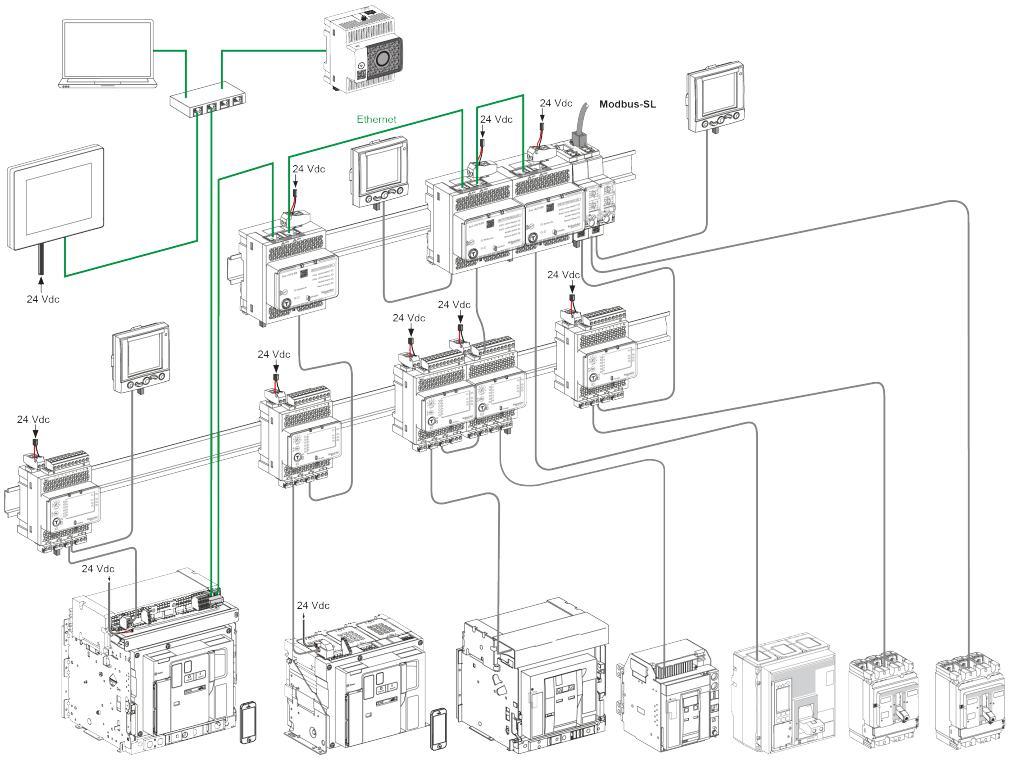
ULP System (IEC Standard)

ULP (Universal Logic Plug) System

User Guide

DOCA0093EN-05
10/2023



www.se.com

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Safety Information

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Cybersecurity Safety Notice

⚠WARNING

POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY

- Change default passwords at first use to help prevent unauthorized access to device settings, controls, and information.
- Disable unused ports/services and default accounts to help minimize pathways for malicious attackers.
- Place networked devices behind multiple layers of cyber defenses (such as firewalls, network segmentation, and network intrusion detection and protection).
- Use cybersecurity best practices (for example, least privilege, separation of duties) to help prevent unauthorized exposure, loss, modification of data and logs, or interruption of services.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

About the Book

Document Scope

The aim of this guide is to provide installers and maintenance personnel with the technical information needed to set up and operate the ULP (Universal Logic Plug) system.

Validity Note

This document is applicable to ULP system modules and accessories associated with the following ranges:

- ComPacT™ NSX circuit breakers and switch-disconnectors from 100 to 630 A
- ComPacT™ NSX DC circuit breakers from 100 to 1200 A and switch-disconnectors from 100 to 630 A
- ComPacT™ NS circuit breakers and switch-disconnectors from 630 to 3200 A
- MasterPact™ NT circuit breakers and switch-disconnectors from 630 to 1600 A
- MasterPact™ NW circuit breakers and switch-disconnectors from 800 to 6300 A
- MasterPact™ MTZ1 circuit breakers from 630 to 1600 A
- MasterPact™ MTZ2 circuit breakers from 800 to 4000 A
- MasterPact™ MTZ3 circuit breakers from 4000 to 6300 A

NOTE:

The information related to the new generation of ComPacT NSX circuit breakers in this guide applies also to the existing range of ComPact NSX circuit breakers.

The information related to the new generation of ComPacT NSX circuit breakers in this guide applies also to the existing range of ComPact NSX circuit breakers.

The exceptions are mentioned wherever applicable. The new ranges are based on the same technical and dimensional architecture as that of the exiting range of circuit breakers.

Online Information

The technical characteristics of the devices described in this guide also appear online. To access the information online, go to the Schneider Electric home page at www.se.com.

The information contained in this guide is likely to be updated at any time. Schneider Electric strongly recommends that you have the most recent and up-to-date version available on www.se.com/ww/en/download.

Related Documents

Title of Documentation	Reference Number
ComPacT NSX - Circuit Breakers and Switch-Disconnectors 100–630 A - User Guide	DOCA0187EN DOCA0187ES DOCA0187FR DOCA0187ZH
ComPacT NSX DC - Circuit Breakers and Switch-Disconnectors - User Guide	DOCA0186EN

Title of Documentation	Reference Number
	DOCA0186ES DOCA0186FR DOCA0186ZH
ComPacT NSX - MicroLogic 5/6/7 Electronic Trip Units - User Guide	DOCA0188EN DOCA0188ES DOCA0188FR DOCA0188ZH
ComPacT NSX - Modbus Communication Guide	DOCA0213EN DOCA0213ES DOCA0213FR DOCA0213ZH
ComPacT NSX & NSXm Catalogue	LVPED221001EN
ComPacT NS - Circuit Breakers and Switch-Disconnectors from 630 to 3200 A - User Guide	DOCA0221EN DOCA0221ES DOCA0221FR DOCA0221ZH
ComPacT NS - Modbus Communication Guide	DOCA0220EN DOCA0220ES DOCA0220FR DOCA0220ZH
ComPacT NS 630b-3200 A Catalogue	LVPED221008EN
MasterPact NT - Circuit Breakers and Switch-Disconnectors - User Guide	51201116AA (EN) EAV16739 (ES) 51201115AA (FR)
MasterPact NW - Circuit Breakers and Switch-Disconnectors - User Guide	04443720AA (EN) EAV16740 (ES) 04443719AA (FR)
MasterPact NT/NW - Modbus Communication Guide	DOCA0054EN DOCA0054ES DOCA0054FR DOCA0054ZH
MasterPact NT/NW Catalogue	LVPED208008EN
MasterPact MTZ1 - IEC Circuit Breakers and Switch-Disconnectors - User Guide	DOCA0100EN DOCA0100ES DOCA0100FR DOCA0100ZH
MasterPact MTZ2/MTZ3 - IEC Circuit Breakers and Switch-Disconnectors - User Guide	DOCA0101EN DOCA0101ES DOCA0101FR DOCA0101ZH
MasterPact MTZ MicroLogic X - Control Unit - User Guide	DOCA0102EN DOCA0102ES DOCA0102FR DOCA0102ZH

Title of Documentation	Reference Number
MasterPact MTZ - Modbus Communication Guide	DOCA0105EN DOCA0105ES DOCA0105FR DOCA0105ZH
MasterPact MTZ Catalogue	LVPED216026EN
Enerlin'X EIFE - Embedded Ethernet Interface for One MasterPact MTZ Drawout Circuit Breaker - Instruction Sheet	NVE23550
Enerlin'X EIFE - Embedded Ethernet Interface for One MasterPact MTZ Drawout Circuit Breaker - User Guide	DOCA0106EN DOCA0106ES DOCA0106FR DOCA0106ZH
Enerlin'X IFE - Ethernet Interface for One Circuit Breaker - Instruction Sheet	QGH13473
Enerlin'X IFE - Ethernet Interface for One IEC Circuit Breaker - User Guide	DOCA0142EN DOCA0142ES DOCA0142FR DOCA0142ZH
Enerlin'X IFE - Ethernet Switchboard Server - User Guide	DOCA0084EN DOCA0084ES DOCA0084FR DOCA0084ZH
Enerlin'X IFM - Modbus-SL Interface for One Circuit Breaker - Instruction Sheet	NVE85393
Enerlin'X IO - Input/Output Application Module for One Circuit Breaker - Instruction Sheet	HRB49217
Enerlin'X IO - Input/Output Application Module for One IEC Circuit Breaker - User Guide	DOCA0055EN DOCA0055ES DOCA0055FR DOCA0055ZH
Enerlin’X FDM121 - Front Display Module for One Circuit Breaker - Instruction Sheet	QGH80971
Enerlin’X FDM121 - Front Display Module for One Circuit Breaker - User Guide	DOCA0088EN DOCA0088ES DOCA0088FR DOCA0088ZH
Service Interface - Instruction Sheet	GDE78167
Service Interface for MasterPact NT/NW, ComPacT, PowerPacT, and EasyPact Circuit Breakers - User Guide	DOCA0170EN DOCA0170ES DOCA0170FR DOCA0170ZH
USB Maintenance Interface - Instruction Sheet	GHD16349AA
Two-Wire RS 485 Isolated Repeater - Instruction Sheet	S1A2181101
MasterPact NT/NW, ComPacT NS, PowerPacT P- and R-Frame Communication Option - Installation Manual	EAV3608000 (EN, ES, FR)

Title of Documentation	Reference Number
EcoStruxure Power connected products Catalogue	LVCATENLX_EN
MasterPact, ComPacT, PowerPacT Cybersecurity Guide	DOCA0122EN DOCA0122ES DOCA0122FR DOCA0122ZH

You can download these technical publications and other technical information from our website at www.se.com/ww/en/download/

Information on Non-Inclusive or Insensitive Terminology

As a responsible, inclusive company, Schneider Electric is constantly updating its communications and products that contain non-inclusive or insensitive terminology. However, despite these efforts, our content may still contain terms that are deemed inappropriate by some customers.

ULP System

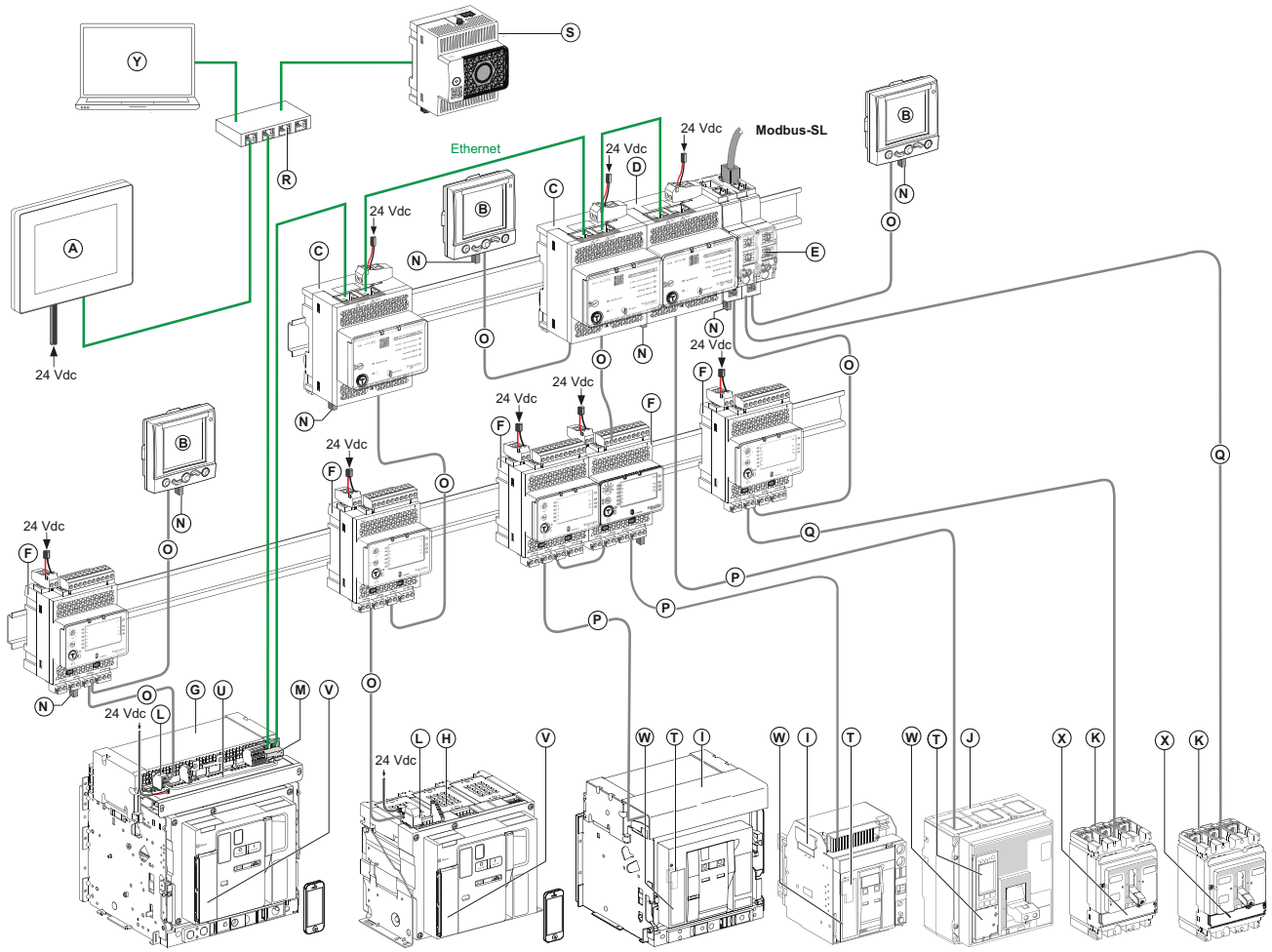
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ULP System Presentation

Description

Use the ULP (Universal Logic Plug) system to construct an electrical distribution solution which integrates metering, communication, and operating assistance functions for circuit breakers.



