

iPMCC Solution by Okken DS

Enerlin'X installation & commissioning guide

Smart Panels for PCC

12/2014



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1. Reference documents

Reference	Document description	Date
DOCA0054EN-00	Masterpact NT/NW, Compact NS - Modbus Communication Guide (EN)	04/2014
LV434107-02	Compact NSX - Modbus communication guide (EN)	04/2014
DOCA0084EN-01	IFE Ethernet Interface for LV Circuit Breakers User Guide (EN)	06/2014

Table 1: Reference documents

2. Before you begin

This document has been created for those having to install & commission the communication part of power breakers as part as the iPMCC Solution. Its objective is to give the main installation and wiring recommendations, the configuration steps, and especially the settings for communication between the device and Unity Pro in the following configuration:

- Unity Pro XL > IFE > BCM (Masterpact).
 - Unity Pro XL > IFE > BSCM (Compact NSX).
 - Unity Pro XL > IFE > IFM > BSCM (Compact NSX).
- The purpose is to be able to Read and Write the circuit breaker's specific ModBus register.

2.1. Assumptions

The structure of this document is based on the following assumptions:

2.1.1. Devices

- Masterpact:
 - BCM ULPs have been installed in the device, and have been configured.
 - Micrologic has been updated with their latest available firmware.
- Compact NSX:
 - BSCMs have been installed and configured.
 - Micrologic has been updated with the latest available firmware.
- IFE and IFM:
 - IFE and IFM have been updated with the latest available firmware.
- PLC M340:
 - PLC and NOC have been implemented and are ready to communicate.

2.1.2. Network

- The communication network is already implemented on the switchboard.
- Free fixed IP addresses are available to configure IFE Address.

2.1.3. Software

- Unity Pro XL V8.0 is installed on a computer connected to the network.
- A project has been created, and CPU and NOC have been declared.

3. Installation and wiring to Okken switchboard

3.1. Integration of Enerlin'X IFE unit in side compartment

For reasons of electromagnetic compatibility, integration of the IFE unit in Okken is applicable only in the side compartment as shown in the following picture:

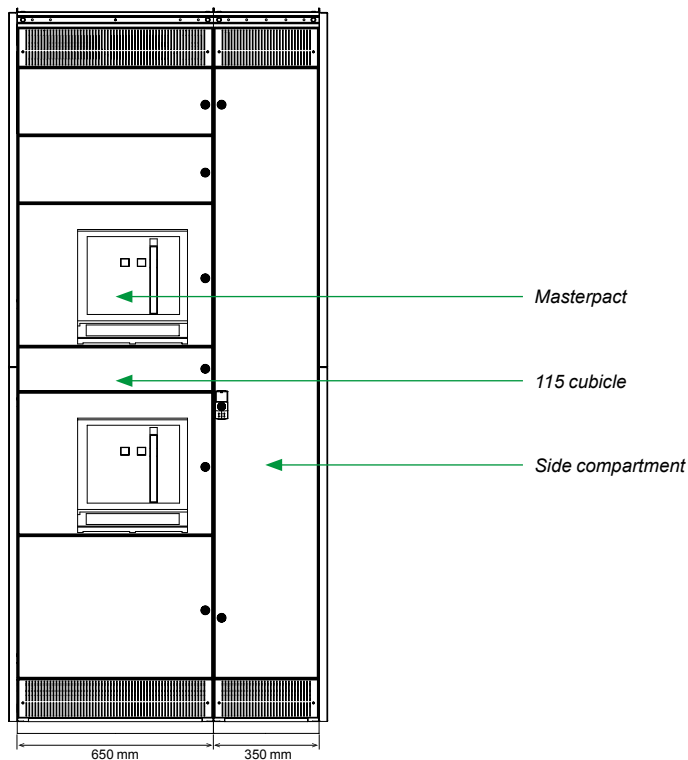


Figure 1: Side compartment location

3.2. Cable ladder location in side compartment

Assembly of 'Cable ladder' in side compartment:

- Assemble 04690509 part in side compartment with dimensions shown below.
- Use 87181 & 87182 parts to fasten 04690509 part.

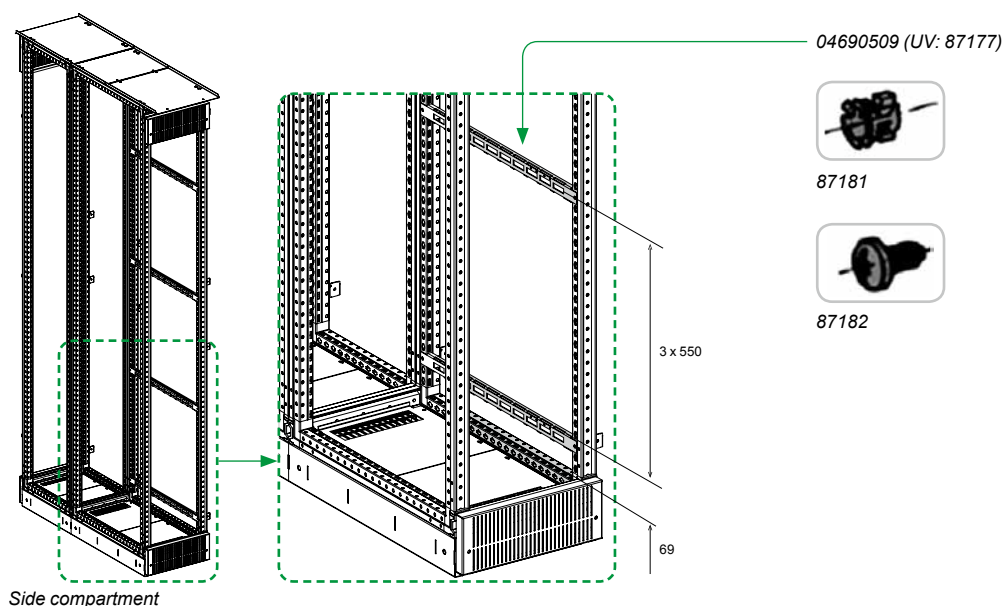


Figure 2: Cable ladder location

3.3. Assembly of Enerlin'X IFE bracket

3.3.1. Step 1: Add a bracket on the right side of the side compartment

- Use M6 stud (Qty: 8) with HUA11490 (Qty: 8) & HUA11412 (Qty: 4).
- Assemble DIN rail, L = 1730 mm, on M6 stud part, with HUA12624 (Qty: 4) & HUA14569 (Qty: 4).

