP3 command variation. *Supported variations depend on signal type and are provided in the table below*	No	No	1	0	4
static_variation	integer	DNP3 command variation (). Supported variations depend on signal type and are provided in the table below.	No	No		0, 1, 2, 3, 4, 5, 6, 9, 10	
event_variation	integer	DNP3 command variation. Supported variations depend on signal type and are provided in the table below.	No	No		0	8
control_code	string	DNP3 control model code of CROB signal. TripClose and Pulse control model requires **PulseOn/off** times to be set	Yes	Yes		LATCH, PULSE, TRIPCLOSE	
pulse_on_time_ms	integer	Pulse ON time in milliseconds, when using Pulse or TripClose control models must be set	Yes	Yes			

pulse_off_time_ms	integer	Pulse OFF time in milliseconds, when using Pulse or TripClose control models must be set	Yes	Yes			
class_num	integer	Class assignment of the signal.	No	No	0	0	3
operate_type	integer	Default command behaviour. If selected: "**-1**" - DirectOperateNoAck (FC=6), "**0**" - DirectOperate (FC=5), "**1**" - SelectBeforeOperate (FC=3).	No	No	1	-1	1
job_todo	string	The device status signal can be configured by providing one of the given values.	No	No		communication_status, device_running, device_error, unknown_error	

Device status signals

To configure any device status signal for the DNP3 protocol additional job_todo column is required. For DNP3 master required parameters for status signal will be: **signal_name, device_alias, signal_alias, index, signal_type**, **event_variation** (1,2 or 3) and **job_todo**. There are 4 possible signals: communication_status, device_running, device_error, uknown_error. Each signal has 4 possible values and is based on the same logic. If the signal returns the value of 0, it means an unknown error has appeared, 1 – device or protocol connection is on and working properly, 2 – device is off or protocol is disconnected, 3 – error or service is down.

Command variations

Signal Type	Available Command Variation	Default Command Variation
Binary Output Command (Group12)	0, 1	1
Analog Output Command (Group41)	0, 1, 2, 3, 4	1

Static and Event variations

Signal Type	Available Variations	Default Variations
Binary	Static variation (Group1) 1, 2 Event variation (Group2) 1, 2, 3	Static variation 2 Event variation 1
Double Binary	Static variation (Group3) 2 Event variation (Group4) 1, 2, 3	Static variation 2 Event variation 1
Binary Output Status	Static variation (Group10) 1, 2 Event variation (Group11) 1, 2	Static variation 2 Event variation 1
Counter	Static variation (Group20) 1, 2, 5, 6 Event variation (Group22) 1, 2, 5, 6	Static variation 1 Event variation 1
Frozen Counter	Static variations (Group21) 1, 2, 5, 6, 9,10 Event variation (Group23) 1, 2, 5, 6	Static variation 1 Event variation 1
Analog	Static variation (Group30) 1, 2, 3, 4, 5, 6 Event variation (Group32) 1, 2, 3, 4, 5, 6, 7, 8	Static variation 1 Event variation 1
Analog Output Status	Static variation (Group40) 1, 2, 3, 4 Event variation (Group42) 1, 2, 3, 4, 5, 6, 7, 8	Static variation 1 Event variation 1
Time and Interval	Static variation (Group50) 1	Static variation 1
Octet String	Static variation (Group110) 0 Event variation (Group111) 0	Static variation 0 Event variation 0

Debugging the DNP3 Master service

If the configuration for DNP3 devices is set up, a handler for the protocol will start automatically. If the configuration is missing or contains errors, the protocol will not start. It is done intentionally to decrease unnecessary memory usage.

DNP3 protocol runs a service called **dnp3-master**. If DNP3 does not work properly (e.g. no communication between devices, data is corrupted, etc.), a user can launch a debug session from the command line interface and find out why the link is not functioning properly. To launch a debugging session, a user should stop the **dnp3-master** process and run the **dnp3-master** command with respective flags as in the table given below.

Procedure for DNP3 Master protocol service debugging:

- **Step 1**: Service must be stopped by entering the following command into the wcclite: **/etc/init.d/dnp3-master stop**
- **Step 2**: After the service is stopped it must be started with the preferred configuration file (JSON files found in the /etc/ folder) and a debug level 7: **dnp3-master -c /etc/dnp3-master/dnp3master.json -d7**Additional output forming options described in the table below.
- **Step 3**: Once the problem is diagnosed normal operations can be resumed with the following command: **/etc/init.d/dnp3-master start**

dnp3-master command line debugging options

Option	Description
-h [–help]	Display help information
-V [–version]	Show version
-p [–port]	Show output for one port only
-d <debug level>	Set debugging level
-c [–config]	Config path
-a [–app]	Show application layer data
–l [–link]	Show link layer data
–t [–transport]	Show transport layer data
-r [–redis]	Show Redis messages
-R [–readyfile]	Ready notification file