Legend	Description	Part of the ULP system
A	FDM128 Ethernet display for eight devices	–
B	FDM121 front display module for one circuit breaker	✓
C	IFE Ethernet interface for one circuit breaker	✓
D	IFE Ethernet switchboard server	✓
E	IFM Modbus-SL interface for one circuit breaker	✓
F	IO input/output application module for one circuit breaker	✓
G	MasterPact MTZ drawout circuit breaker	✓
H	MasterPact MTZ fixed circuit breaker	✓
I	MasterPact NT/NW circuit breaker	✓
J	ComPacT NS circuit breaker	✓
K	ComPacT NSX circuit breaker	✓
L	ULP port module for MasterPact MTZ circuit breakers	✓
M	EIFE embedded Ethernet interface for one MasterPact MTZ drawout circuit breaker	✓
N	ULP line termination	✓

Legend	Description	Part of the ULP system
O	RJ45 plug/plug ULP cord	✓
P	Circuit breaker BCM ULP cord	✓
Q	NSX cord	✓
R	Ethernet switch	–
S	Panel server	–
T	BCM ULP circuit breaker communication module	✓
U	Cord between ULP port module and EIFE interface	✓
V	MicroLogic X control unit for MasterPact MTZ circuit breakers	✓
W	MicroLogic trip unit for MasterPact NT/NW and ComPacT NS circuit breakers	✓
X	MicroLogic 5, 6, or 7 trip unit for ComPacT NSX circuit breakers	✓
Y	PC with EPC software for test and commissioning of the IMUs	✓

Cable	Description
	Ethernet network
	Modbus network
	ULP network
	24 Vdc power supply

Features

Use the ULP system to enhance the functions of ComPacT NSX, ComPacT NS, MasterPact NT/NW, and MasterPact MTZ circuit breakers by:

- An Ethernet communication link for access and remote monitoring with the IFE interface or EIFE interface (MasterPact MTZ drawout circuit breakers only).
- Web access to monitor and control the circuit breaker connected to an IFE interface or EIFE interface (MasterPact MTZ circuit breakers only).
- An input/output application with an IO module. It benefits from the extended capability of the IO module to monitor and control position of drawout circuit breakers in the cradle, circuit breaker operation, and custom application, and so on.
- Test, setup, and maintenance functions with EcoStruxure Power Commission software, page 34.
- A Modbus-SL communication link for access and remote monitoring with the IFM interface.
- Local display of measurements and operating assistance data with the FDM121 display.

The ULP system lets the circuit breakers become a metering and supervision tool to assist energy efficiency and can:

- Optimize energy consumption by zone or by application, according to the load peaks or priority zones.
- Improve electrical equipment management.

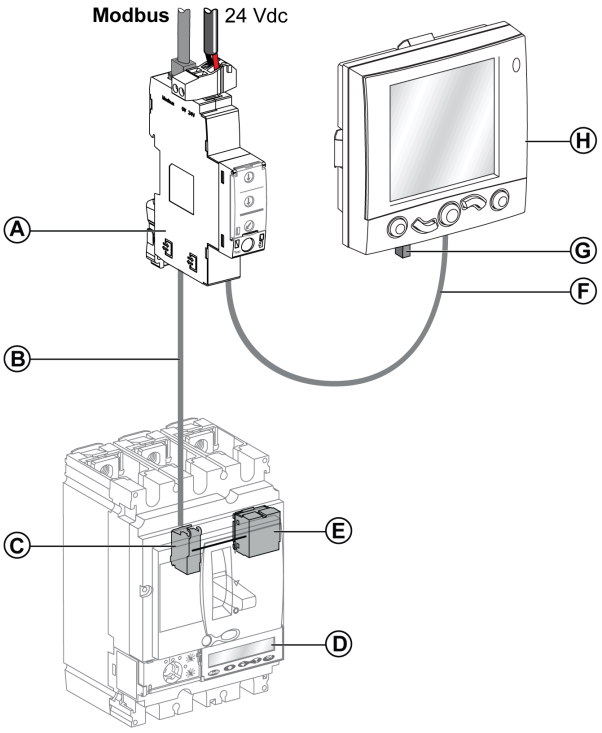
Intelligent Modular Unit (IMU)

A modular unit is a mechanical and electrical assembly containing one or more products to perform a function in electrical equipment (incoming protection, motor command, and control). The modular units are easily installed in the electrical equipment.

The circuit breaker with its internal communicating components (for example, MicroLogic™ trip unit) and external ULP modules (for example, IO module) connected to one communication interface (IFM, IFE, or EIFE depending on the circuit breaker type) is called an IMU.

Examples of IMU with ComPacT NSX Circuit Breaker

Example 1: IMU composed of a fixed ComPacT NSX circuit breaker connected to an IFM interface and an FDM121 display.



A IFM Modbus-SL interface for one circuit breaker

B NSX cord

C NSX cord terminal block (included with NSX cord)

D MicroLogic trip unit

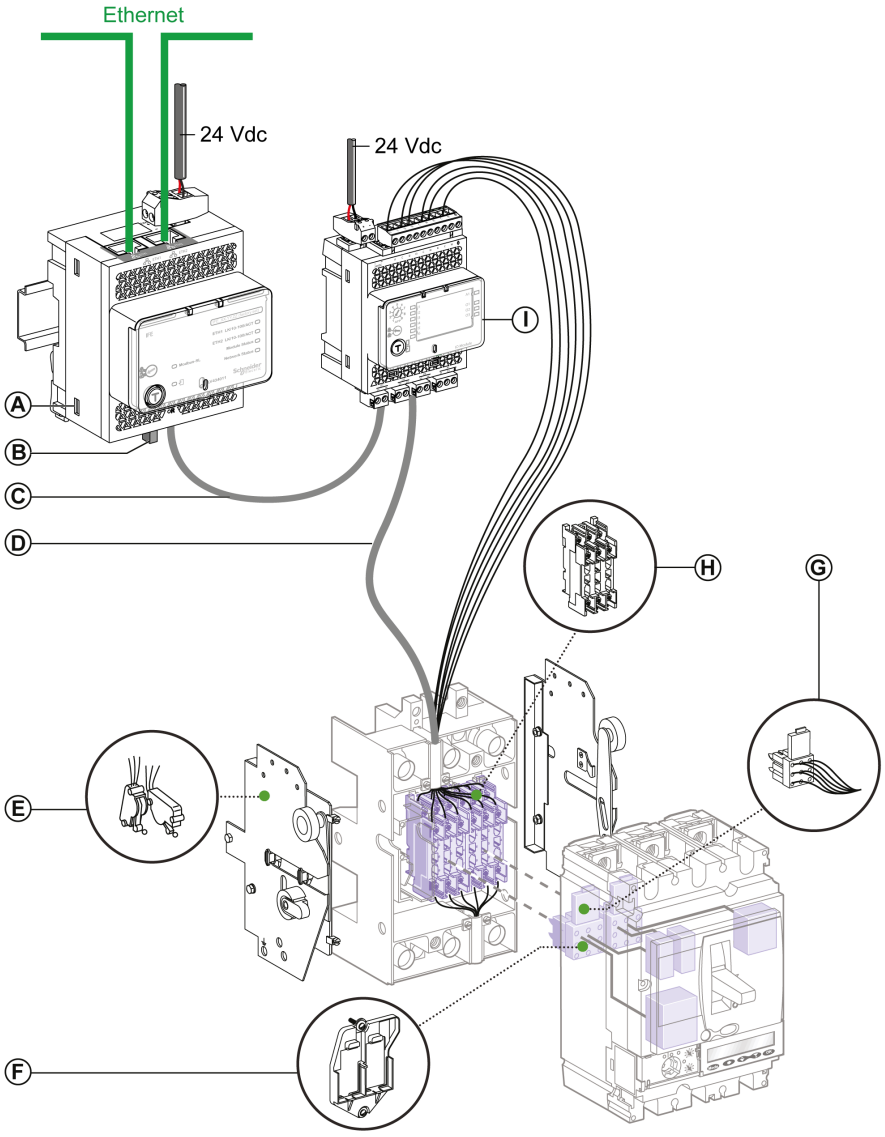
E BSCM circuit breaker status control module

F RJ45 plug/plug ULP cord

G ULP line termination

H FDM121 front display module for one circuit breaker

Example 2: IMU composed of a drawout ComPacT NSX circuit breaker connected to one IO module for cradle management and an IFE interface.



A IFE Ethernet interface for one circuit breaker

B ULP line termination

C RJ45 plug/plug ULP cord

D NSX cord

E CE/CD (connected/disconnected) position auxiliary switches

F Support for two moving connectors

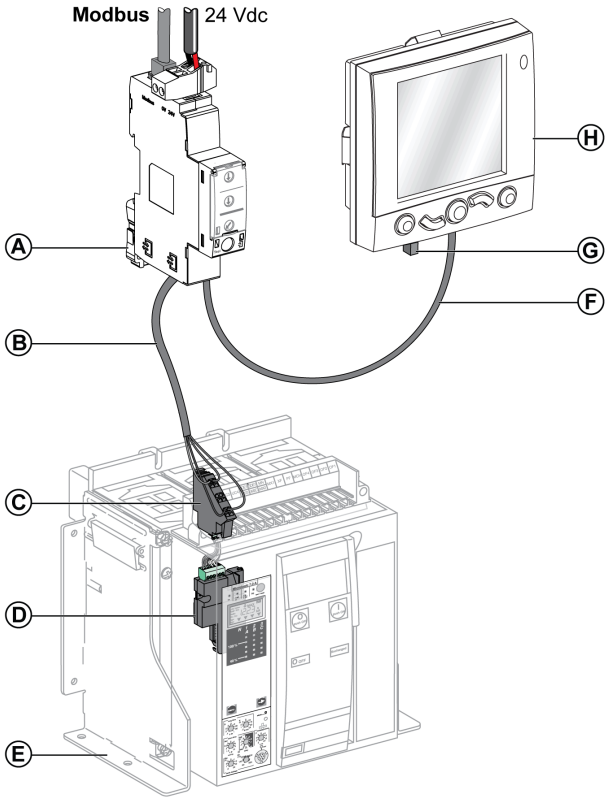
G 9-wire moving connector

H 9-wire fixed connector for base

I IO input/output application module for one circuit breaker

Examples of IMU with MasterPact NT/NW Circuit Breaker

Example 1: IMU composed of a fixed, electrically-operated MasterPact NT circuit breaker connected to an IFM interface and an FDM121 display.



A IFM Modbus-SL interface for one circuit breaker

B Circuit breaker BCM ULP cord

C Fixed terminal block

D BCM ULP circuit breaker communication module

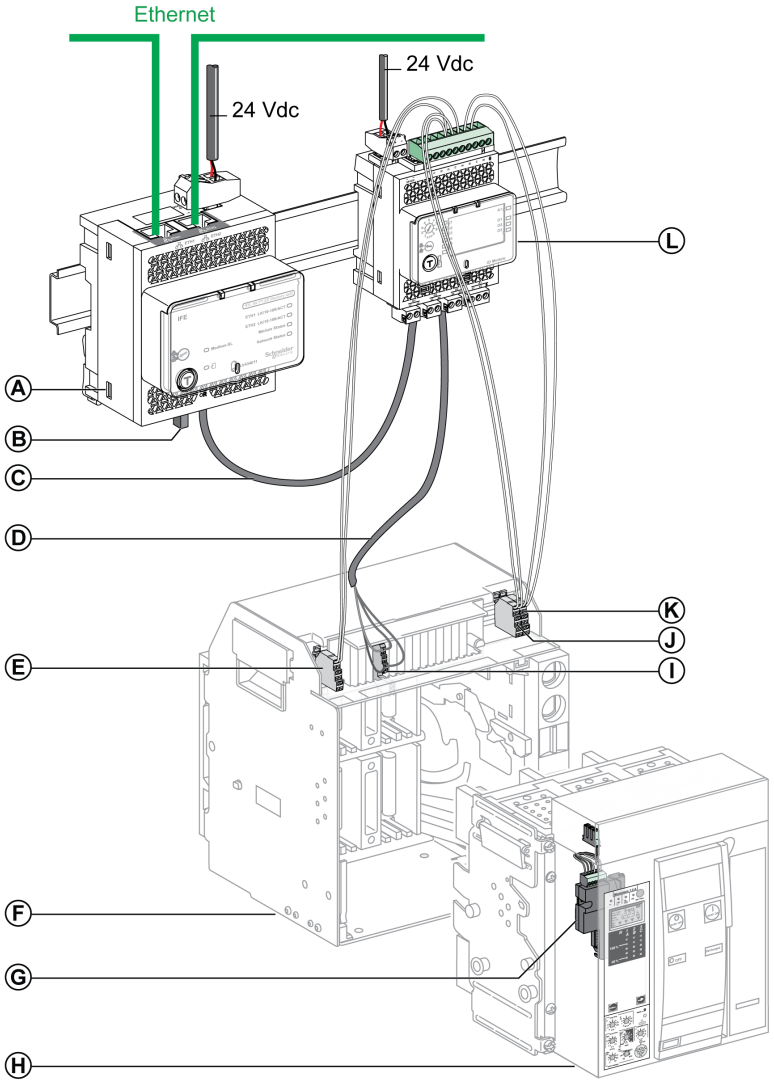
E Fixed electrically-operated circuit breaker

F RJ45 plug/plug ULP cord

G ULP line termination

H FDM121 front display module for one circuit breaker

Example 2: IMU composed of a drawout MasterPact NT circuit breaker connected to one IO module for cradle management and an IFE interface.