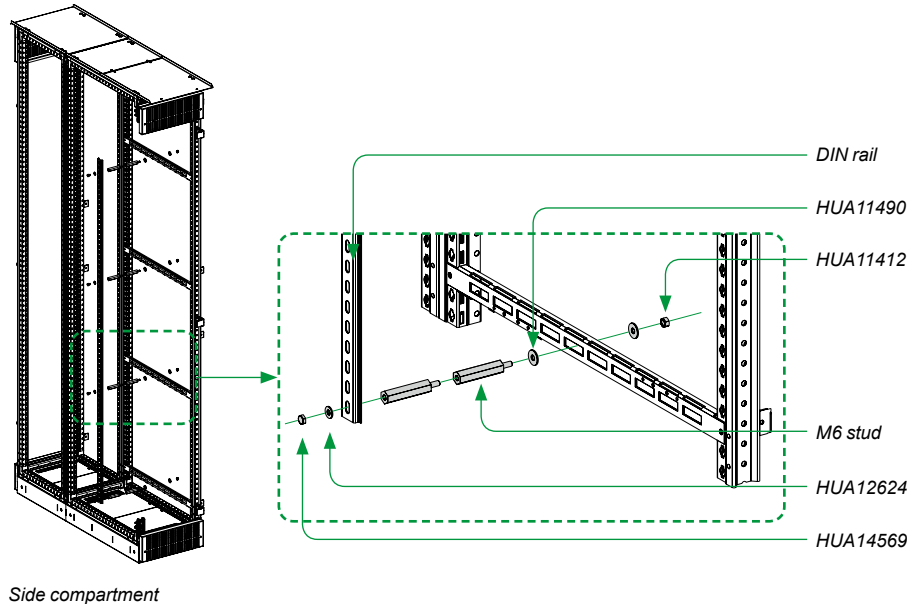


Figure 3: IFE bracket - Step 1

3.3.2. Step 2: Add "L" brackets

- Use OKKEN_L-BRACKET.
- Assemble OKKEN_L-BRACKET (Qty: 4) on DIN rail LVM31069XE_IFE, with HUA12624 (Qty: 8), HUA11450 (Qty: 4) and HUA11412 (Qty: 4).

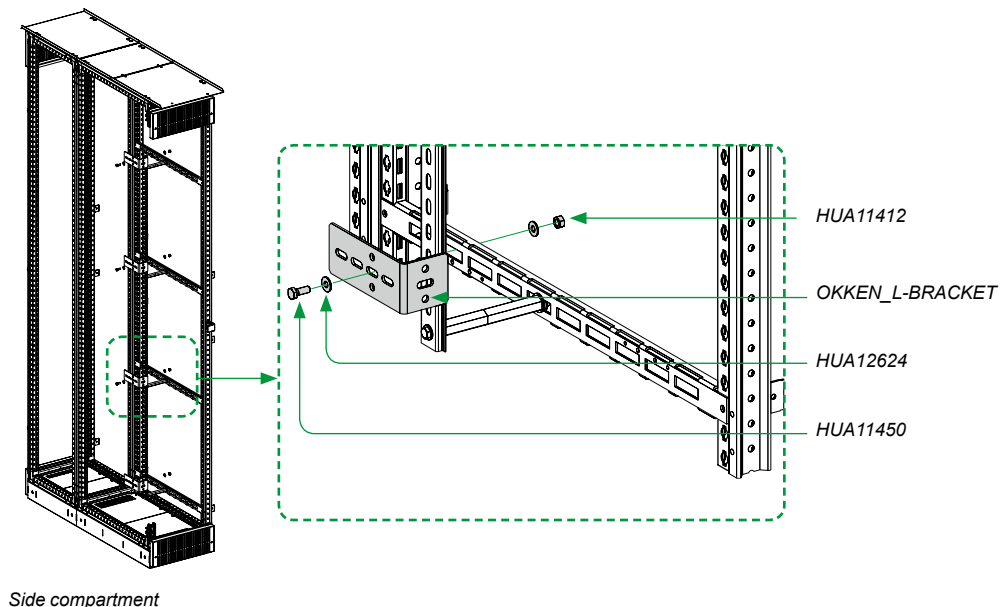


Figure 4: IFE bracket - Step 2

3.3.3. Step 3: Add DIN rail, Enerlin'X IFE and I/O modules

- Assemble DIN rail, L = 1730 mm (Qty: 1).
- Assemble IFE & I/O modules on DIN rails.

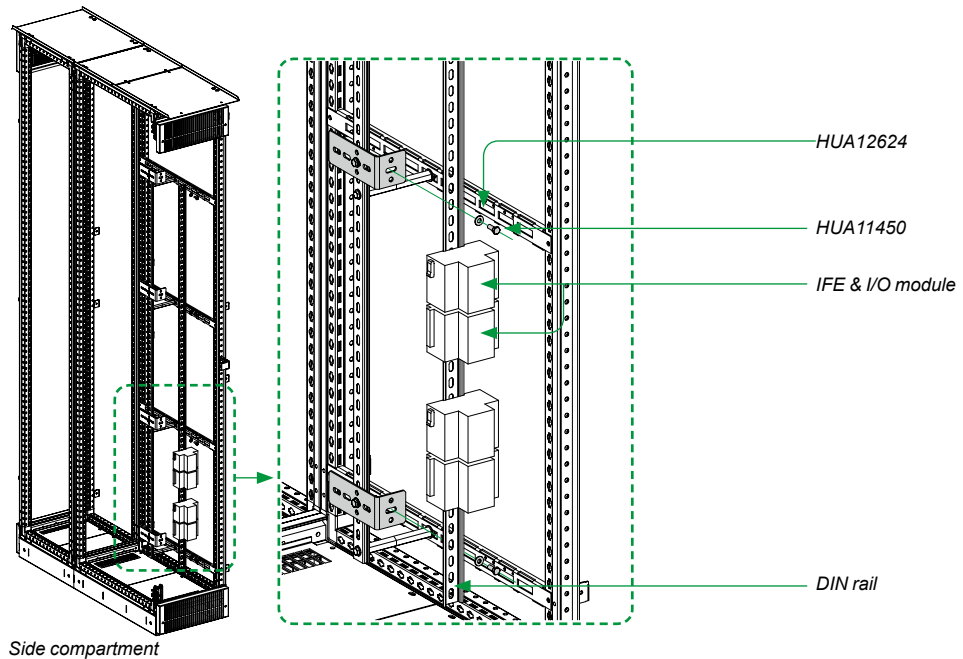


Figure 5: IFE bracket - Step 3

3.4. Wiring of Enerlin'X IFE unit and ULP cord location

Wiring of IFE unit:

- Use metal cable conduits to protect the communication wiring.
- Cable must comply with its bending radius.
- Connect cables from I/O unit to Masterpact BCM ULP.
- Follow installation guide, wiring rules & recommendations for IFE unit.

