

Connecting two IOMod 16DI

Description

This article describes how to connect and configure two IOMods 16DI to the WCC Lite using IEC103, and Modbus RTU.



Typical connection schematic for two IOMod 16DI

i WCC Lite can be connected to two IOMod 16DI via PORT1 or PORT2.

Preparing the configuration

At first, you need to make a configuration for the WCC Lite. This can be done using any spreadsheet editing program. Templates for configuration can be found on the WCC Lite web. Protocol Hub --> Configuration. At the bottom of the page, there will be a *Download* button for template configurations.

PROTOCOL HUB	STATUS	SYSTEM	SERVICES	NETWORK	USERS	LOGOUT (ROOT)
CONFIGURATION	IMPORTED SIGNALS	EVENT LOG	PROTOCOL CONNECTIONS	PROTOCOL LOGGER	SCRIPT-RUNNER	

Protocol configuration

IMPORT PROTOCOL CONFIGURATION

Here you can import Excel configuration file. Up to 1000 signals are allowed. All previous signals will be replaced.

Configuration file:	<input type="button" value="Choose File"/> No file chosen	<input type="button" value="Import configuration"/>
PLC (IEC-61499) Boot file:	<input type="button" value="Choose File"/> No file chosen	<input type="button" value="Import FBOOT file"/>
IEC61850 Client model file:	<input type="button" value="Choose File"/> No file chosen	<input type="button" value="Import client model file"/>
IEC61850 Server model file:	<input type="button" value="Choose File"/> No file chosen	<input type="button" value="Import server model file"/>

DOWNLOAD CONFIGURATION

Template configurations:

<input type="button" value="Download"/>

You need to configure the Devices and Signals sheets before continuing. These template configurations can also be used to configure protocols like Modbus-master and DNP3. Configuration can be modified according to the functionality needed. In this case, the *Device* sheet will only have three devices: WCC Lite and two IOMod 16DI. It is important to use only one protocol for each port, otherwise configuration will not work.

name	description	device_alias	enable	protocol	id	device	baudrate	databits	stopbits	parity	flowcontrol	scan_rate_ms	timeout_ms	link_address	serial_delay	bind_address	host	port	asdu_size	cot_size	ioa_size	rwt	swt	t1	t2	t3	time_sync	message_size	cache_size	destination_address	source_address	unsol_classes	update
First IOMod16DI	IOMod 16DI via modbus	First_IOMod16	1	Modbus rtu	1	PORT1	9600	8	1	none	none	300	10000	50																		0	
Second IOMod16DI	IOMod 16DI via modbus	Second_IOMod16	1	Modbus rtu	2	PORT1	9600	8	1	none	none	300	10000	50																		0	
IEC104 SCADA system	IEC104 SCADA signals	IEC104_SCADA	1	IEC 60870-5-104 slave												0.0.0.0	192.168.1.2	2404	2	2	3	8	15	15	10	20	1	249	100				

You can download the example configuration for each firmware version at the bottom of the article, or create your own using these links:

- For IEC103
- For IEC101
- For Modbus

You need to configure the devices and signal sheets before continuing. After downloading template configurations, open the phub templates folder. You will see that there are different template folders for each IOMod:

4CS4VS	2025-03-13 11:06	File folder
4RTD	2025-03-14 10:14	File folder
8AI	2025-03-13 11:06	File folder
8DI4RO	2025-03-13 16:01	File folder
8DI8DO	2025-03-13 16:26	File folder
16DI	2025-03-13 16:27	File folder

To select a correct configuration, check the sticker on the back of the IOMod. There, you will find which protocol to use according to Factory FW type. For example, if you have IOMod 16DI with IEC103 FW, select configuration `iomod_16DI_IEC103_to_IEC104_DNP3_Modbus_SCADA`.

IOMOD needs to be configured, as in the Excel configuration. If templates are being used, default parameters should be set for the IOMOD. IOMODs with firmware version 1 are configured via PuTTY or other SSH programs using the USB port on the device's front panel. This can be done following the [IOMod 16DI user manual](#).

IOMOD also has a series of parameters that can be configured directly for the IOMOD without changing the WCC Lite configuration. Each IOMOD has its unique parameters, which can be seen on the configuration menu.

```

----- IOMOD Configure Terminal (IEC-103) (V1.8.7)---

[1] Link Address (1)
[2] Baudrate & bits(9600, 8+1) E Parity
[3] Data addressing config
[4] RS485 Terminating Resistor (Disabled)
[5] Input State Inversion
[6] Input Configure
[7] Set Default Settings
[8] Firmware Upgrade
[9] Diagnostics screen
[0] Exit
-----

```

A new menu opens by clicking [6], allowing the user to configure the 16DI inputs. Input grouping allows grouping of neighbour inputs, the first being an odd-numbered input. This then makes the grouped inputs a double-point input. When making an Excel configuration for WCC Lite with double-point information, the even-numbered input signal should be deleted, and the odd-numbered input signal should be configured as a double-point signal.