A IFE Ethernet interface for one circuit breaker or IFE Ethernet switchboard serve

B ULP line termination

C RJ45 plug/plug ULP cord

D Circuit breaker BCM ULP cord

E Circuit breaker disconnected position contact (CD)

F Circuit breaker cradle

G BCM ULP circuit breaker communication module

H Drawout circuit breaker

I Drawout terminal block

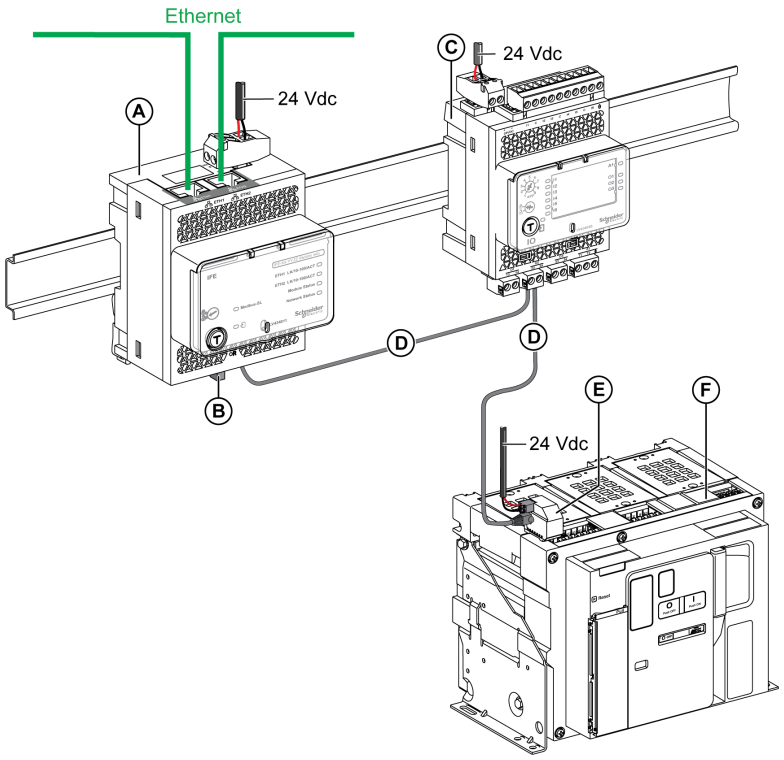
J Circuit breaker connected position contact (CE)

K Circuit breaker test position contact (CT)

L IO input/output application module for one circuit breaker

Examples of IMU with MasterPact MTZ Circuit Breaker

Example 1: IMU composed of a MasterPact MTZ fixed circuit breaker connected to one IO module and an IFE interface.



A IFE Ethernet interface for one circuit breaker or IFE Ethernet switchboard server

B ULP line termination

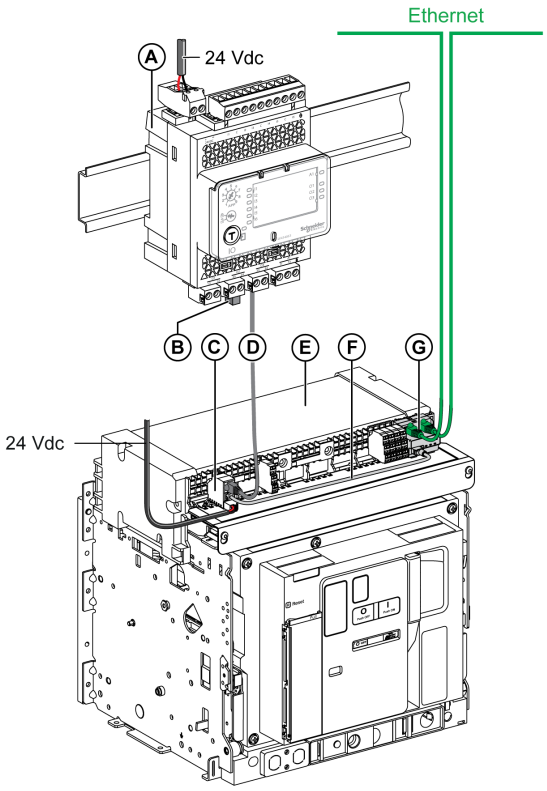
C IO input/output application module for one circuit breaker

D RJ45 plug/plug ULP cord

E ULP port module

F MasterPact MTZ fixed circuit breaker

Example 2: IMU composed of a MasterPact MTZ drawout circuit breaker connected to an EIFE interface and one IO module.



A IO input/output application module for one circuit breaker

B ULP line termination

C ULP port module

D RJ45 plug/plug ULP cord

E MasterPact MTZ drawout circuit breaker

F Cord between ULP port module and EIFE interface

G EIFE embedded Ethernet interface for one MasterPact MTZ drawout circuit breaker

ULP Modules

ULP Modules

ULP modules can be grouped in categories:

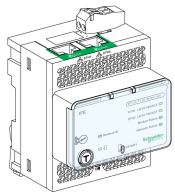
- Generic ULP modules which are compliant with all circuit breakers as presented in the following tables.
- ULP modules specific to ComPacT NSX circuit breakers, page 27.
- ULP modules specific to MasterPact NT/NW and ComPacT NS circuit breakers, page 31.
- ULP modules specific to MasterPact MTZ circuit breakers, page 32.

IFE Ethernet Interface for One Circuit Breaker

The IFE Ethernet interface for one circuit breaker provides an Ethernet access to a single intelligent modular unit using a ComPacT or MasterPact circuit breaker.

Each circuit breaker has its own IFE interface and a corresponding IP address.

NOTE: The IFE interface with part number LV434001 replaces the IFE interface with part number LV434010. The IFE interface LV434001 comes with the real time clock (RTC) feature and allows ULP connections up to 20 m (65.6 ft) with MasterPact MTZ circuit breakers. IFE interface LV434010 has a theoretical limitation of 5 m (16.4 ft) over the life of the IFE interface.

Illustration	Part number	Documentation
	LV434001	• Instruction sheet: QGH13473 • *Enerlin'X IFE - Ethernet Interface for One IEC Circuit Breaker - User Guide* , page 7

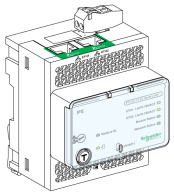
IFE Ethernet Switchboard Server

The IFE Ethernet switchboard server provides an Ethernet access to one or several intelligent modular units using ComPacT or MasterPact circuit breakers.

It supports the following communication architectures:

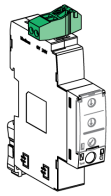
- One single circuit breaker connected to the IFE server.
- Up to 11 circuit breakers through IFM Modbus-SL interfaces that are stacked to the IFE server.

NOTE: The IFE server with part number LV434002 replaces the IFE server with part number LV434011. The IFE server LV434002 comes with the real time clock (RTC) feature and allows ULP connections up to 20 m (65.6 ft) with MasterPact MTZ circuit breakers. The IFE server LV434011 has a theoretical limitation of 5 m (16.4 ft) over the life of the IFE server.

Illustration	Part number	Documentation
	LV434002	• Instruction sheet: QGH13473 • *Enerlin'X IFE - Ethernet Switchboard Server - User Guide* , page 7

IFM Modbus-SL Interface for One Circuit Breaker

The IFM Modbus-SL interface provides access to a Modbus serial line communication network for a single intelligent modular unit using a ComPacT or MasterPact circuit breaker.

Illustration	Part number	Documentation
	LV434000	Instruction sheet: NVE85393

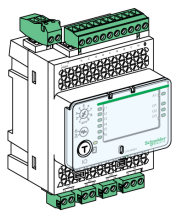
NOTE: The IFM interface with part number LV434000 replaces the IFM interface with part number TRV00210. The specific features of IFM interface with part number TRV00210, including rules for ULP connection and power supply, are detailed in the appendix B, page 120.

IO Input/Output Application Module for One Circuit Breaker

The IO input/output application module for one circuit breaker is one of the components of the ULP architecture.

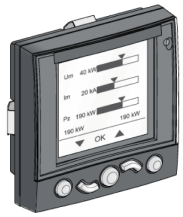
The IO application module enhances control and monitoring functions of a single intelligent modular unit with a ComPacT or MasterPact circuit breaker, thanks to its built-in applications. Its resources are:

- Six digital inputs: self-powered inputs, used as NO and NC dry contact or pulse counter.
- Three digital outputs: bistable relay (5 A maximum).
- One analog input for Pt100 temperature sensor.

Illustration	Part number	Documentation
	LV434063	• Instruction sheet: HRB49217 • *Enerlin'X IO - Input/Output Application Module for One IEC Circuit Breaker - User Guide* , page 7

FDM121 Front Display Module for One Circuit Breaker

The FDM121 front display module for one circuit breaker shows the measurements, alarms, and operating assistance data from a single intelligent modular unit with a ComPacT or MasterPact circuit breaker.

Illustration	Part number	Documentation
	TRV00121	• Instruction sheet: QGH80971 • *Enerlin'X FDM121 - Front Display Module for One Circuit Breaker - User Guide* , page 7

Service Interface

The Service Interface is a portable instrument designed for field testing.

The Service Interface is used for:

- Configuration of Enerlin'X devices
- Testing and configuration of MicroLogic trip units mounted in the following low voltage circuit breakers:
  - MasterPact NT/NW circuit breakers
  - EasyPact MVS circuit breakers
  - ComPacT NS circuit breakers
  - PowerPacT P- and R- frame circuit breakers
  - ComPacT NSX circuit breakers
  - PowerPacT H-, J-, and L-frame circuit breakers

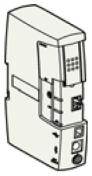
NOTE: The Service Interface cannot be connected to a MasterPact MTZ circuit breaker.

Illustration	Part number	Documentation
	LV485500	• Instruction sheet: GDE78167 • User Guide: Service Interface for MasterPact NT/NW, ComPacT, PowerPacT, and EasyPact Circuit Breakers, page 7

USB Maintenance Interface

The USB maintenance interface is used to set up, test, and maintain a single intelligent modular unit with a ComPacT NSX circuit breaker and the associated ULP modules.

NOTE: The USB maintenance interface is discontinued. It cannot be connected to a MasterPact MTZ or NT/NW circuit breaker or a ComPacT NS circuit breaker.

Illustration	Part number	Documentation
	TRV00911	Instruction sheet: GHD16349AA

RJ45 ULP Ports

NOTICE

HAZARD OF EQUIPMENT DAMAGE

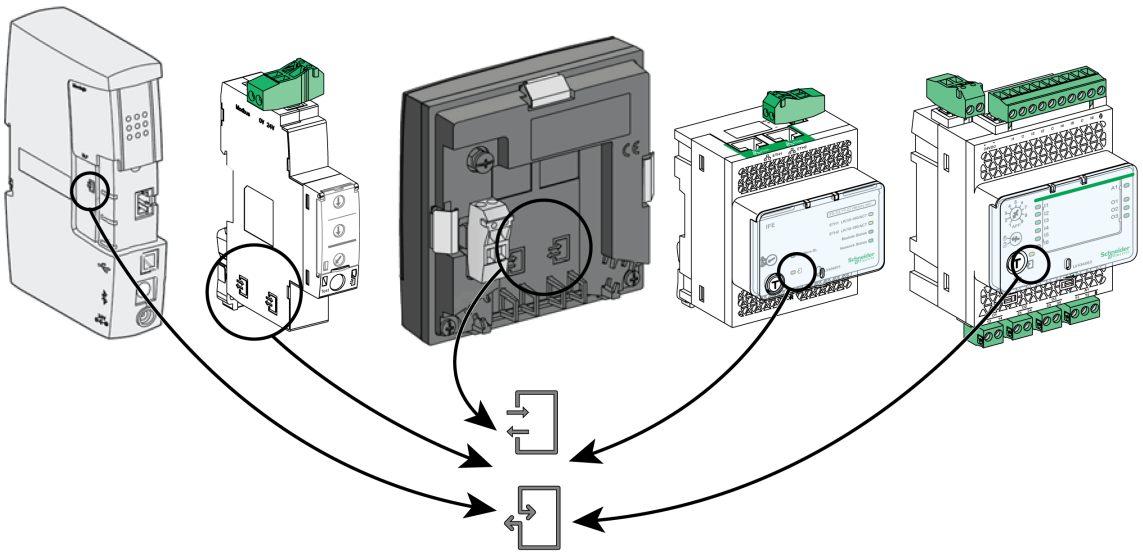
- Never connect an Ethernet device, a Modbus-SL device, or a Modbus line termination to an RJ45 ULP port.
- The RJ45 ULP ports are for ULP modules only.
- Any other use can damage the ULP module or the device connected to the ULP module.

Failure to follow these instructions can result in equipment damage.

ULP modules have RJ45 ports, identified by one of the following pictograms:

 or  .