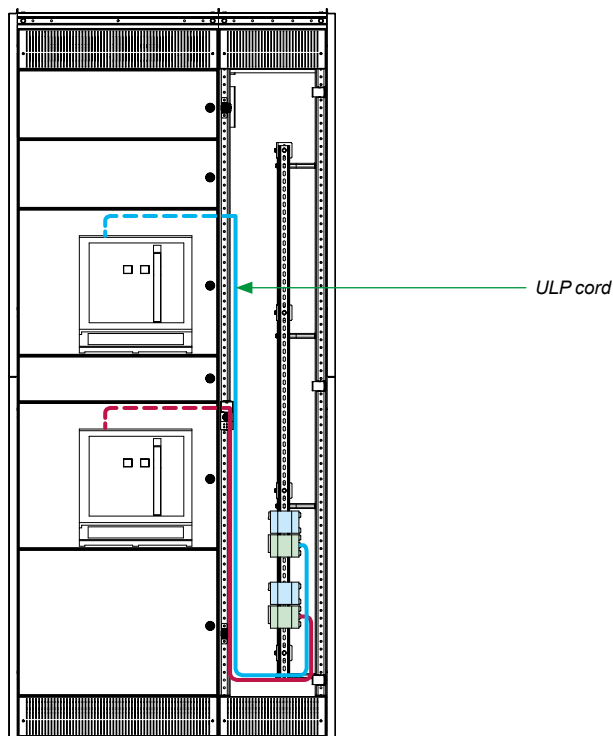


Figure 6: ULP cord location

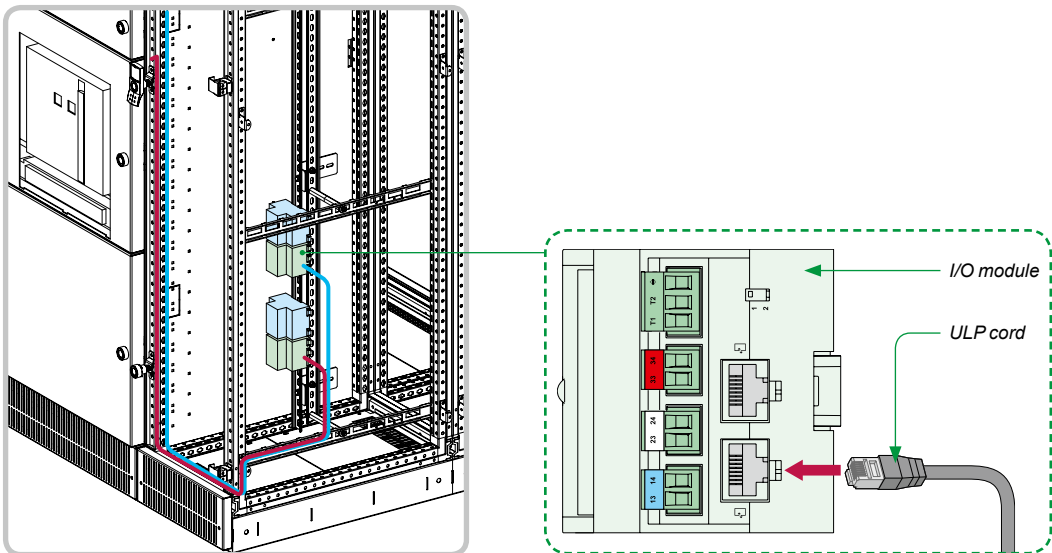


Figure 7: Connect the ULP cord to I/O module

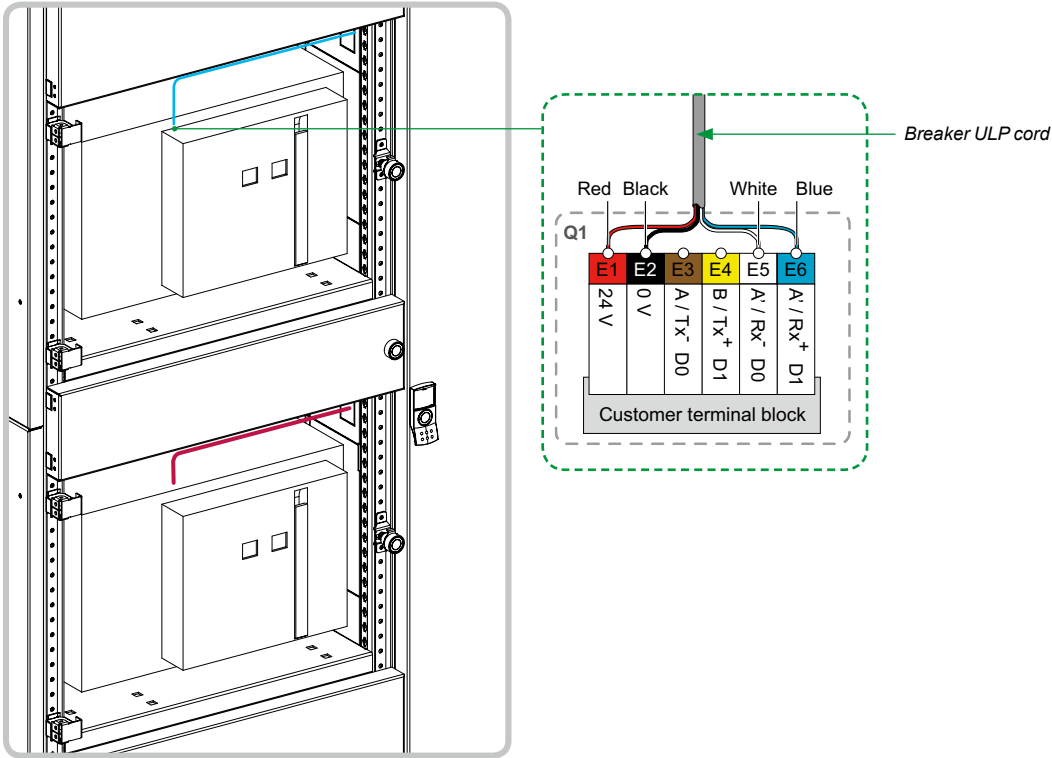


Figure 8: Connect the ULP cord to Masterpact

4. Overall architecture

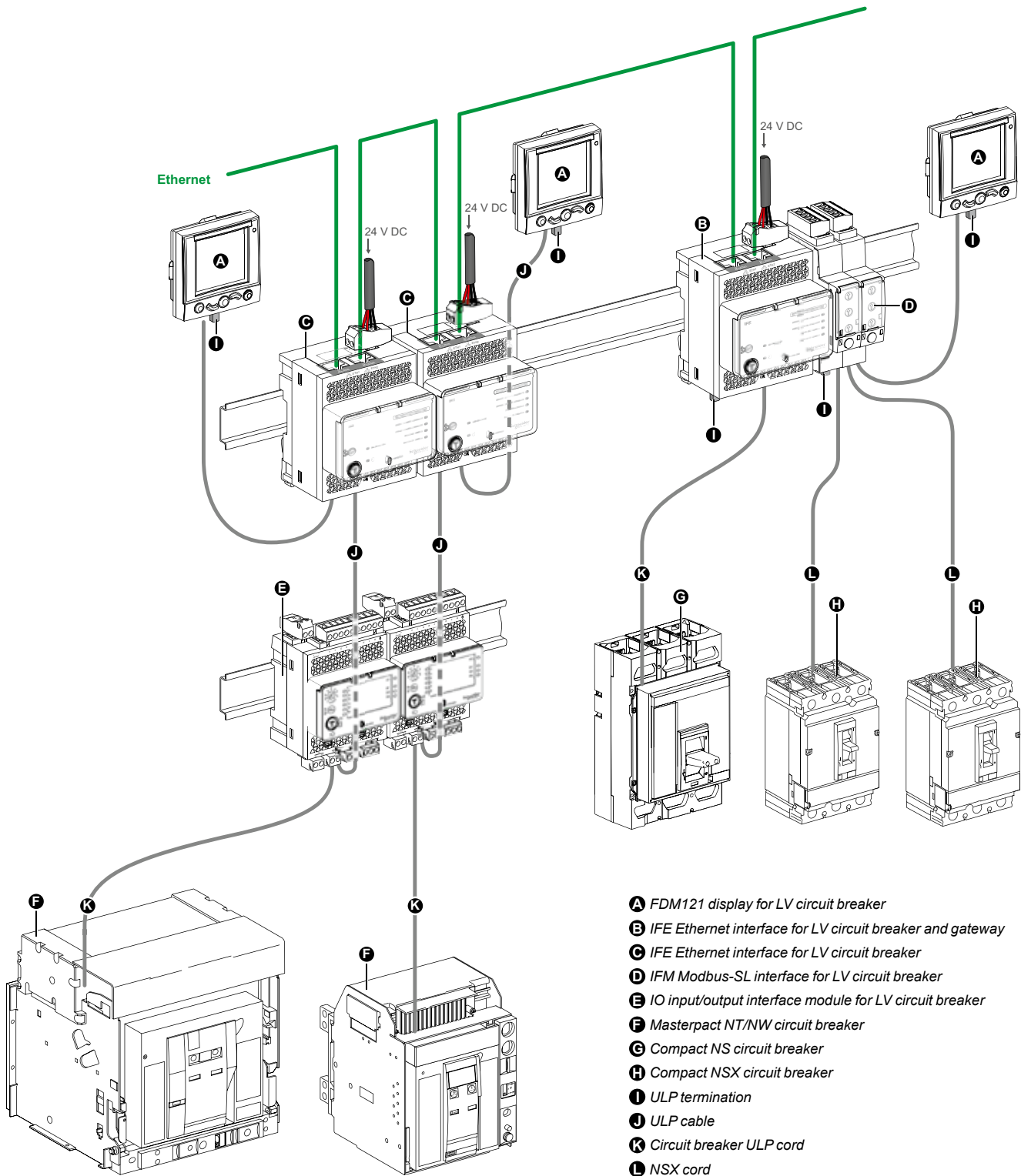


Figure 9: Overall architecture

5. Enerlin'X IFM

5.1. Set the Modbus addresses

The Modbus addresses must be set with the two rotary switches symbolized by x1 and x10; the 'x10' symbol corresponds to the tens and the 'x1' symbol to the ones. The following illustration shows the location of these rotary switches on the device:

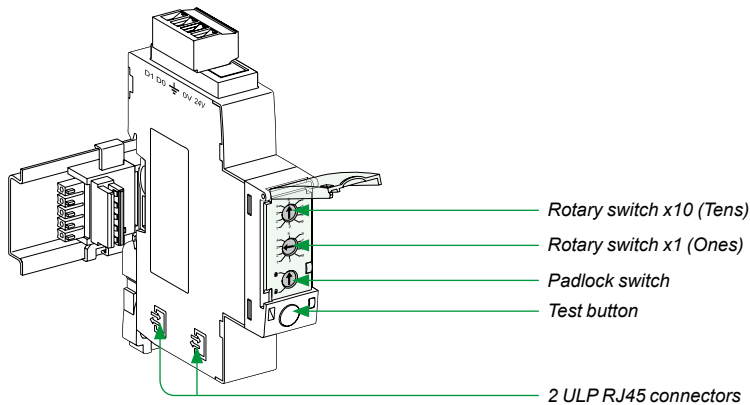


Figure 10: IFM description

For example, to set the Modbus address to 21, proceed as follows:

IFM Rotary switch:

- Set the x10 switch to 2.
- Set the x1 switch to 1.
- Turn the padlock switch to the unlocked position.

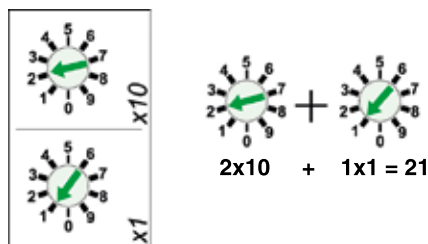


Figure 11: MB address

Test the connection between Enerlin'X IFM and circuit breaker:

