

14.4 IEC 60870-5-103 Master

The IEC 60870-5-103 protocol is a companion standard for the informative interface of protection equipment. Standard IEC 60870-5-103 was prepared by IEC Technical Committee 57 (Power system control and associated communications). It is a companion standard for the basic standards in series IEC 60870-5:

Standard IEC 60870-5-103 defines communication between protection equipment and devices of a control system (supervisor or RTU) in a substation.

Standard IEC 60870-5-103 defines a multipoint communication protocol via exchanging information between a control system (supervisor or RTU) and one or more protection devices. The control system is the master and the protection devices are the slaves. Each slave is identified by a unique address between 1 and 254. Address 255 is reserved for broadcast frames.

IEC 60870-5-103 Master

Configuring datapoints

WCC Lite supports IEC 60870-5-103 Master protocol over a serial link (according to EIA RS-485). Its full functionality list can be found in an [IEC 60870-5-103 PID Interoperability List](#).

The IEC 60870-5-103 Master in WCC Lite has to be configured in Excel. This configuration contains two Excel sheets where parameters must be filled in - Devices and Signals.

IEC 60870-5-103 parameters for Devices tab

| Parameter | Type | Description | Required | Default value (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 60870-5-103 master | |
| device | string | Communication port | Yes | | PORT1 | PORT2 |
| baudrate | integer | Communication speed (bauds/s) | No | 9600 | 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 | |
| databits | integer | Data bit count for communication | No | 8 | 8 | |
| stopbits | integer | Stop bit count for communication | No | 1 | 1 | 2 |
| parity | string | Communication parity option | No | none | none, even, odd | |

| | | | | | | |
|------------------------|---------|--|-----|------|------|-------|
| flowcontrol | string | Number of requests, before the link is considered lost (device status signals are changed) and reconnect attempt will be issued | No | none | none | |
| link_address | integer | Destination address when in transmit and source address when broadcasting | Yes | | 0 | 65535 |
| asdu_address | integer | Application Service Data Unit address | Yes | | 0 | 65535 |
| time_sync_interval_sec | integer | The time frame between Time Synchronization requests in seconds. If 0 requests are disabled. | No | 60 | | |
| gi_interval_sec | integer | The time frame between General Interrogation requests in seconds if 0 requests are disabled | No | 300 | | |
| scan_rate_ms | integer | Polling interval in milliseconds. The time frame between two telegrams from the master. | No | 100 | | |
| timeout_ms | integer | Response timeout in milliseconds | No | 1000 | | |
| serial_delay | integer | Communication device's serial delay in milliseconds. Time frame in which the master station is not TX'ing after the last RX byte | No | 50 | | |
| retry_count | integer | Number of retries of failed requests before announcing that the device is in Error state | No | 3 | | |
| retry_delay_ms | integer | Time before the next retry in milliseconds | No | 500 | | |
| reset_command_type | string | The user can choose the reset command type between FCB and CU. | No | FCB | FCB | CU |

IEC 60870-5-103 master parameters for Signals tab

| Parameter | Type | Description | Required | Default value (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 the log is 0, the signal will not be logged. If the log is more than 0 signal will be logged | No | 0 | | |
| gi | boolean | Including/excluding (1 or 0) signals 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 | | | |
| info_number | integer | Information number | Yes | | | |
| data_type | integer | ASDU type identifier | No | 0 | 0, 1, 2, 3, 4, 9, 20 | |
| fleeting | boolean | Mark the signal as a fleeting type (1 or 0). Fleeting signals have to go to DPI::OFF after a defined time | No | | 0 | 1 |
| normalise_time_ms | integer | Time in milliseconds between station receiving DPI::ON and automatically switching to DPI::OFF | If fleeting is used | 100 | | |
| periodic_update_ms | integer | Signal value is published periodically according to the value set. | No | - | - | - |

Device status signals

IEC 60870-5-103 has an additional signal which can be configured to show communication status. It indicates if the slave device has disconnected from the master (WCC Lite). To configure such signal for IEC 60870-5-103 protocol, **job_todo** and **tag_job_todo** fields with string values are required. For IEC 60870-5-103 master required parameters for the status signal will be: **signal_name device_alias, signal_alias, common_address, info_address, info_number, job_todo** and **tag_job_todo**. Job_todo value must be *device_status* and for tag_job_todo there are 4 variations: *communication_status*, *device_running*, *device_error*, *unknown_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.

Debugging an IEC 60870-5-103 Master application

If the configuration for IEC 60870-5-103 devices is set up, the handler for the protocol will start automatically. If a configuration is missing parameters or contains errors, the protocol will not start. It is done intentionally to decrease unnecessary memory usage.

If IEC 60870-5-103 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 iec103-master process and run the iec103-master command with respective flags.

- Step 1: Service must be stopped by entering the following command into the WCC Lite:

```
/etc/init.d/iec103-master stop
```

- Step 2: After the service is stopped it must be started with the preferred configuration file (JSON files found in /etc/ folder) and a debug level 7:

```
iec103-master -c /etc/iec103-master/ttyPORT1.json -d7
```

- Step 3: Once the problem is diagnosed normal operations can be resumed with the following command:

```
/etc/init.d/iec103-master start
```

IEC 60870-5-103 command line debugging options

```
-h [ -help ] Display help information  
-V [ -version ] Show version  
-d<debug level> Set debugging level  
-c [ -config ] Config path  
-e [ -redis ] Show redis debug information
```

🔄Revision #7

★Created 22 November 2024 07:15:19 by Gabriele

✍Updated 10 March 2025 13:43:02 by Tomas