Generally, each ULP module has two identical RJ45 ports in parallel to connect the IMU ULP modules in a daisy chain, in any order, by using RJ45 plug/plug ULP cords.



Updating the Firmware in ULP Modules

The user can update the firmware of a ULP module by using the latest version of EcoStruxure Power Commission software.

The compatibility matrix embedded in EcoStruxure Power Commission software helps the user to perform diagnostics and correct the firmware discrepancy issues between the ULP modules by providing recommended actions and diagnostics messages relevant to the detected discrepancies, page 37.

NOTE: The following firmware cannot be updated using EcoStruxure Power Commission software:

- The firmware of the BSCM circuit breaker status control module.
- The firmware of the MicroLogic, MasterPact NT/NW, and ComPacT NS circuit breakers.

ULP Accessories

ULP Accessories

ULP accessories can be grouped in categories:

- Generic ULP accessories which are compliant with all circuit breakers as presented in the following tables.
- ULP accessories specific to ComPacT NSX circuit breakers, page 27.
- ULP accessories specific to MasterPact NT/NW and ComPacT NS circuit breakers, page 31.
- ULP accessories specific to MasterPact MTZ circuit breakers, page 32.

RJ45 Plug/Plug ULP Cord

Use simple plug-and-play ULP cords to interconnect ULP modules within a single IMU. They have RJ45 plug connectors at both ends and are available in several lengths.

Illustration	Description	Part number
	L = 0.3 m (0.98 ft) (ten cords)	TRV00803
	L = 0.6 m (1.98 ft) (ten cords)	TRV00806
	L = 1 m (3.28 ft) (five cords)	TRV00810
	L = 2 m (6.56 ft) (five cords)	TRV00820
	L = 3 m (9.84 ft) (five cords)	TRV00830
	L = 5 m (16.4 ft) (one cord)	TRV00850

ULP Line Termination

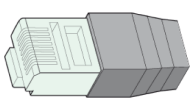
NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Never connect a ULP line termination to an Ethernet or Modbus-SL RJ45 port.
- The ULP line termination must be connected on an RJ45 ULP port only.

Failure to follow these instructions can result in equipment damage.

The ULP line termination closes the unused RJ45 ULP port on a ULP module. It consists of an RJ45 connector with passive components in a sealed unit.

Illustration	Description	Part number
	Ten ULP line terminations	TRV00880

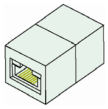
ULP Line Termination in an IMU with MasterPact MTZ Circuit Breaker

The following table lists the ULP module on which the ULP line termination must be connected in the case of an IMU with a MasterPact MTZ circuit breaker with MicroLogic X control unit and a ULP port module.

IMU	Connection of the ULP line termination
MasterPact MTZ circuit breaker with ULP port module	No ULP line termination (connect a protection cap on the unused connector on the ULP port module)
MasterPact MTZ circuit breaker with ULP port module connected to an EIFE interface	On ULP port module
MasterPact MTZ circuit breaker with ULP port module connected to an EIFE interface and one IO module	On IO module
MasterPact MTZ circuit breaker with ULP port module connected to one IO module and an IFE interface	On IFE interface

RJ45 Socket Connector

Use the RJ45 socket connector to connect two ULP cords end-to-end and thus extend them. It consists of two RJ45 socket connectors linked by a direct electrical connection.

Illustration	Description	Part number
	Ten RJ45 socket connectors	TRV00870

The length of the extended ULP cord is limited.

Connecting ComPacT NSX Circuit Breakers to the ULP System

Introduction

Use the NSX cord to connect the ComPacT NSX circuit breakers to the ULP system:

- The ComPacT NSX circuit breaker must have a BSCM circuit breaker status control module and/or a MicroLogic 5, 6, or 7 trip unit.
- The ComPacT NSX DC circuit breaker must have a BSCM circuit breaker status control module.

For more information, refer to the following documentation:

- *ComPacT NSX - Circuit Breakers and Switch-Disconnectors 100–630 A - User Guide*, page 7
- *ComPacT NSX DC - Circuit Breakers and Switch-Disconnectors - User Guide*, page 7

MicroLogic Trip Units

MicroLogic 5, 6, or 7 trip units provide multiple functions:

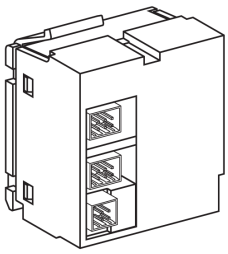
- Protecting the electrical distribution system or specific applications
- Metering instantaneous values, metering demand values for electrical quantities
- Kilowatt hour metering
- Operating information (such as peak demand, customized alarms, and operation counter)
- Communication

For more information, refer to *ComPacT NSX – MicroLogic 5/6/7 Electronic Trip Units - User Guide* , page 7.

BSCM Circuit Breaker Status Control Module

The BSCM circuit breaker status control module can be used

- to send the following data via the communication network:
  - Circuit breaker states from OF, SD, and SDE auxiliary contacts
  - Control instructions for the communicating motor mechanism (if present): opening, closing, and resetting
  - Information to assist the operator: storage of the last 10 events
- to indicate the status of the circuit breaker with communicating and non-communicating trip unit through external communications. This requires an external communication module.

Illustration	Part number	Documentation
	LV434205	• Instruction sheet: GHD16046AA • User guides: ◦ *ComPacT NSX – Circuit Breakers and Switch-Disconnectors 100–630 A - User Guide* , page 7 ◦ *ComPacT NSX DC – Circuit Breakers and Switch-Disconnectors 1 - User Guide* , page 7

NSX Cord

NSX cords are internal connection blocks used to connect a ComPacT NSX circuit breaker equipped with the BSCM module and/or the MicroLogic 5, 6, or 7 trip unit to a ULP module.

⚠WARNING

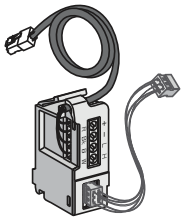
HAZARD OF ELECTRIC SHOCK

For system voltage greater than 480 Vac:

- Use the insulated NSX cord LV434204.
- Do not use NSX cords LV434200, LV434201, and LV434202.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

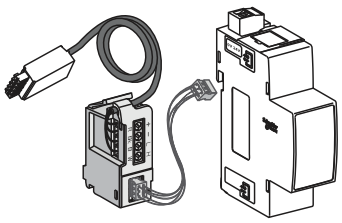
The NSX cord is suited to applications less than 480 Vac. It is available in three cable lengths and terminates with a RJ45 plug connector for direct connection to a ULP module.

Illustration	Length	Part number	Documentation
	L = 0.35 m (1.15 ft)	LV434200	• Instruction sheet: GHD16047AA • User guides: ◦ *ComPacT NSX – Circuit Breakers and Switch-Disconnectors 100–630 A - User Guide* , page 7 ◦ *ComPacT NSX DC – Circuit Breakers and Switch-Disconnectors - User Guide* , page 7
	L = 1.3 m (4.3 ft)	LV434201	
	L = 3 m (9.8 ft)	LV434202	

Lengths up to 5 m (16.4 ft) are possible by using RJ45 socket/socket connectors.

Isolated NSX Cord

For system voltages greater than 480 Vac, using an insulated NSX cord is mandatory. This is to ensure data integrity on ULP network. The insulated NSX cord is an isolated variant of the NSX cord, terminated by an electronic module with a RJ45 socket connector. Use an RJ45 plug/plug ULP cord to connect the isolated electronic module of the NSX cord to a ULP module.

Illustration	Length	Part number	Documentation
	L = 1.3 m (4.3 ft)	LV434204	• Instruction sheet: GHD16313AA • *ComPacT NSXCircuit Breakers and Switch-Disconnectors 100–630 A - User Guide* , page 7

The electronic module of the isolated NSX cord must be powered by a 24 Vdc power supply so that the ULP system is isolated.

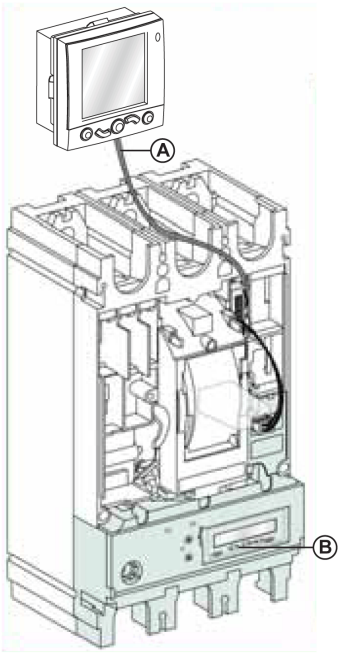
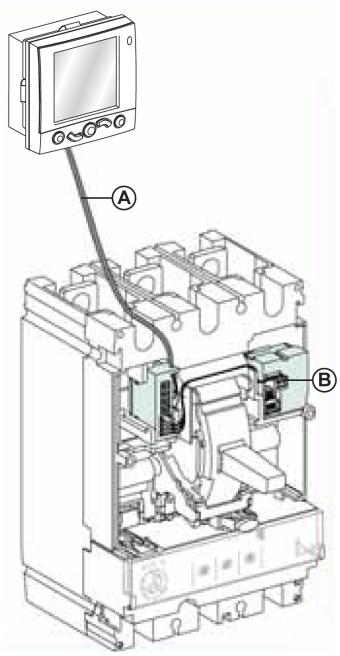
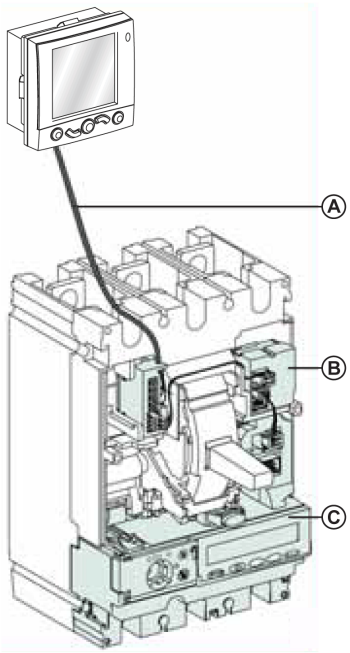
The following table summarizes the electronic module characteristics:

Characteristic	Value
Dimensions	27 x 27 x 27 mm (1 x 1 x 1 in)
Mounting	On DIN rail
Degree of protection of the installed module	• On the front panel (wall-mounted enclosure): IP40

Characteristic	Value
	• On the connections (behind the enclosure door): IP20
Operating temperature	-25 °C to +70 °C (-13 °F to +158 °F)
Power supply voltage	24 Vdc -20%/+10% (19.2–26.4 Vdc)
Consumption	• Typical: 20 mA/24 Vdc at 20 °C (68 °F) • Maximum: 30 mA/19.2 Vdc at 60 °C (140 °F)

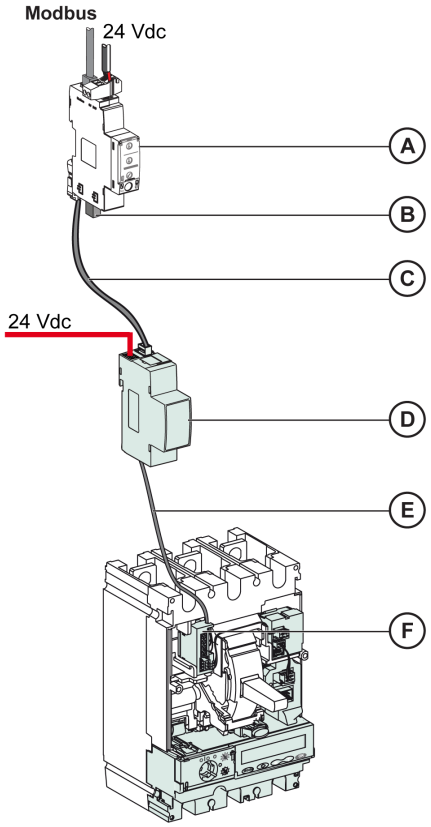
Connection to the ULP System with NSX Cord

The following figures show connection of the ComPacT NSX circuit breaker to the IMU with the NSX cord.

ComPacT NSX circuit breaker with MicroLogic 5, 6, or 7 trip unit	ComPacT NSX circuit breaker with BSCM module	ComPacT NSX circuit breaker with BSCM module and MicroLogic 5, 6, or 7 trip unit
		
A NSX cord **B** MicroLogic 5, 6, or 7 trip unit	**A** NSX cord **B** BSCM module	**A** NSX cord **B** BSCM module **C** MicroLogic 5, 6, or 7 trip unit

Connection to the ULP System with Isolated NSX Cord

The following figure shows connection of the ComPacT NSX circuit breaker to the IMU with the isolated NSX cord:



A IFM Modbus-SL interface for one circuit breaker

B ULP line termination

C RJ45 plug/plug ULP cord

D Insulated ULP module for system voltage greater than 480 Vac

E Circuit breaker ULP cord for system voltage greater than 480 Vac

F Connector for ComPacT NSX circuit breaker internal connection

Connecting MasterPact NT/NW and ComPacT NS Circuit Breakers to the ULP System

Introduction

Use the circuit breaker BCM ULP cord to connect MasterPact NT/NW and ComPacT NS circuit breakers to the ULP system. The circuit breaker must have a BCM ULP circuit breaker communication module.