- Press the 'test' button on IFM and visually check that the associated Micrologic trip unit flashes simultaneously (ON: 1000 ms/OFF: 1000 ms).
- Pressing the test button launches the connection test for 15 seconds.

Note: During the test, all the ULP modules keep working normally. If an FDM121 is used, its screen also flashes.

5.2. Padlock switch

The Modbus locking pad on the front panel of the IFM enables or disables remote control commands to be sent over the Modbus network to the IFM itself, and to the other modules of the connected IMU.

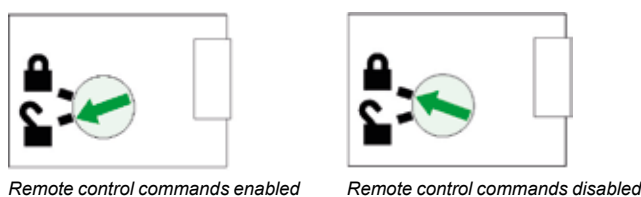


Figure 12: Padlock switch

Note: Our configuration requires that the padlock switch allow remote control commands.

5.3. Hardware Configuration

NOTICE

DANGER OF DEVICE DAMAGE

- The IFM RJ45 ports are for ULP modules only.
- Any other use can damage the IFM or the device connected to the IFM.
- To check if a ULP module is compatible with the IFM's RJ45 ports, refer to the ULP System User Guide.