The user can also change the input filter time. This parameter is set in milliseconds and determines the time after which the input is represented with the changed state. For example, if the filter time is 1000ms, and the input has been on for 500ms, the state won't change from OFF to ON. This is relevant when seeking to avoid unnecessary data.

Uploading configuration

Template configurations can work with default settings without any further changes. These template configurations can also be used to configure protocols like Modbus-master and DNP3. Configuration can be modified according to the functionality needed. For that, you can rely on the examples given in the links above (Preparing the configuration). If you need to specify different IEC104 slave settings, you can do that by changing the Excel configuration. By changing settings such as `info_address` or `data_type`, you can adapt the IEC104 slave to work as needed. To test this example,

specify your computer's IP address in the Excel configuration for the IEC104 slave.

After the configuration is ready, upload it to WCC Lite (Configuration --> Choose file --> Import configuration):

PROTOCOL HUB

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PROTOCOL CONNECTIONS



PROTOCOL LOGGER

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Protocol configuration

IMPORT PROTOCOL CONFIGURATION

Here you can import Excel configuration file. Up to 1000 signals are allowed. All previous signals will be replaced.

Configuration file:  No file chosen 

PLC (IEC-61499) Boot file: **1** No file chosen **2**

IEC61850 Client model file: No file chosen

IEC61850 Server model file: No file chosen

DOWNLOAD CONFIGURATION

Template configurations:

After the upload is done and no errors were detected, you should see all imported signals (Protocol Hub --> Imported signals):

PROTOCOL HUB

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IMPORTED SIGNALS

☐ Column filter

Device name	Signal name	Device alias	Signal alias	Value	Units	State	Attributes	Time
First IOMod16DI	DI13	First_IOMod16	DI13	0				2025-03-17 15:48:44.75
First IOMod16DI	DI14	First_IOMod16	DI14	0				2025-03-17 15:48:44.75
First IOMod16DI	DI15	First_IOMod16	DI15	0				2025-03-17 15:48:44.75
First IOMod16DI	DI16	First_IOMod16	DI16	0				2025-03-17 15:48:44.75
First IOMod16DI	COMMUNICATION STATUS	First_IOMod16	comm_stat	1				2025-03-17 15:48:44.74
Second IOMod16DI	DI1	Second_IOMod16	DI1	0				2025-03-17 15:48:45.20
Second IOMod16DI	DI2	Second_IOMod16	DI2	0				2025-03-17 15:48:45.20
Second IOMod16DI	DI3	Second_IOMod16	DI3	0				2025-03-17 15:48:45.20
Second IOMod16DI	DI4	Second_IOMod16	DI4	0				2025-03-17 15:48:45.20
Second IOMod16DI	DI5	Second_IOMod16	DI5	0				2025-03-17 15:48:45.20

Before doing anything further, you should also check for protocol connections if both IOMod 16DI are connected to WCC Lite via PORT1. Go to Protocol connections, where you can see all the connected slave and master protocol devices:

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PROTOCOL CONNECTIONS

Device name	Device alias	Protocol	Host	Status	Timestamp
<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
Second IOMod16DI	Second_IOMod16	Modbus Serial master	PORT1	Connected	2025-03-17 15:48:45
First IOMod16DI	First_IOMod16	Modbus Serial master	PORT1	Connected	2025-03-17 15:48:44
IEC104 SCADA system	IEC104_SCADA	IEC 60870-5-104 slave	192.168.1.2	Disconnected	2025-03-17 15:48:42

You can also change signal names according to your needs:

signal_name	device_alias	signal_alias	source_device_alias	source_signal_alias	enable	math_expression	multiply	add	operation	units	min_value	max_value	absolute_threshold	threshold_units	suppression_time_m	suppression_values	gi	log	function	common_address	info_address	info_number	data_type	tag_job_todo
DOOR OPEN	IOMod16	DI1			1			-1					0,1	real			1	1	160	1	1	0	1	

PROTOCOL HUB

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IMPORTED SIGNALS

☐ Column filter

Device name	Signal name	Device alias	Signal alias	Value	Units	State	Attributes	Time
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Elseta IOMod16DI	DOOR OPEN	IOMod16	DI1	0			cot=20	2025-03-14 15:12:20.17

In every signals sheet, you can see a signal named COMMUNICATION STATUS. It is an indicator that shows whether the service is running and whether there is a connection with the device.