BCM ULP Circuit Breaker Communication Module

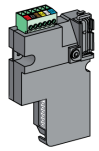
Supplied with the circuit breaker, the BCM ULP circuit breaker communication module is installed behind the MicroLogic trip unit and is wired to the microswitches:

- For manually-operated devices:
  - OF, SDE and/or SD contacts
- For electrically-operated devices:
  - OF, SDE, PF, CH contacts
  - Connection kit to the MX1 and XF communicating voltage releases

The BCM ULP circuit breaker communication module is independent of the trip unit. It communicates two-way with:

- the ULP system via the circuit breaker BCM ULP cord
- the MicroLogic trip unit via an infra-red link

The part number depends on the circuit breaker type. For details, refer to a selector program of Schneider Electric products.

Illustration	Part number	Documentation
	47405	Instruction sheet: EAV3608000

Circuit Breaker BCM ULP Cord

The circuit breaker BCM ULP cord is used to connect a MasterPact NT/NW or ComPacT NS circuit breaker equipped with the BCM ULP module and/or a MicroLogic trip unit to a ULP module.

It is available in three lengths and terminates with a RJ45 plug connector for direct connection to a ULP module.

Illustration	Length	Part number	Documentation
	L = 0.35 m (1.15 ft)	LV434195	Instruction sheet: S1A73172
	L = 1.3 m (4.26 ft)	LV434196	
	L = 3 m (9.84 ft)	LV434197	
	L = 5 m (16.4 ft)	LV434198	

Connecting MasterPact MTZ Circuit Breakers to the ULP System

Introduction

Use the RJ45 plug/plug ULP cord to connect a MasterPact MTZ circuit breaker to the ULP system. The circuit breaker must have a ULP port module.

ULP Port Module

Depending on the type of circuit breaker, the ULP port module is supplied as follows:

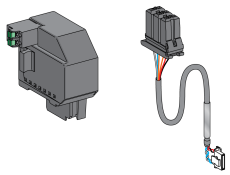
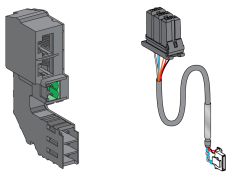
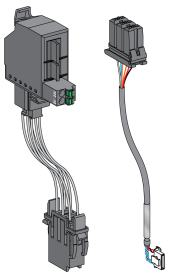
- As standard on MasterPact MTZ2/MTZ3 drawout circuit breakers.
- As an option on MasterPact MTZ1/MTZ2/MTZ3 fixed circuit breakers and MasterPact MTZ1 drawout circuit breakers. It is mounted with the terminal blocks of the circuit breaker.

The ULP port module:

- Supplies power to the MicroLogic X control unit.
- Has an integrated ULP line termination.
- Enables the connection to external ULP modules, like the IO module or the IFE interface.

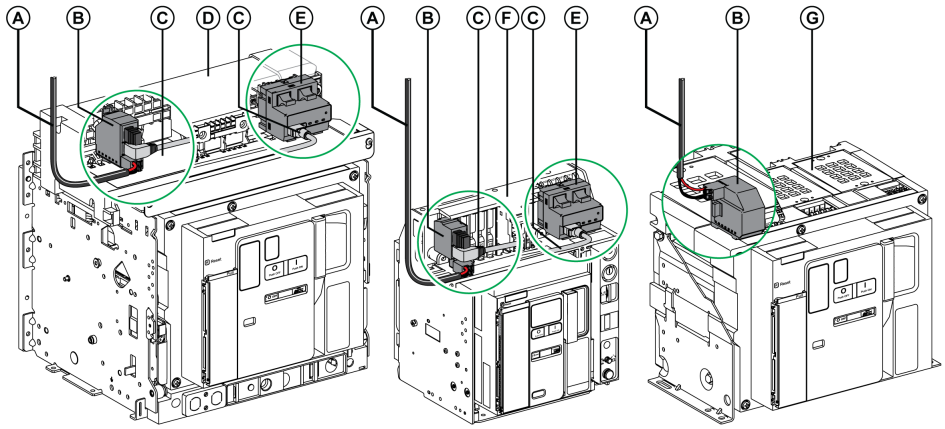
For MasterPact MTZ drawout circuit breakers with optional EIFE interface, the ULP port module:

- Supplies power to the EIFE interface.
- Connects the EIFE interface to the other IMU modules (for example, IO module).

Illustration	Description	Part number	Documentation
	ULP port module for MasterPact MTZ1 fixed circuit breaker	LV850063SP	Instruction sheet: NVE40791
	ULP port module for MasterPact MTZ2/MTZ3 fixed circuit breaker	LV850061SP	
	ULP port module for MasterPact MTZ1 drawout circuit breaker	LV850064SP	Instruction sheet: NVE40796
	ULP port module for MasterPact MTZ2/MTZ3 drawout circuit breaker	LV850062SP	Instruction sheet: NVE40797

Power Supply of ULP Port Module in MasterPact MTZ Circuit Breakers

The ULP port module in MasterPact MTZ circuit breakers supply power directly to the MicroLogic X control unit and EIFE interface.



A 24 Vdc power supply

B ULP port module

C ULP port module and EIFE interface

D Drawout MasterPact MTZ2/MTZ3 circuit breaker

E EIFE embedded Ethernet interface for one MasterPact MTZ drawout circuit breaker

F Drawout MasterPact MTZ1 circuit breaker

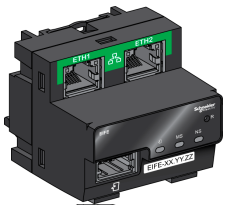
G MasterPact MTZ circuit breaker

EIFE Embedded Ethernet Interface for One MasterPact MTZ Drawout Circuit Breaker

The EIFE interface is an optional accessory that is mounted on the cradle of a MasterPact MTZ drawout circuit breaker.

The EIFE interface enables MasterPact MTZ drawout circuit breakers to be connected to an Ethernet network. It provides digital access to all the data delivered by the MicroLogic X control unit. In addition, it monitors the position of the device in the cradle: connected, test, and disconnected.

Kits with cord between ULP port module and EIFE interface in different lengths are available.

Illustration	Part number	Documentation
	LV851001	• Instruction sheet: NVE23550 • *Enerlin'X EIFE - Embedded Ethernet Interface for One MasterPact MTZ Drawout Circuit Breaker - User Guide* , page 7

EcoStruxure Power Commission Software

Overview

EcoStruxure Power Commission software helps you to manage a project as part of testing, commissioning, and maintenance phases of the project life cycle. The innovative features in it provide simple ways to configure, test, and commission the smart electrical devices.

EcoStruxure Power Commission software automatically discovers the smart devices and allows you to add the devices for an easy configuration. You can generate comprehensive reports as part of Factory Acceptance Test and Site Acceptance Test to replace your heavy manual work. Additionally, when the panels are under operation, any change of settings made can be easily identified by a yellow highlighter. This indicates the difference between the project and device values, and hence provides a system consistency during the operation and maintenance phase.

EcoStruxure Power Commission software enables the configuration of the following circuit breakers, modules, and accessories:

Circuit breaker ranges	Modules	Accessories
MasterPact MTZ circuit breakers	• MicroLogic X control unit • Communication interface modules: IFM interface, IFE interface, IFE server, and EIFE interface • ULP modules: IO module, FDM121 display(1)	M2C output module
• MasterPact NT/NW circuit breakers • ComPacT NS circuit breakers • PowerPacT P- and R-frame circuit breakers	• MicroLogic trip units • Communication interface modules: BCM module, CCM module, BCM ULP module, IFM interface, IFE interface, IFE server • ULP modules: IO module, FDM121 display(1)	M2C and M6C output modules
• ComPacT NSX circuit breakers • PowerPacT H-, J-, and L-frame circuit breakers	• MicroLogic trip units • Communication interface modules: BSCM module, IFM interface, IFE interface, IFE server • ULP modules: IO module, FDM121 display(1)	SDTAM and SDx output modules
(1) For FDM121 display, only the firmware and language download are supported.		

For more information, refer to the *EcoStruxure Power Commission Online Help*.

Click here to download the latest version of EcoStruxure Power Commission software.

Key Features

EcoStruxure Power Commission software performs the following actions for the supported devices and modules:

- Create projects by device discovery
- Save the project in the EcoStruxure Power Commission cloud for reference
- Upload settings to the device and download settings from the device
- Compare the settings between the project and the device
- Perform control actions in a secured way
- Generate and print the device settings report
- Perform a communication wiring test on the entire project and generate and print test report
- View the communication architecture between the devices in a graphical representation
- View the measurements, logs, and maintenance information
- Export Waveform Capture on Trip Event (WFC)
- View the status of device and IO module
- View the alarm details
- Buy, install, remove, or retrieve the Digital Modules
- Check the system firmware compatibility status
- Update to the latest device firmware
- Perform force trip and automatic trip curve tests

Design Rules of ULP System

What's in This Part

Compatibility Rules of ULP Modules 37
Rules for ULP Connection and Power Supply 42
Rules for Connection to the Communication Network 63
ULP System Architectures 78

Compatibility Rules of ULP Modules

What's in This Chapter

Hardware and Firmware Compatibility of ULP Modules 38
Compatibility Check of Device/Firmware and Corrective Actions 40

Hardware and Firmware Compatibility of ULP Modules

Introduction

ULP modules must be compatible with both the hardware and firmware.

The hardware and firmware compatibility of ULP modules can be checked with:

- ULP status LED, page 39
- EcoStruxure Power Commission software, page 39

Hardware Compatibility

The following table lists the compatible ULP modules for each range of circuit breakers.

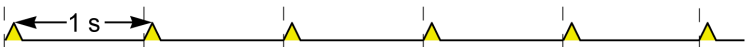
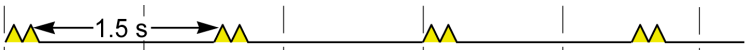
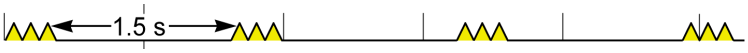
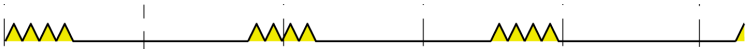
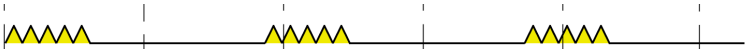
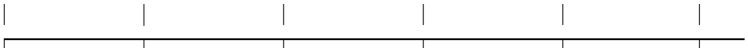
ULP module	Part number	Circuit breakers		
		MasterPact MTZ with ULP port module and MicroLogic control unit	MasterPact NT/NW or ComPacT NS with BCM ULP module and MicroLogic trip unit	ComPacT NSX with BSCM module and/or MicroLogic trip unit
IFE Ethernet interface for one circuit breaker	LV434001	✓	✓	✓
IFE Ethernet switchboard server	LV434002	✓	✓	✓
EIFE embedded Ethernet interface for one MasterPact MTZ drawout circuit breaker	LV851001	✓	–	–
Spare part kit EIFE for one MasterPact MTZ1 drawout circuit breaker	LV851100SP	✓	–	–
Spare part kit EIFE for one MasterPact MTZ2/MTZ3 drawout circuit breaker	LV851200SP	✓	–	–
IFM Modbus-SL interface for one circuit breaker with Modbus-SL RJ45 port	LV434000	✓	✓	✓
IFM Modbus-SL interface for one circuit breaker with Modbus-SL 5-pin connector	TRV00210	–	✓	✓
FDM121 front display module for one circuit breaker	TRV00121	✓	✓	✓
IO input/output application module for one circuit breaker	LV434063	✓	✓	✓
Service Interface	LV485500	–	✓	✓
USB maintenance interface	TRV00911	–	✓	✓

Firmware Compatibility Matrix

The primary reason for updating the system is to obtain the latest system features. The latest device firmware baseline and version details of the devices are available in EcoStruxure Power Commission software.

Checking Hardware and Firmware Compatibility with ULP Status LED

The yellow ULP LED indicates the mode of the ULP module.

ULP LED	Mode	Action
	Nominal	None
	Conflict	Remove extra ULP module
	Degraded	Replace ULP module at the next maintenance operation
	Test	None
	Non-critical firmware discrepancy	Update firmware at the next maintenance operation
	Non-critical hardware discrepancy	Replace ULP module at the next maintenance operation
	Configuration discrepancy	Install missing features
	Critical firmware discrepancy	Use EcoStruxure Power Commission software to check the firmware and hardware compatibility and follow the recommended actions
	Critical hardware discrepancy	
	Stop	Replace ULP module
	Power off	Check power supply

Checking Hardware and Firmware Compatibility with EcoStruxure Power Commission Software

EcoStruxure Power Commission software can be used to check hardware and firmware compatibility of the modules in the IMU and to get recommended actions to recover from a compatibility discrepancy situation, page 40.

For more information, refer to *EcoStruxure Power Commission Online Help*.