Failure to follow these instructions can result in device damage.

All connection configurations require the breaker ULP cord as shown in Figure 14: IFM + Compact NSX on page 12. The insulated NSX cord is mandatory for system voltages greater than 480 V AC.

When the second ULP RJ45 connector is not used, it must be closed with a ULP terminator:

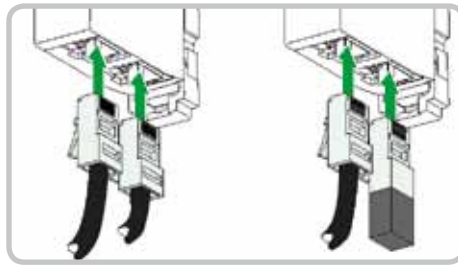


Figure 13: IFM - ULP connection

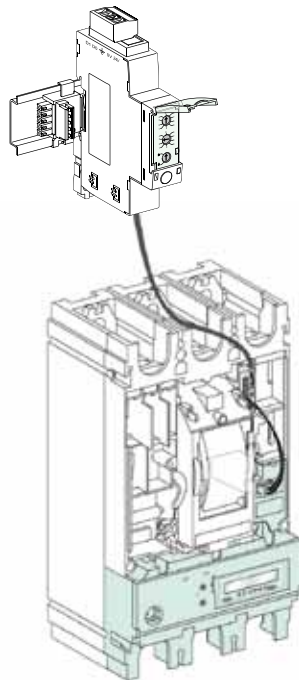


Figure 14: IFM + Compact NSX

6. Enerlin'X IFE

In this section we configure communication with LV circuit breakers.

6.1. Hardware Configuration

6.1.1. ULP Connection

All connection configurations require the circuit-breaker ULP cord. An insulated Compact NSX cord is mandatory for system voltages greater than 480 V AC. When the second ULP RJ45 connector is not used, it must be closed with a ULP terminator.

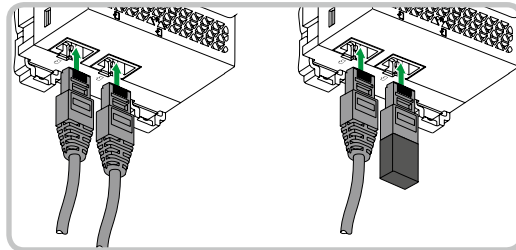


Figure 15: IFE - ULP connection

Check the connection between Enerlin'X IFE, IO interface and circuit breaker using the "ULP test button". Press the test button on IFE and visually check that IFE, IO interface and associated Micrologic trip unit flash simultaneously (ON: 1000 ms/OFF: 1000 ms).

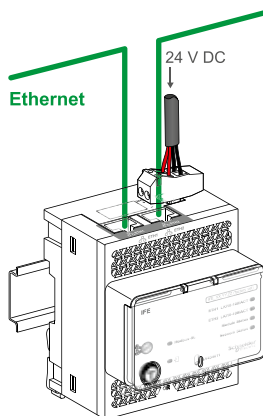
6.1.2. Ethernet connection

Enerlin'X IFE has two Ethernet ports E1 and E2.

Ethernet Cabling:

100 base T - 2* RJ45 - E1 and E2

Ethernet 1 and Ethernet 2 ports act as a non-manageable switch.



Notes:

- IFE doesn't support redundant Ethernet protocol (RSTP, MRP, Ring, etc.).
- IFE provides Ethernet daisy chain connection.
- If a daisy chain loop is required, an Ethernet loop manager must be used.

Note: Be careful with ULP and Ethernet connections as both use RJ45 connectors. ULP system supplies 24 V DC power to all connected devices. Serious damage can occur in the event of a false connection.

6.2. How to know the factory IP address of the IFE Module?

The factory IP address on an IFE module is always based on its Mac address according to the following format:

169.254.YY.ZZ

Where **YY** and **ZZ** are the decimal values of the four last digits of the IFE Mac address. Note that **YY** and **ZZ** Mac address parameters are hexadecimal values. The following illustration shows the location of the device's Mac address.

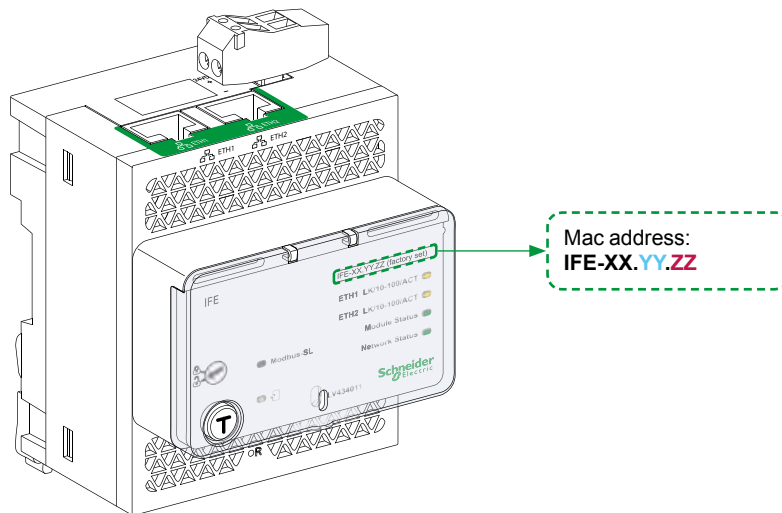


Figure 16: IFE Mac address location

Example:

IFE Mac address: IFE-A1-**B0-23**

Corresponding IP address: **169.254.176.35**

Where 16#**B0** = **176** and 16#**23** = **35** in decimal

7. Example of "Read/Write" program with Unity Pro XL

Open Unity Pro XL, and declare an M340 PLC, with an NOC0401 on the same slot backplane, and configure the IP address of your PLC and NOC0401.

Once these steps are completed, you can use the steps outlined below as a guide.