signal_name	device_alias	signal_alias	source_device_alias	source_signal_alias	enable	math_expression	multiply	add	operation	units	min_value	max_value	absolute_threshold	threshold_units	suppression_time_ms	suppression_values	gi	log	common_address	info_address	data_type	tag_job_todo
IEC104 SCADA DI1	IEC104_SCADA	IEC104_SCADA_DI1	IOMod16	DI1	1												1	0	1	1	30	
IEC104 SCADA DI2	IEC104_SCADA	IEC104_SCADA_DI2	IOMod16	DI2	1												1	0	1	2	30	
IEC104 SCADA DI3	IEC104_SCADA	IEC104_SCADA_DI3	IOMod16	DI3	1												1	0	1	3	30	
IEC104 SCADA DI4	IEC104_SCADA	IEC104_SCADA_DI4	IOMod16	DI4	1												1	0	1	4	30	
IEC104 SCADA DI5	IEC104_SCADA	IEC104_SCADA_DI5	IOMod16	DI5	1												1	0	1	5	30	
IEC104 SCADA DI6	IEC104_SCADA	IEC104_SCADA_DI6	IOMod16	DI6	1												1	0	1	6	30	
IEC104 SCADA DI7	IEC104_SCADA	IEC104_SCADA_DI7	IOMod16	DI7	1												1	0	1	7	30	
IEC104 SCADA DI8	IEC104_SCADA	IEC104_SCADA_DI8	IOMod16	DI8	1												1	0	1	8	30	
IEC104 SCADA DI9	IEC104_SCADA	IEC104_SCADA_DI9	IOMod16	DI9	1												1	0	1	9	30	
IEC104 SCADA DI10	IEC104_SCADA	IEC104_SCADA_DI10	IOMod16	DI10	1												1	0	1	10	30	
IEC104 SCADA DI11	IEC104_SCADA	IEC104_SCADA_DI11	IOMod16	DI11	1												1	0	1	11	30	
IEC104 SCADA DI12	IEC104_SCADA	IEC104_SCADA_DI12	IOMod16	DI12	1												1	0	1	12	30	
IEC104 SCADA DI13	IEC104_SCADA	IEC104_SCADA_DI13	IOMod16	DI13	1												1	0	1	13	30	
IEC104 SCADA DI14	IEC104_SCADA	IEC104_SCADA_DI14	IOMod16	DI14	1												1	0	1	14	30	
IEC104 SCADA DI15	IEC104_SCADA	IEC104_SCADA_DI15	IOMod16	DI15	1												1	0	1	15	30	
IEC104 SCADA DI16	IEC104_SCADA	IEC104_SCADA_DI16	IOMod16	DI16	1												1	0	1	16	30	
COMMUNICATION STATUS	IEC104_SCADA	comm_stat															1					communication_status

If everything is connected and service is running, COMMUNICATION STATUS should display 1. Otherwise, if not, it should display 2.

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IMPORTED SIGNALS

☐ Column filter

Device name	Signal name	Device alias	Signal alias	Value	Units	State	Attributes	Time
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
IEC104 SCADA system	COMMUNICATION STATUS	IEC104_SCADA	comm_stat	1				2025-03-14 17:43:51.48

If IOMOD needs to be connected to another port, this could also be changed in the configuration. On the Device sheet, change the Device value from PORT1 to PORT2:

name	description	device_alias	enable	protocol	device	baudrate	databits	stopbits	parity	flowcontrol	scan_rate_ms	retry_count	timeout_ms	link_address	asdu_address	time_sync_interval_sec	pl_interval_sec	serial_delay	retry_delay_ms	link_address	host	port	asdu_size	cod_size	ioa_size	rwt	t1	t2	t3	time_sync	message_size	cache_size	destination_address	source_address	unisol_classes	
Excel IOMod16DI	IOMod 16DI via IEC103	IOMod16	1	IEC 60870-5-103 master	PORT2	9600	8	1	even	none	300	3	1000	1	1	300	300	50	500	0.0.0.0	192.168.1.2	2404	2	2	3	8	12	15	10	20	1	249	100			
IEC104 SCADA system	IEC104 SCADA signals	IEC104_SCADA	1	IEC 60870-5-104 slave	PORT2	9600	8	1	none	none										0.0.0.0	192.168.1.2	2404	1	1	2											
IEC101 SCADA system	IEC101 SCADA signals	IEC101_SCADA	1	IEC 60870-5-101 slave	PORT1	9600	8	1	none	none				1						0.0.0.0	192.168.1.2	20000														
DNP3 SCADA system	DNP3 SCADA signals	DNP3_SCADA	1	DNP3 tcp slave																0.0.0.0	192.168.1.2	20000												10	1	1,2,3
Modbus SCADA system	Modbus SCADA signals	Modbus_SCADA	1	Modbus tcp slave																0.0.0.0	192.168.1.2	502														

 When configuring ports, please note that there can be 2 of the same protocol on the same port (with different IDs, link addresses, etc.), but there cannot be 2 different protocols on the same port.