Compatibility Check of Device/Firmware and Corrective Actions

Overview

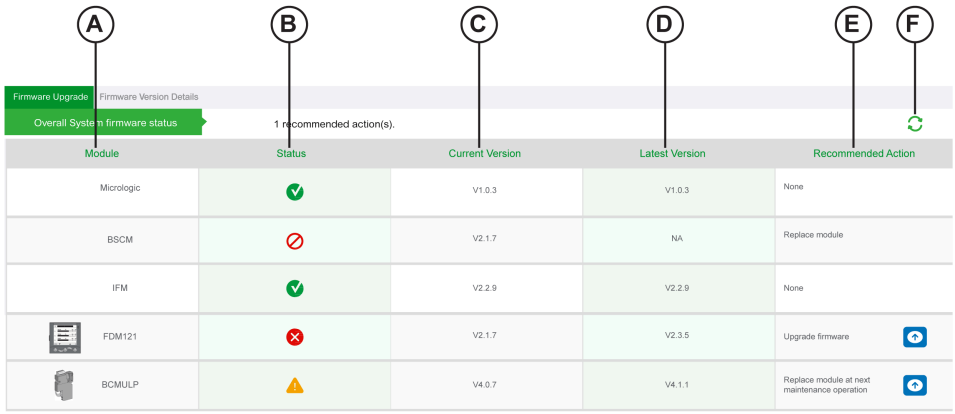
When ULP modules are upgraded with new functionalities, verify with the EcoStruxure Power Commission software that they are compatible with the different modules in the IMU system. Use the **Firmware Upgrade** table to perform diagnostics and identify discrepancies between the ULP modules. This table also provides the recommended actions relevant to the detected discrepancies.

NOTE: Compatibility check will only work if the device is connected.

Firmware Upgrade

To view the firmware status, click **Firmware** in the Device view.

The **Firmware Upgrade** window displays the following compatibility table.



Legend	Name	Description
A	**IP address**	Displays the IP address of the connected device.
B	**Modbus address**	Displays the Modbus address of the connected device.
C	**Module**	Lists the ULP modules of the connected device.
D	**Status**	Displays the compatibility status of the module inside the system.
E	**Device Version**	Displays the current firmware version installed in the module.
F	**Available Version**	Displays the latest firmware version available for upgrade.
G	**Recommended Action**	Provides the solution for discrepancies.
H	**Refresh**	Updates the changes made as per the recommended action.

Status

The **Status** column identifies the discrepancy conditions within the ULP modules.

Icons	Module status
	Nominal
	Non-critical firmware discrepancy Or

Icons	Module status
	Non-critical hardware discrepancy
	Critical firmware discrepancy Critical hardware discrepancy Or Hardware degraded
	Stop Or Conflict

Recommended Actions

The **Recommended Action** column on the **Firmware Upgrade** window provides a solution to resolve a discrepancy. Each discrepancy has a generic predefined recommended action.

The table lists the recommended actions to take in the case of a detected discrepancy.

Module status	Description	Recommended action
Nominal	The ULP module is in nominal mode.	None.
Non-critical firmware discrepancy	There is a non-critical firmware discrepancy between the ULP module and other modules in the IMU.	Upgrade firmware at the next maintenance operation.
Non-critical hardware discrepancy	There is a non-critical hardware discrepancy between the ULP module and other modules in the IMU.	Replace module at the next maintenance operation.
Critical firmware discrepancy	There is a critical firmware discrepancy between the ULP module and other modules in the IMU.	Upgrade firmware.
Critical hardware discrepancy	There is a critical hardware discrepancy between the ULP module and other modules in the IMU.	Replace module.
Hardware degraded	The ULP module is in degraded mode.	Replace module at the next maintenance operation.
Stop	The ULP module is out of service.	Replace module.
Conflict	The ULP module is in conflict mode.	Remove duplicate module.

Refresh

After performing a recommended action for a specific discrepancy, you can click the **Refresh** button to update the changes in the **Firmware Upgrade** window.

Rules for ULP Connection and Power Supply

What's in This Chapter

Composition Rules for Intelligent Modular Units (IMUs) 43
Intelligent Modular Unit (IMU) with Withdrawable Drawer 50
Earthing System 53
ULP System Power Supply 55

Composition Rules for Intelligent Modular Units (IMUs)

Introduction

Connection of an IMU in the ULP system is simple, but must comply with the rules concerning composition, RJ45 plug/plug ULP cords, and the ULP module power supply.

General Rule: Composition of an IMU

An IMU is composed of the following two device types:

- One main device (circuit breaker or switch-disconnector) and an internal ULP communication module
- One or several external ULP modules

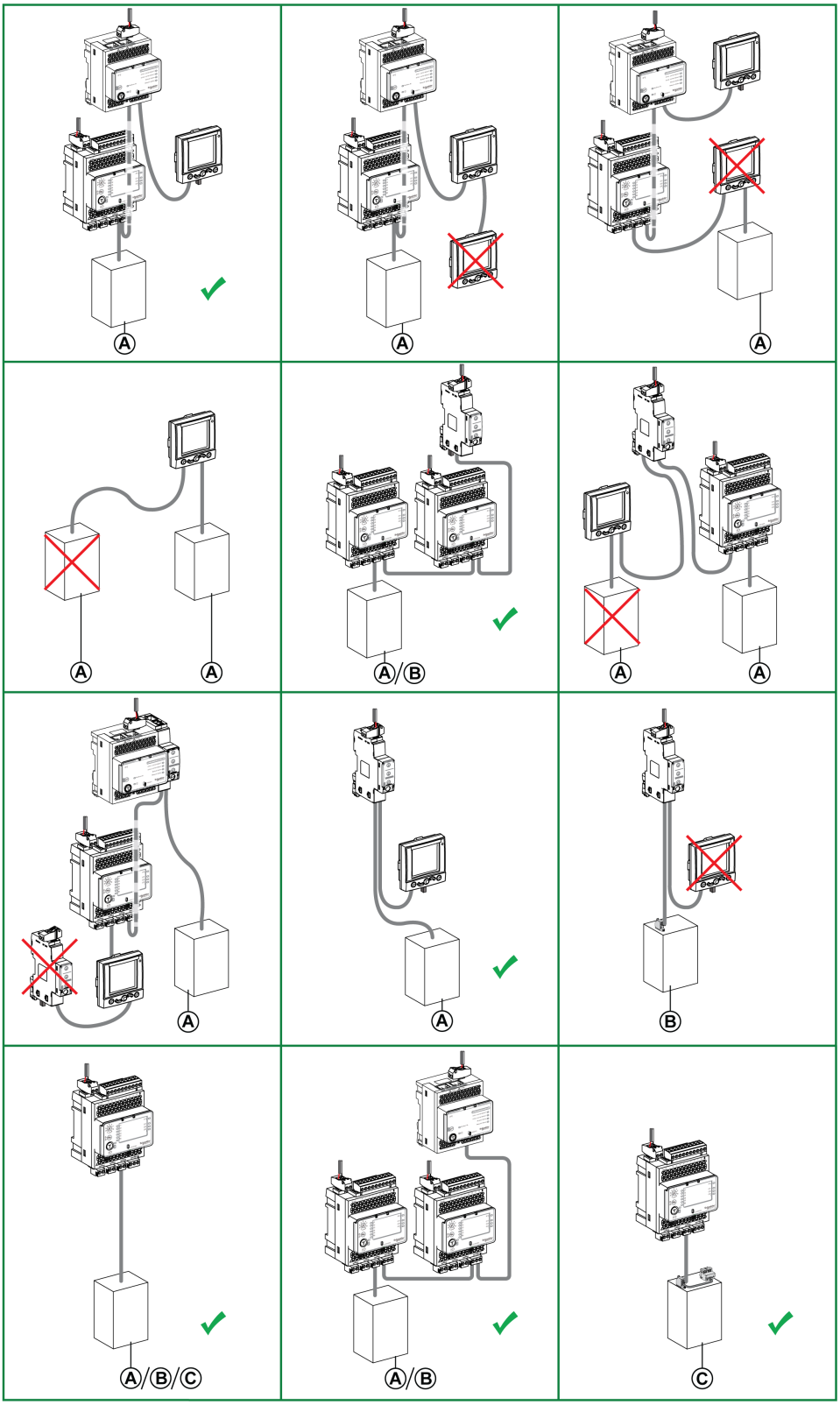
Main device type	ULP modules
• ComPacT NSX circuit breaker with BSCM circuit breaker status control module and/or MicroLogic 5, 6, or 7 trip unit • ComPacT NSX switch-disconnector with BSCM circuit breaker status control module • ComPacT NSX DC circuit breaker or switch-disconnector with BSCM circuit breaker status control module	• 0 or 1 FDM121 display • 0, 1, or 2 IO modules • 0 or 1 interface among: ◦ IFE interface ◦ IFE server (1) ◦ IFM interface
• ComPacT NS circuit breaker with BCM ULP circuit breaker communication module • MasterPact NT/NW circuit breaker with BCM ULP circuit breaker communication module	• 0 or 1 FDM121 display • 0, 1, or 2 IO modules • 0 or 1 interface among: ◦ IFE interface ◦ IFE server (1) ◦ IFM interface
MasterPact MTZ drawout circuit breaker with ULP port module	• 0 or 1 FDM121 display • 0, 1, or 2 IO modules • 0 or 1 interface among: ◦ IFE interface ◦ IFE server (1) ◦ EIFE embedded Ethernet interface ◦ IFM interface (LV434000 only)
MasterPact MTZ fixed circuit breaker with ULP port module	• 0 or 1 FDM121 display • 0, 1, or 2 IO modules • 0 or 1 interface among: ◦ IFE interface ◦ IFE server (1) ◦ IFM interface (LV434000 only)

(1) One IFE server with stacked IFM interfaces:

- In terms of power supply, the maximum number of IFM interfaces stacked to one IFE server is 11 in order to limit voltage drop.
- In terms of Modbus-SL communication, it depends on the performance requirement. As it takes approximately 500 ms at 19,200 Baud per device to refresh 100 registers, the more interfaces added the longer the minimum refreshment period. The minimum refreshment period depends on the number of IFM interfaces stacked to one IFE server. Multiply the time to refresh one device by the number of devices to find the minimum refreshment period expected in the application. For instance, an installation with eight IFM interfaces stacked to one IFE server at 19,200 Baud would take approximately 4 seconds to be read.

  For good communication performance, a maximum of eight IFM interfaces stacked to one IFE server is recommended.

These examples illustrate the composition rules for an IMU.



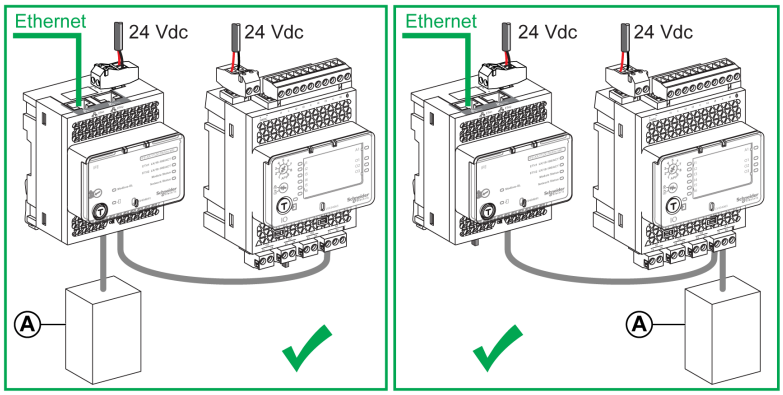
A ComPacT NSX, ComPacT NS, or MasterPact NT/NW circuit breaker

B MasterPact MTZ circuit breaker with ULP port module

C MasterPact MTZ drawout circuit breaker with ULP port module and EIFE interface

General Rule: Order of ULP Modules in an IMU

Connect the ULP modules in a single IMU in any order. Base the connection on the ULP cable recommendations and the desired layout for the ULP modules in the electrical equipment.

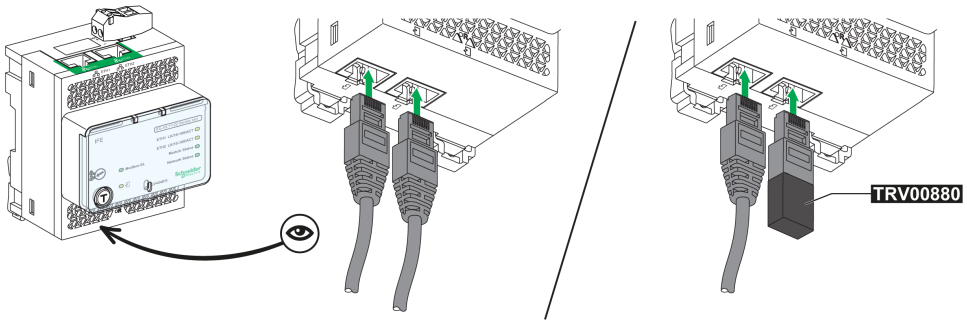


A ComPacT NSX, ComPacT NS, MasterPact NT/NW, or MasterPact MTZ circuit breaker

General Rule: ULP Line Termination

The ULP modules placed at the end of the ULP line must have a ULP line termination (part number TRV00880) on the unused ULP RJ45 connector.

Example of ULP line termination on IFE interface:



Place the ULP modules which have an internal ULP line termination at the end of the ULP line, that is:

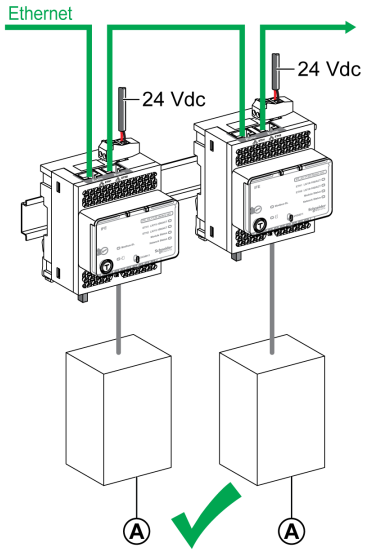
- BSCM module or MicroLogic 5, 6, or 7 trip unit for ComPacT NSX circuit breakers.
- BSCM module for ComPacTNSX DC circuit breakers.
- BCM ULP module for ComPacT NS or MasterPact NT/NW circuit breakers.
- ULP port module for MasterPact MTZ circuit breakers.