7.1. Activate the use of arrays on the project

On the top ribbon of Unity Pro XL,

- Go to "Tools" and "Project Settings". The following menu is displayed:

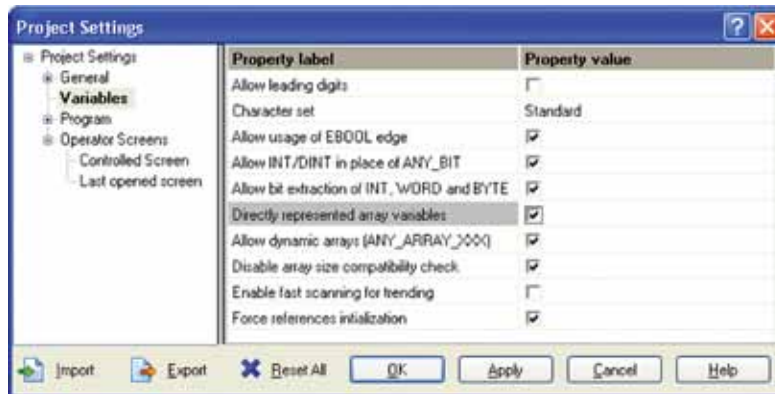


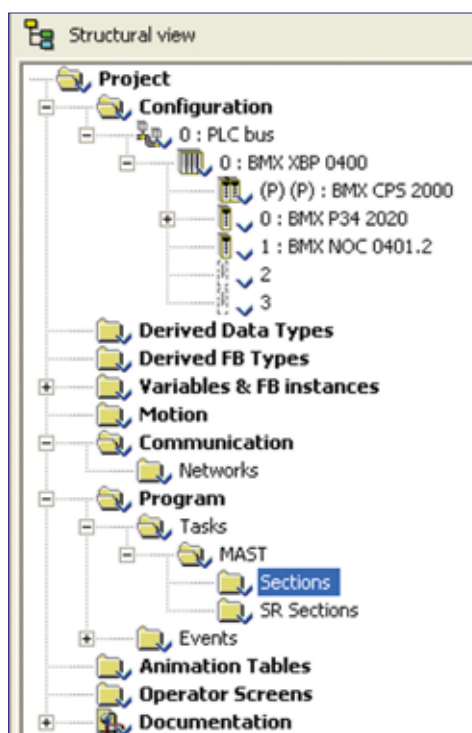
Figure 17: Unity Pro - Project Settings menu

- Click on "Variables" and make sure that the following check boxes are activated:
 - Directly represented array variables
 - Allow dynamic arrays (ANY_ARRAY_XXX)
 - Disable array size compatibility check
- Click on "Apply" then "OK".

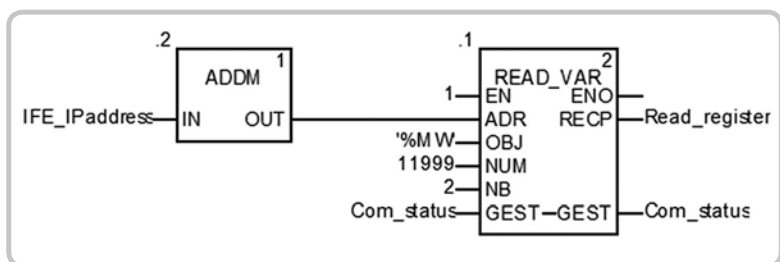
Note: This will allow us to directly enter Arrays into our project rather than having to first declare them as variables.

7.2. Create sections

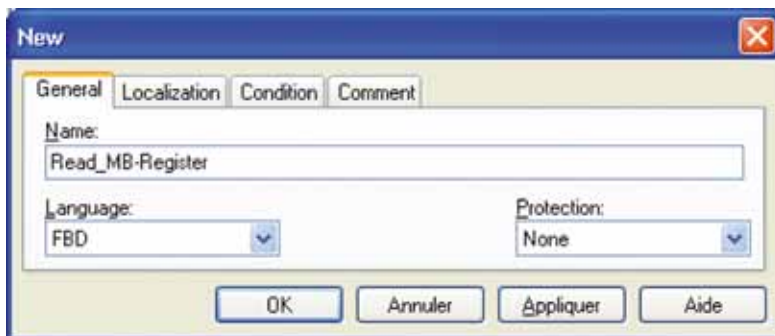
Under the structural view of the project, open the "Program" folder, then "Task", "MAST" and right-click on "Sections", as shown below:



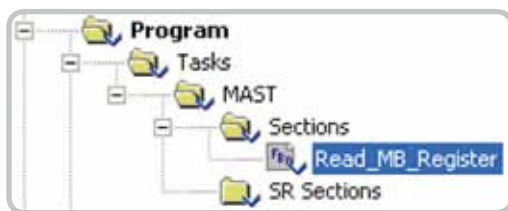
7.3. Create a "Read register" section



Right-click > New Section.



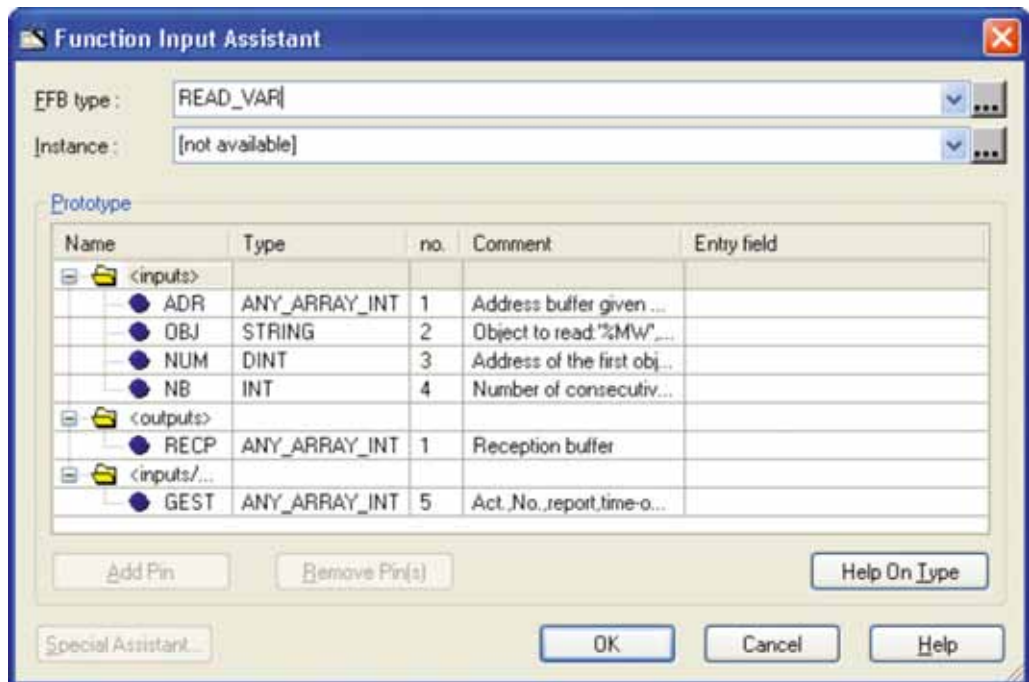
Click on OK.



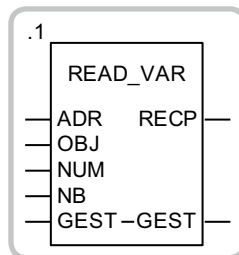
Double-click on the section to open it.

7.3.1. Add a "READ_VAR" block

Press Ctrl+I to open the FFB Input Assistant
Fill the first field "FFB" Type with "read_var".



