

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	Yes	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/iec103-master.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
```

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