NOTE: In an architecture with an EIFE interface connected to a ULP port module, the ULP port module is the end of the ULP line.

General Rule: Cables to Interconnect IMUs on Communication Networks

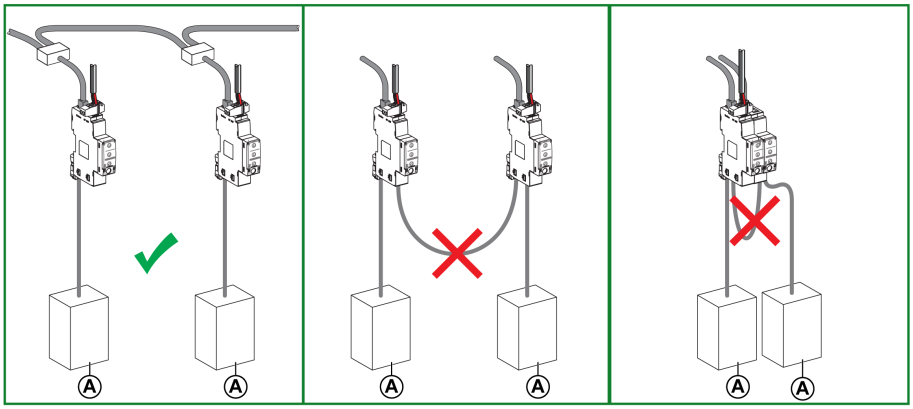
Do not connect the IMUs to one another with ULP cords.

- Use only the Ethernet cable to interconnect IMUs connected to an Ethernet network.



A ComPacT NSX, ComPacT NS, MasterPact NT/NW, or MasterPact MTZ circuit breaker

- Use only the Modbus cable or stacking accessory to interconnect IMUs connected to a Modbus network.



A ComPacT NSX, ComPacT NS, MasterPact NT/NW, or MasterPact MTZ circuit breaker

General Rule: Limitation of Number of MasterPact MTZ and ComPacT NSX Circuit Breakers

In case of floating power supply and when no IFM interface with part number TRV00210 is installed in the ULP system, the number of MasterPact MTZ and ComPacT NSX circuit breakers is limited by earth leakage currents as described in the following tables.

The limitation is valid for all MasterPact MTZ and ComPacT NSX circuit breakers used with a ULP connection.

Limiting the maximum number of IMUs on the same external DC power supply limits the cumulated leakage currents under 0.5 mA (human sensitivity level) or 3.5 mA (class I equipment).

Number of MicroLogic trip units or control units in the case of 0.5 mA leakage current maximum:

Ue (V L-N / U L-L) (Vac)	Maximum number of MicroLogic X control units without VPS power supply (MasterPact MTZ circuit breakers)	Maximum number of MicroLogic X control units with VPS power supply (MasterPact MTZ circuit breakers)	Maximum number of MicroLogic trip units (ComPacT NSX circuit breakers)
66 / 115	144	23	66
127 / 220	75	12	34
230 / 400	41	6	19
347 / 600	27	4	12
400 / 690	24	9	11
1,000	16	6	0

Number of MicroLogic trip units or control units in the case of 3.5 mA leakage current maximum:

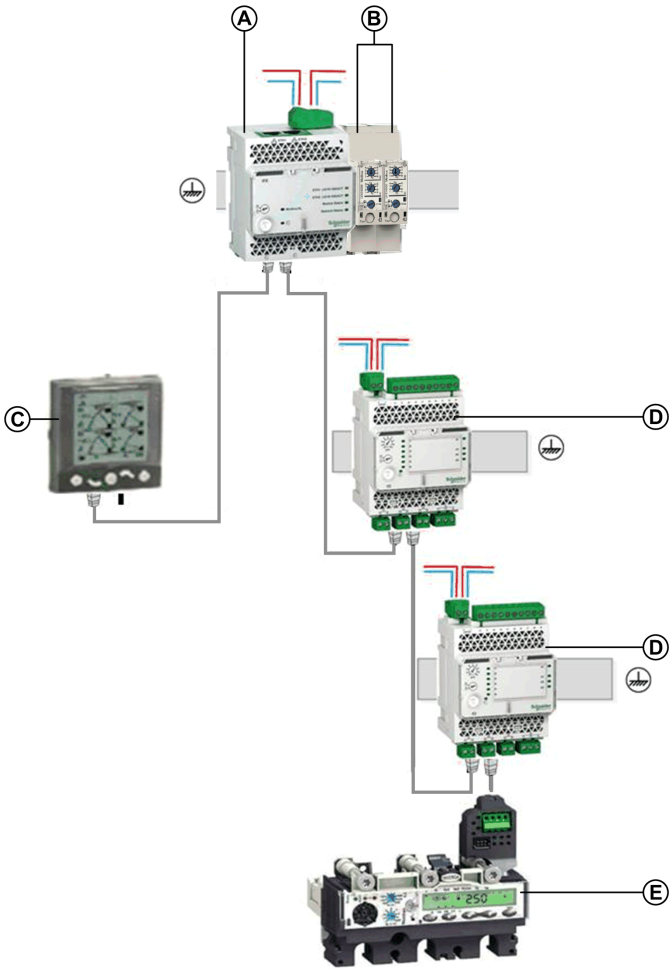
Ue (V L-N / U L-L) (Vac)	Maximum number of MicroLogic X control units without VPS power supply (MasterPact MTZ circuit breakers)	Maximum number of MicroLogic X control units with VPS power supply (MasterPact MTZ circuit breakers)	Maximum number of MicroLogic trip units (ComPacT NSX circuit breakers)
66 / 115	344	57	156
127 / 220	180	29	81
230 / 400	99	16	44
347 / 600	66	10	29
400 / 690	57	23	26
1,000	39	16	0

General Rule: Power Supply Through the ULP Cord

Only one device can be powered through the ULP cord. This device must be at the end of the ULP line. It can be done only for the following devices:

- FDM121 display.
- BSCM module and MicroLogic trip unit for ComPacT NSX circuit breakers.
- BSCM module for ComPacTNSX DC circuit breakers.
- BCM ULP module for MasterPact NT/NW and ComPacT NS circuit breakers.

Example: In the diagram, the FDM121 display and the ComPacT NSX MicroLogic trip unit are powered through ULP system. The IFE server and the IO modules are connected to the power supply. As the IFM interfaces are stacked on the IFE server, they are already powered.



A IFE server

B IFM interfaces stacked on IFE server

C FDM121 display

D IO module

E MicroLogic trip unit in ComPacT NSX circuit breaker

NOTE: The ULP port module on MasterPact MTZ circuit breaker must be connected to a 24 Vdc power supply.

Length of ULP Cords

The rules for ULP cord length are as follows:

- The maximum length of the ULP cord between two ULP modules in an IMU is 5 m (16.4 ft) if one of the ULP modules does not have an external power supply.
- The maximum length of the ULP cord between two ULP modules in an IMU is 10 m (32.8 ft) if both ULP modules have an external power supply.
- The maximum length of all the ULP cords on a single IMU is 20 m (65.6 ft).
- In the case of an installation with a withdrawable drawer, the total length of the ULP cords for the fixed part must be less than 12 m (39.4 ft). This length limitation is to ensure that the fixed part operates correctly when the drawer is drawn out, page 50.
- The bending radius of the ULP cords must be 50 mm (1.97 in) minimum.

  NOTE: In the following cases of device combinations with an IFE interface with part number LV434010 or LV434011, ULP total network length is limited to a maximum of 5 m (16.4 ft):

  - A MasterPact MTZ circuit breaker and an IFE interface.
  - A MasterPact MTZ circuit breaker, one IO module, and an IFE interface.
  - A MasterPact MTZ circuit breaker, two IO modules, and an IFE interface.

Summary of Connection Rules

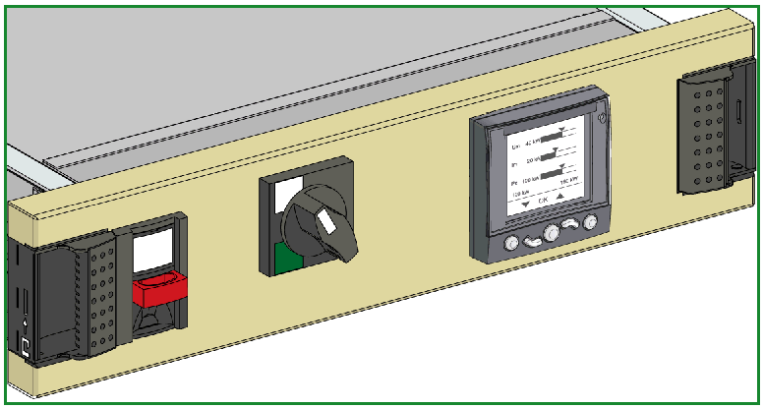
Characteristic	Value
Connection	Daisy-chaining of ULP cords and ULP line termination at the end of the ULP line.
Maximum length	• 20 m (65.6 ft) in total for the IMU. • 10 m (32.8 ft) between two ULP modules if both ULP modules have an external power supply. • 5 m (16.4 ft) between two ULP modules if one of the ULP modules does not have an external power supply. • 12 m (39.4 ft) for the fixed part in the case of an installation with a withdrawable drawer, page 50.
Voltage range supported	24 Vdc -10%/+10% (21.6–26.4 Vdc)
Current limitation on each ULP RJ45 port, page 55	300 mA

Intelligent Modular Unit (IMU) with Withdrawable Drawer

Installation in a Withdrawable Drawer

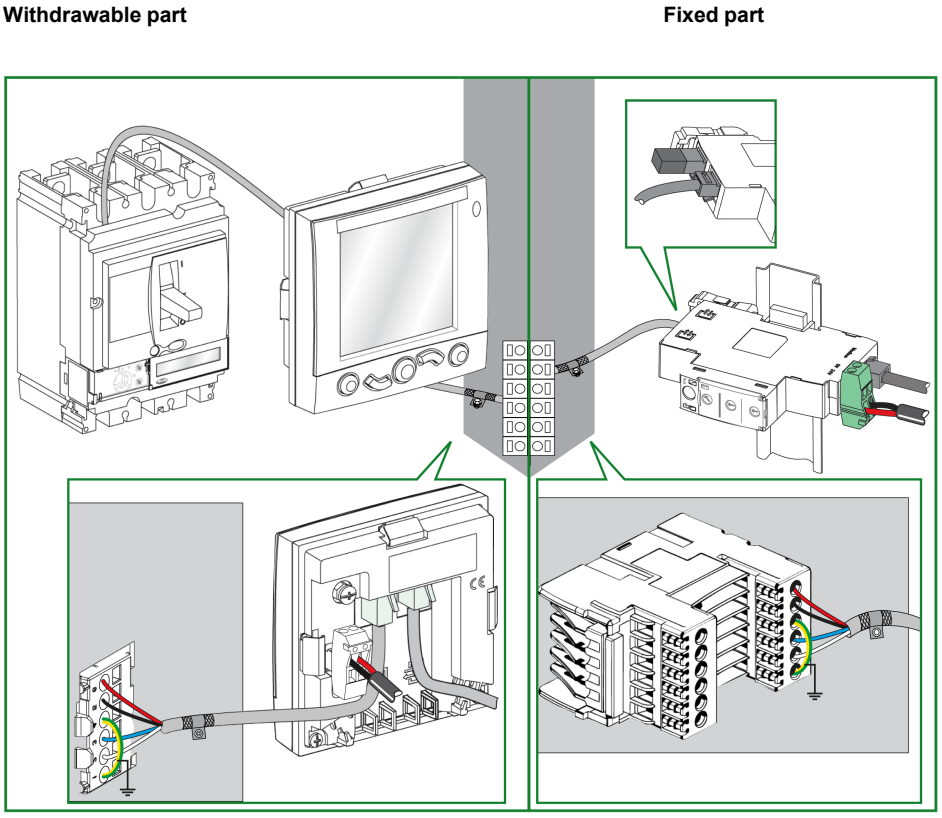
In equipment with withdrawable drawers, the circuit breaker is found in the withdrawable drawer. The IFE or IFM interface and IO modules must always be in the fixed part.

The FDM121 display can be placed in the withdrawable drawer or on the front of the drawer as shown:



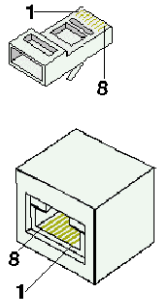
Connection of the Withdrawable Drawer

The ULP connection between the fixed part and the part built into the withdrawable drawer is made with the pluggable control terminal blocks on the unit.



