

# 14.5 IEC 60870-5-104 Master

IEC 60870-5-104 protocol (in short IEC 104) is a part of IEC Telecontrol Equipment and Systems Standard IEC 60870-5 that provides a communication profile for sending basic telecontrol messages between two systems in electrical engineering and power system automation. Telecontrol means transmitting supervisory data and data acquisition requests for controlling power transmission grids.

IEC 104 provides network access to IEC 60870-5-101 (in short IEC 101) using standard transport profiles. In simple terms, it delivers IEC 101 messages as application data (L7) over TCP, usually port 2404. IEC 104 enables the communication between the control station and a substation via a standard TCP/IP network. The communication is based on the client-server model.

 To set up TLS connection for both IEC104 Master and Slave, refer to sections Excel configuration and Certificates. All keys and certificates should be provided in the PEM format.

 If no configuration is set up, IEC104 Master and Slave services are not started.

## Configuring IEC 104 Master datapoints

To use IEC 60870-5-104 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.

### IEC 60870-5-104 Master parameters for *Devices* tab

| Parameter              | Type    | Description  | Required | Default value<br>(when not specified) | Range                  |       |
|------------------------|---------|--|----------|---------------------------------------|------------------------|-------|
|                        |         |  |          |                                       | Min                    | Max   |
| name                   | string  | User-friendly name for a device  | Yes      |                                       |                        |       |
| description            | string  | Description of a device  | No       |                                       |                        |       |
| device_alias           | string  | Alphanumeric string to identify a device   | Yes      |                                       |                        |       |
| enable                 | boolean | Enabling/disabling of a device   | No       | 1                                     | 0                      | 1     |
| protocol               | string  | Protocol to be used  | Yes      |                                       | IEC 60870-5-104 master |       |
| asdu_address           | integer | Application Service Data Unit address  | Yes      |                                       | 0                      | 65535 |
| asdu_size              | integer | Common address size in bytes   | No       | 2                                     | 1                      | 3     |
| time_sync_interval_sec | integer | Time frame between Time Synchronization requests in seconds                              | No       | 60                                    |                        |       |
| gi_interval_sec        | integer | Time frame between General Interrogation requests in seconds. If 0 requests are disabled | No       | 300                                   |                        |       |
| port                   | integer | TCP port   | Yes      |                                       | 0                      | 65535 |

|            |         |  |     |    |   |     |
|------------|---------|--|-----|----|---|-----|
| ioa_size   | integer | Information object address (IOA) size in bytes                           | No  | 3  | 1 | 3   |
| swt        | integer | Send window (SWT)  | Yes |    |   |     |
| rwt        | integer | Receive window (RWT)   | Yes |    |   |     |
| cot_size   | integer | Cause of transmission (COT) size in bytes                                | No  | 2  | 1 | 2   |
| ip         | string  | Host IP address (ipv4)   | Yes |    |   |     |
| t1         | integer | Acknowledge timeout t1 (sec)   | No  | 15 |   |     |
| t2         | integer | Connection ACKRSN clock t2 (sec)   | No  | 10 |   |     |
| t3         | integer | Connection TESTFR clock t3 (sec)   | No  | 20 |   |     |
| originator | integer | Provides a means for a controlling station to explicitly identify itself | No  | 0  | 0 | 255 |

### IEC 60870-5-104 Master parameters for *Signals*

| Parameter             | Type    | Description   | Required     | Default value<br>(when not specified) | Range |     |
|-----------------------|---------|---|--------------|---------------------------------------|-------|-----|
|                       |         |   |              |                                       | Min   | Max |
| signal_name           | string  | User-friendly signal name   | Yes          |                                       |       |     |
| device_alias          | string  | Alphanumeric string to identify a device  | Yes          |                                       |       |     |
| signal_alias          | string  | Unique alphanumeric name of the signal to be Yes used   | Yes          |                                       |       |     |
| source_device_alias   | string  | device_alias of a source device   | For commands |                                       |       |     |
| source_signal_aliases | string  | signal_alias of a source signal   | For commands |                                       |       |     |
| enable                | boolean | Enabling/disabling of an individual signal  | No           | 1                                     | 0     | 1   |
| log                   | integer | Allow signal to be logged. If <b>log is 0</b> signal will not be logged. If <b>log is more than 0</b> signal will be logged | No           | 0                                     |       |     |
| gi                    | boolean | Including/excluding (1 or 0) signal from General Interrogation  | No           | 0                                     | 0     | 1   |
| common_address        | integer | Address of a destination device   | Yes          |                                       |       |     |
| function              | integer | Function number   | No           | 0                                     |       |     |
| info_address          | integer | Information object address  | Yes          |                                       |       |     |

|           |         |  |    |   |  |  |
|-----------|---------|--|----|---|--|--|
| data_type | integer | ASDU type identifier   | No |   |  |  |
| select_ms | integer | Time limit in milliseconds for command execution. Command select has to be performed before execution if this parameter is specified. Direct command execution can be performed only if this field is left empty or set to zero. | No | 0 |  |  |

## Debugging an IEC 60870-5-104 Master application

If the configuration for IEC 60870-5-104 devices is set up, the handler for the protocol will start automatically. If a configuration is missing or contains errors, the protocol will not start. It is done intentionally to decrease unnecessary memory usage.

If IEC 60870-5-104 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 or use WCC Utility to do that.

To launch a debugging session, a user should stop the *iec104-master* process and run the *iec104-master* command with respective flags.

- Step 1: Service must be stopped by entering the following command into the wccite:  
**/etc/init.d/iec104-master stop**
- Step 2: After service is stopped it must be started with the preferred configuration file (JSON files found in /etc/ folder) and a debug level 7: **iec104-master -c /etc/iec104-master/iec104-master.json -d7**
- Step 3: Once the problem is diagnosed normal operations can be resumed with the following command:  
**/etc/init.d/iec104-master start**

### IEC 60870-5-104 command-line debugging options

```
-h [ -help ] Display help information
-V [ -version ] Show version
-d<debug level> Set debugging level
-c [ -config ] Config path
-r [ -raw ] Show raw telegram data
-f [ -frame ] Show frame data
-e [ -redis ] Show redis message
-R [ -readyfile ] Ready notification file
```

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