Click on OK and place the block on the section page.



Parameter	Type	Comment	Our Settings
ADR	ARRAY [0..7] OF INT	Address of the IFE or IFM. The array is given by the ADDM function.	ARRAY [0..7] OF INT
OBJ	STRING	Type of object to read.	"%MW"
NUM	DINT	Address of the first register to write. Note that with Unity, the address of the register is given by: Address = Register number - 1 e.g.: Register 8000 > @7999.	11999
NB	INT	Number of registers to read.	2
RECP	ARRAY [n..m] OF INT	Receiving array, word table containing the value of the registers read. NOTE: The size of the data received (in bytes) is written automatically by the system in the fourth word of the management table.	ARRAY [0..1] OF INT
GEST	ARRAY [0..3] OF INT	Exchange management table. Gives the status of communication with remote device.	ARRAY [0..3] OF INT

Table 2: READ_VAR parameters

7.3.2. Add an "ADDM" block

The ADDM function is used to convert a character string into an address that can be used directly by the READ_VAR and WRITE_VAR communication functions.

- Press [Ctrl+I] to open the FFB Input Assistant.
- Enter "ADDM" in the first field, "FFB Type".
- Click on [OK] and place the block on the section page.

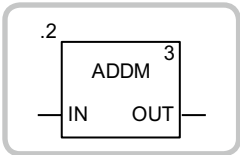


Figure 18: ADDM FFB block

Parameter	Type	Comment
IN	STRING	Device address on network. This input is the concatenation of up to three elements that can take various values: Output Port & Node address & Target entity Note that each element is optional.
OUT	ARRAY [0..7] OF INT	Device address under a specific format, to be read by the READ_VAR and WRITE_VAR block.

Table 3: ADDM parameters

- The "IN" parameter is built with the following elements:

Output Port	Node address	Target entity
rack.module.channel	• {<IP host address>} • {<IP host address>}<2-digit number>	TCP.MBS: Modbus TCP

Table 4: Address format definition

7.3.3. How to define the output port?

- Go under the Project Browser, extend the entire "configuration" folder and double-click on the NOC, to open its setting page.

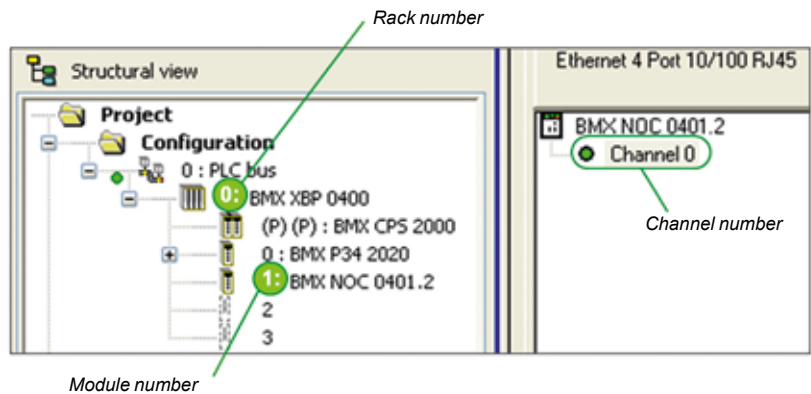


Figure 19: NOC - Identification of the Output port

7.3.4. Example for defining the node address string

The following picture shows a common IFE and IFM configuration:

- 1 Masterpact directly connected to the ULP port of the IFE.
- 2 Compact NSX connected to the ULP port of the IFM.

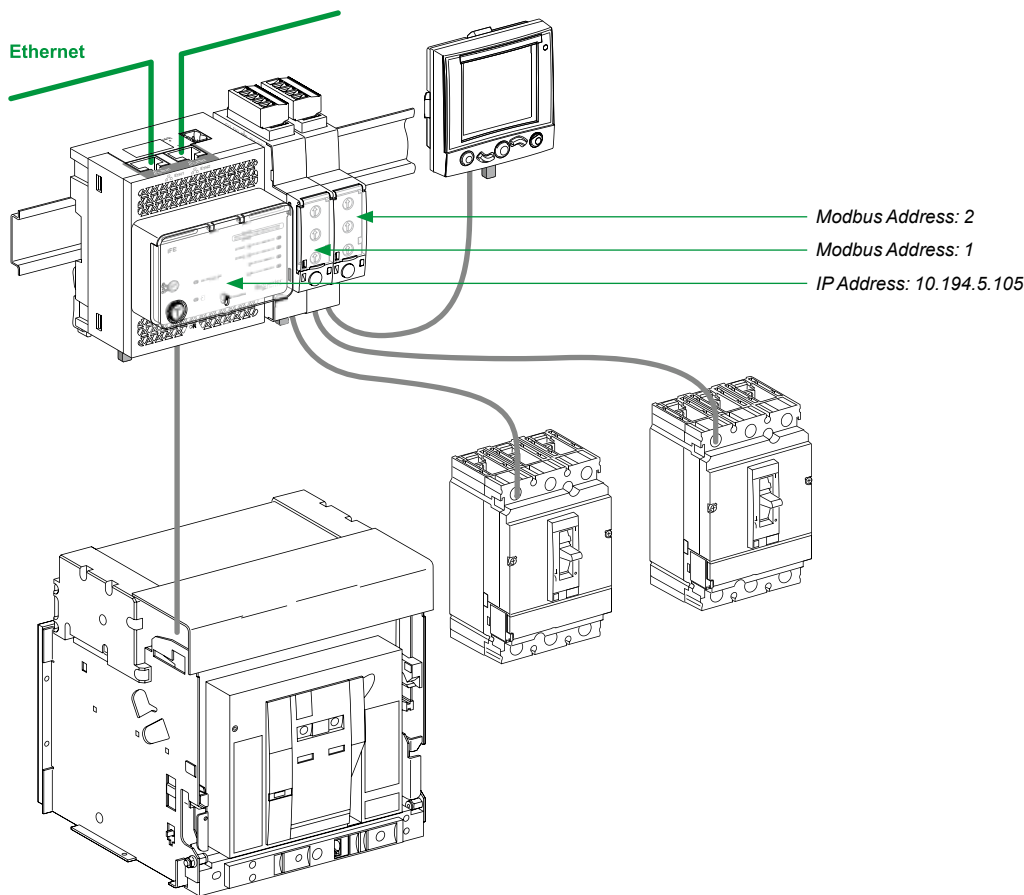


Figure 20: Communication architecture - Example

The following table contains the node address strings of the architecture in this example:

Device	Related address	Node address string	ADDM 'IN' parameter
Masterpact	IP 10.194.5.105	'{10.194.5.105}'	'0.1.0{10.194.5.105}'
Compact NSX 1	Modbus 1	'{10.194.5.105}1'	'0.1.0{10.194.5.105}1'
Compact NSX 2	Modbus 2	'{10.194.5.105}2'	'0.1.0{10.194.5.105}2'

Table 5: ADDM 'IN' parameter examples

7.3.5. Masterpact and Compact NSX status Modbus registers

Address	Register	Type	Bit	Description
11999	12000	INT16U	-	Indicates the validity of each bit in the circuit breaker status register (12001)
12000	12001	INT16U	0	OF status indication contact 0 = The circuit breaker is open 1 = The circuit breaker is closed
			1	SD trip indication contact 0 = Circuit breaker is not tripped 1 = Circuit breaker is tripped due to electrical fault or shunt trip or push-to-trip <i>Note: Bit always equal to '0' for Masterpact circuit breakers with motor mechanism.</i>
			2	SDE fault trip indication contact 0 = Circuit breaker is not tripped on electrical fault 1 = Circuit breaker is tripped due to electrical fault
			3	CH spring loaded contact (only with Masterpact) 0 = Spring discharged 1 = Spring loaded
			4	Reserved
			5	PF ready to close contact (only with Masterpact) 0 = Not ready to close 1 = Ready to close
			6	Distinction between Compact NSX and Masterpact NT/NW 0 = Compact NSX 1 = Masterpact NT/NW
			7 - 14	Reserved
			15	Data availability If this bit is at '1', the circuit breaker status is not available

Table 6: Masterpact status registers table

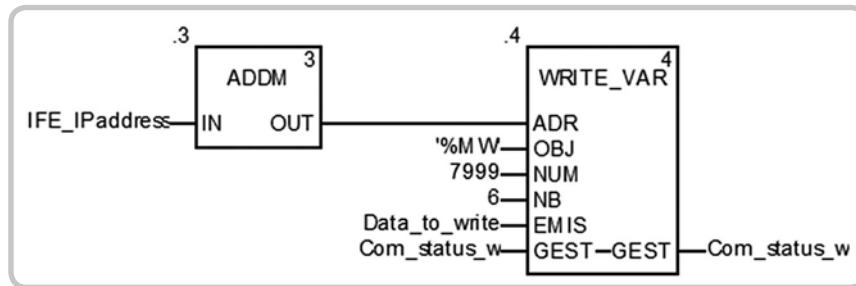
Note: The value of the Modbus register's address is always equal to the value of the register - 1.

Address	Register	Type	Bit	Description
11999	12000	INT16U	-	Indicates the validity of each bit in the circuit breaker status register (12001)
12000	12001	INT16U	0	OF status indication contact 0 = The circuit breaker is open 1 = The circuit breaker is closed
			1	SD trip indication contact 0 = Circuit breaker is not tripped 1 = Circuit breaker is tripped due to electrical fault or shunt trip or push-to-trip <i>Note: Bit always equal to '0' for Compact NSX circuit breakers with motor mechanism.</i>
			2	SDE fault trip indication contact 0 = Circuit breaker is not tripped on electrical fault 1 = Circuit breaker is tripped due to electrical fault
			3	Bit always equal to '0' for Compact NSX circuit breaker.
			4	Reserved
			5	Bit always equal to '0' for Compact NSX circuit breaker.
			6	Distinction between Compact NSX and Masterpact NT/NW 0 = Compact NSX 1 = Masterpact NT/NW
			7 - 14	Reserved
			15	Data availability If this bit is at '1', the circuit breaker status is not available.

Table 7: Compact NSX status registers table

Note: The value of the Modbus register's address is always equal to the value of the register - 1.

7.4. Create a "Write register" section



- Right-click on **"Sections"** folder then on **"New section..."**
- Under **"General"** tab, enter the name of the section, e.g. **"Write_Register"**
- Then click on **"Condition"** tab and create a variable to enable the section, e.g. **"Write"**.



- The following message is displayed; click on **"Yes"**.



Note: This variable will allow us to activate the control commands only when we need them. By contrast, the read commands can remain activated constantly.

- Click on **"Apply"**, then **"OK"**.

7.4.1. Add a "WRITE_VAR" block

- Open the section and Press [Ctrl+I] to open the FFB Input Assistant.
- Enter **"WRITE_VAR"** in the first field, **"FFB Type"**.
- Press [Enter] and click on **"Yes"** on the displayed message.
- Place the FFB block on the page.



Figure 21: WRITE_VAR FFB block

All the parameters of this FFB block are described in the following table. The last column contains the values and settings we have implemented.

Parameter	Type	Comment	Our Settings
ADR	ARRAY [0..7] OF INT	Address of the IFE or IFM. The array is given by the ADDM function.	ARRAY [0..7] OF INT
OBJ	STRING	Type of object to read.	'%MW'
NUM	DINT	Address of the first register to write. Note that with Unity, the address of the register is given by: Address = Register number - 1 e.g.: Register 8000 > @7999.	7999
NB	INT	Number of registers to read.	6
EMIS	ARRAY [n..m] OF INT	Word table containing the value of the objects to be written.	ARRAY [0..5] OF INT
GEST	ARRAY [0..3] OF INT	Exchange management table. Gives the status of communication with remote device.	ARRAY [0..3] OF INT

Table 8: WRITE_VAR parameters

7.4.2. Add an "ADDM" block

- Add an "ADDM" function block, as described in section 7.3.2 'Add an "ADDM" block' on page 18 of this document.

7.4.3. Masterpact and Compact NSX control command registers

Address	Register	Type	Value	Description
7999	8000	INT16U	904 / 905	Command code: • 904 : Open circuit breaker • 905 : Close circuit breaker
8000	8001	INT16U	10	Number of parameters
8001	8002	INT16U	4609	Destination code for Masterpact and Compact NS
8002	8003	INT16U	1	-
8003	8004	STRING	-	Password '0000' = 16#30303030 in hexadecimal. Converted to decimal format: • Register 8004 = 12336 • Register 8005 = 12336
8004	8005			

Table 9: Masterpact control command table

Note: The value of the Modbus register's address is always equal to the value of the register - 1.

Address	Register	Type	Value	Description
7999	8000	INT16U	904 or 905	Command code: • 904 : Open circuit breaker • 905 : Close circuit breaker
8000	8001	INT16U	10	Number of parameters
8001	8002	INT16U	4353	Destination code for Compact NSX
8002	8003	INT16U	1	-
8003	8004	STRING	-	Password '0000' = 16#30303030 in hexadecimal. Converted to decimal format: • Register 8004 = 12336 • Register 8005 = 12336
8004	8005			

Table 10: Compact NSX control command table

Note: The value of the Modbus register's address is always equal to the value of the register - 1.

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