Connecting IEC104-slave via Vinci

After Excel and USB configurations, you can connect to the device using the Vinci software. To simulate an IEC 104 slave, you need to choose the IEC 60870-5-104 protocol and Master(Client) mode and press start. In the *Settings* tab, check Structure, Timeouts and Windows values to match Excel configuration.

Settings

Console

Statistic

Structure

COT size in bytes:

ASDU size in bytes:

IOA size in bytes:

Parameters

☒ Send Start DT on start up

☒ Auto ack. Test Frame

Security

☐ Enable TLS

Timeouts

t0 in seconds:

t1 in seconds:

t2 in seconds:


t3 in seconds:

Windows


RWT (w) size:

SWT (k) size:

Then set the correct IP address and Port at the top of the program page**Port** for IEC104 should be 2404, and**IP address** should match your WCC Lite IP address.

 THE VINCI PROTOCOL ANALYZER

FileTagsOptionsHardwareHelp



Protocol: IEC 60870-5-104

Mode: Master (Client)

START

IP: 127.0.0.1

Port: 2404

Extra

Interface infoPingSockets

SettingsConsoleStatistic

After clicking start, you should check the protocol connections tab again to see if the IEC104 slave is connected.

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PROTOCOL CONNECTIONS

Device name	Device alias	Protocol	Host	Status	Timestamp
Second IOMod16DI	Second_IOMod16	Modbus Serial master	PORT1	Connected	2025-03-17 15:48:45
First IOMod16DI	First_IOMod16	Modbus Serial master	PORT1	Connected	2025-03-17 15:48:44
IEC104 SCADA system	IEC104_SCADA	IEC 60870-5-104 slave	192.168.1.2	Connected	2025-03-17 15:53:13

Once the IEC104 slave is connected, the console tab in Vinci software should look something like this:

FileTagsOptionsHardwareHelp

Protocol: IEC 60870-5-104

Mode: Master (Client)

STOP

IP: 192.168.1.1

Port: 2404

Extra

Interface infoPingSockets

SettingsConsoleStatistic

Time	Source	Message	TI	Cause	ASDU	IOA	Value	Status	Time Tag	Name	RawData
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	8	Off[0]	Not Topical	2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	9	Off[0]	Not Topical	2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	10	Off[0]	Not Topical	2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	11	Off[0]	Not Topical	2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	12	Off[0]	Not Topical	2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	13	Off[0]	Not Topical	2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	14	Off[0]	Not Topical	2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	15	Off[0]	Not Topical	2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	16	Off[0]	Not Topical	2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	1	Off[0]		2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	2	Off[0]		2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	3	Off[0]		2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	4	Off[0]		2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:0	M_SP_TB_1 (30)	Spontan (3)	1	5	Off[0]		2025-3-17 13:48:...		68 F1 00 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:1	M_SP_TB_1 (30)	Spontan (3)	1	6	Off[0]		2025-3-17 13:48:...		68 83 02 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:1	M_SP_TB_1 (30)	Spontan (3)	1	7	Off[0]		2025-3-17 13:48:...		68 83 02 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:1	M_SP_TB_1 (30)	Spontan (3)	1	8	Off[0]		2025-3-17 13:48:...		68 83 02 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:1	M_SP_TB_1 (30)	Spontan (3)	1	9	Off[0]		2025-3-17 13:48:...		68 83 02 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:1	M_SP_TB_1 (30)	Spontan (3)	1	10	Off[0]		2025-3-17 13:48:...		68 83 02 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:1	M_SP_TB_1 (30)	Spontan (3)	1	11	Off[0]		2025-3-17 13:48:...		68 83 02 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:1	M_SP_TB_1 (30)	Spontan (3)	1	12	Off[0]		2025-3-17 13:48:...		68 83 02 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:1	M_SP_TB_1 (30)	Spontan (3)	1	13	Off[0]		2025-3-17 13:48:...		68 83 02 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:1	M_SP_TB_1 (30)	Spontan (3)	1	14	Off[0]		2025-3-17 13:48:...		68 83 02 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:1	M_SP_TB_1 (30)	Spontan (3)	1	15	Off[0]		2025-3-17 13:48:...		68 83 02 00 00
11:54:15.816	192.168.1.1:2404	RSN:0 SSN:1	M_SP_TB_1 (30)	Spontan (3)	1	16	Off[0]		2025-3-17 13:48:...		68 83 02 00 00

If you want to configure IOMod 16DI, you should refer to ->IOMod 16DI User Manual.

⌚Revision #6

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