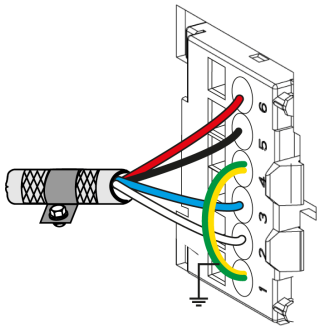
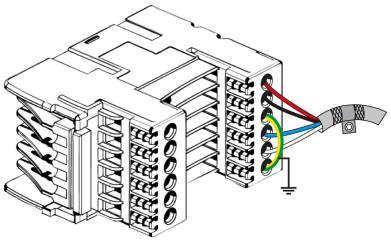
RJ45 Pin Connection of ULP Cord

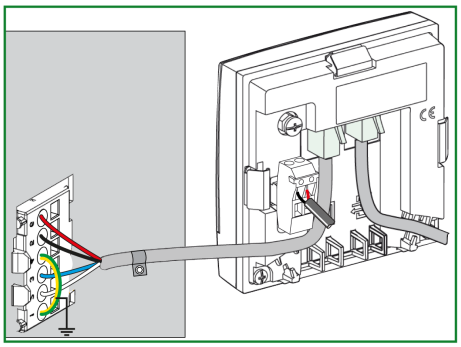
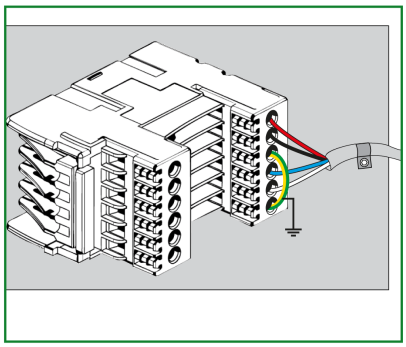
The RJ45 plug/plug ULP cord uses an RJ45 connector with pin connection as follows:

RJ45 connector	Pin number	Pair number	Wire color	Assignment
	Cover	Shielding	Braid	Shielding
	1	Pair 1	White	Data (H)
	2	Pair 1	Blue	Data (L)
	3-4-5-6	–	–	Reserved
	7	Pair 2	Black	0 V
	8	Pair 2	Red	24 Vdc

Connection Procedure

The procedure for connecting the withdrawable drawer terminal block is as follows:

Step	Action	
1	Plug the four conductors into the terminal block (removable side): • Terminal 1: Connected to terminal 4 and to ground • Terminal 2: White wire (L data) • Terminal 3: Blue wire (H data) • Terminal 5: Black wire (0 V) • Terminal 6: Red wire (24 Vdc)	
2	Plug the four ULP cord conductors into the terminal block on the fixed part in the same order.	
3	Strip the ULP cord insulation: • Close to the ULP cord end connected into the terminal block (removable side). • Close to the ULP cord end connected on the fixed part.	

Step	Action
4	Insert the wire braid into a grounding clamp at both ends of the stripped ULP cord.
5	Screw the grounding clamps on the fixed part and withdrawable part of the drawer.  

Earthing System

Introduction

The earthing system of the ULP system architectures must be designed and installed in power switchgear and controlgear assemblies in accordance with IEC 61439-2 standard.

The types of earthing are as follows (conforming to standard IEC 60050-826):

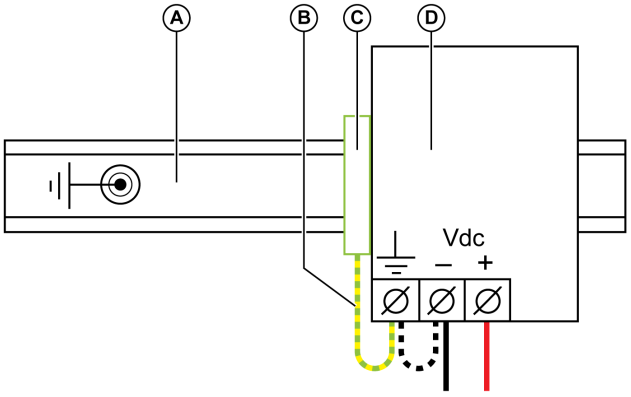
- Protective earthing:
  - Earthing a point or points in a system or in an installation or in equipment for purposes of electrical protection.
- Functional earthing:
  - Earthing a point or points in a system or in an installation or in equipment for purposes other than electrical protection.

Mounting Devices in the Electrical Enclosure

The following rules for mounting devices in the enclosure must be followed:

- The enclosure can be used to connect devices to the earth, in particular auxiliary power supply, PLC, and ULP modules, when the resistance between the protective conductor (PE) and all the metallic parts of the enclosure is 0.1 Ω maximum (conforming to IEC 61439-2 standard).
- All metallic parts of the enclosure must be connected together. The contact between parts must be metal on metal: paint and other isolating material must be removed. A special grease or paint must be applied on the connection to avoid corrosion in harsh environmental conditions (for example, relative humidity >65%, outdoor applications, atmosphere where corrosive agents, such as Hydrogen Sulfide (H_2S, are present).
- The connection to the protective earth terminal block in the enclosure must be as short as possible.
- The power supply used with ULP modules is limited, page 58.
- Each DIN rail must be connected to the protective earth of the enclosure. A stainless steel DIN rail is recommended rather than an aluminum one in order to provide the most consistent earthing.

The following figure shows installation for continuity of protective earth:



A DIN rail connected to the protective earth of the enclosure

B Connection as short as possible

C Protective earth terminal block

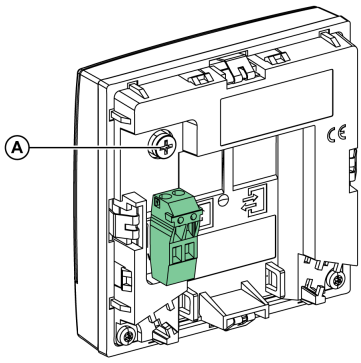
D Power supply

Functional Earthing

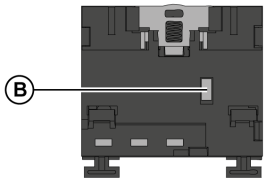
The Enerlin'X modules (IFE, EIFE, and IFM interfaces, IO module, and FDM121 display) have a functional earth. The functional earth is provided by the metallic parts of the assembly (enclosure with metallic DIN rails) having a resistance equal to 0.1 Ω maximum with the main protective earth conductor (PE).

If the devices are mounted on the door of the enclosure, check the earth continuity between the door and the PE conductor. The door must be connected to the enclosure frame with at least one PE cable. It is recommended to use PE cable with copper braids.

Examples:



A Earthing connection on FDM121 display to be connected to the enclosure frame



B Earthing connection on EIFE interface in contact with earthing plate installed on MasterPact MTZ circuit breaker

ULP System Power Supply

Power Supply Distribution Systems

The power supply distribution system can be installed following either of these topologies:

- Star topology:

  In a cubicle, the star supply distribution system is recommended to minimize EMC disturbances due to common impedance.

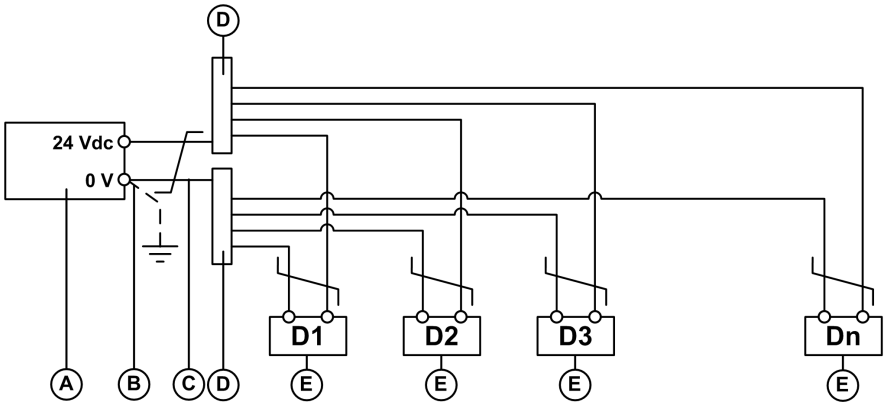
- Daisy chain topology:

  The daisy chain supply distribution system enables service continuity: a device can be disconnected without impacting the others and the common impedance and voltage drop on devices are limited.

Star Supply Distribution System

The following diagram shows the design of a star supply distribution system (DC or AC). In this configuration, only the link between the main power supply and the terminal distribution is common impedance. The common impedance is minimized. The shorter the cable length (**C**), the lower the common impedance.

The wiring of each device must be done with twisted-pair cables to avoid loops and radiated emissions.



A Power supply

B 0 V connection of power supply, page 58

C Cable between power supply and terminal distribution

D Terminal distribution

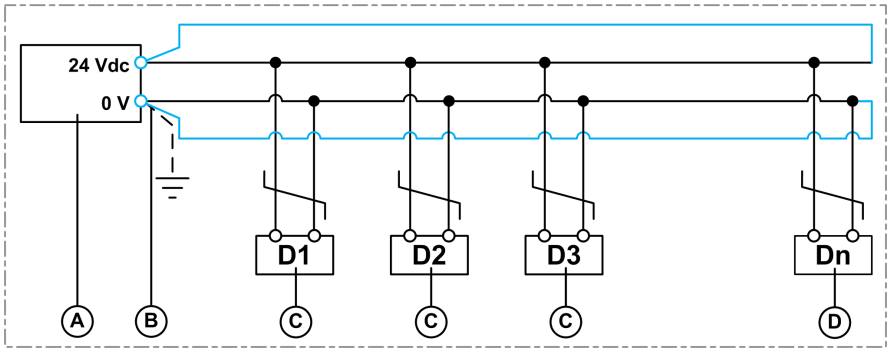
E Device (D1–Dn)

Daisy Chain Supply Distribution System

The devices in the system are connected in a daisy chain and a loop, in which the first and the last device are connected directly to the power supply.

The cables between the daisy chain and the loop for reconnecting to the power supply must be close together to avoid current loop and generation of EMC disturbances.

The following diagram shows the design of a daisy chain supply distribution system in a single cubicle. In this configuration, additional wiring closing the daisy chain is required.



A Power supply

B 0 V connection of power supply, page 58

C Device (D1–Dn)

D **D** Last device connected to the power supply on the line

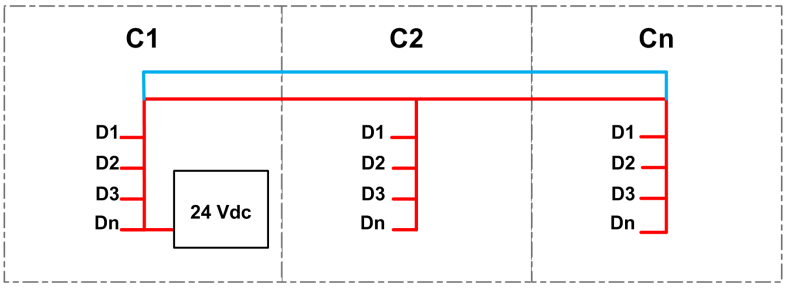
Wiring closing the daisy chain

Power Supply Distribution in a System with Several Cubicles

In a power supply distribution system with several cubicles, it is possible to feed three or four devices per line if the current consumption is low (less than 500 mA) and the total length is less than 5 m (16.4 ft).

The following diagram shows the design of the power supply distribution system in a global system with several cubicles:

- The devices (D1–Dn) are connected in a star to reduce common impedance, page 55.
- The cubicles (C1–Cn) are connected in a daisy chain with additional loop wiring to minimize drop voltage, reduce common impedance, and provide service continuity.



Cubicles connected in daisy chain topology with cables for reconnecting to the power supply close to the loop

Devices connected in star topology

ULP Module Consumption

To limit voltage drops on the ULP cords, the consumption of each RJ45 ULP port is limited to 300 mA.

The following table lists ULP module consumption.

Module	Typical consumption (24 Vdc at 20 °C / 68 °F)	Maximum consumption (19.2 Vdc at 60 °C / 140 °F)
IFE Ethernet interface for one circuit breaker	100 mA	140 mA
IFE Ethernet switchboard server	100 mA	140 mA
EIFE embedded Ethernet interface for one MasterPact MTZ drawout circuit breaker	115 mA	180 mA
IFM Modbus-SL interface for one circuit breaker	21 mA	30 mA
IO input/output application module for one circuit breaker	100 mA	130 mA
FDM121 front display module for one circuit breaker	21 mA	30 mA
MicroLogic 5, 6, or 7 trip unit for ComPacT NSX circuit breakers	30 mA	55 mA
MicroLogic X control unit for MasterPact MTZ circuit breaker (powered through ULP port module)	200 mA	335 mA
BSCM circuit breaker status control module for ComPacT NSX circuit breaker	9 mA	15 mA
MicroLogic trip units for MasterPact NT/NW and ComPacT NS circuit breakers	100 mA	100 mA
BCM ULP circuit breaker communication module for MasterPact NT/NW and ComPacT NS circuit breakers	40 mA	65 mA
Service Interface	0 mA (the Service Interface has its own power supply)	0 mA (the Service Interface has its own power supply)
USB maintenance interface	0 mA (the USB maintenance interface has its own power supply)	0 mA (the USB maintenance interface has its own power supply)

Power Supply Characteristics

NOTICE

LOSS OF DOUBLE INSULATION

- Supply the MicroLogic X control unit with a 24 Vdc Safety Extra Low Voltage (SELV) power supply only, connected through the ULP port module or through the terminal block for external power supply (F1- F2+). Pay attention to the polarity.
- Do not connect devices which do not have double insulation to the 24 Vdc SELV power supply which is being used to supply the MicroLogic X control unit. For example, do not use the same 24 Vdc SELV power supply to supply a MicroLogic X control unit for MasterPact MTZ circuit breakers and a MicroLogic A/E/P/H trip unit for MasterPact NT/NW circuit breakers.

Failure to follow these instructions will result in a basic/single insulated system.

The 24 Vdc power supplies of the ULP system must be SELV to provide insulation coordination (IEC 60664-1 and IEC 61204-7) and distribute a SELV along the entire length of the ULP connections. The 24 Vdc power supply must be connected at the primary end to a low-voltage distribution zone, whose overvoltage category is less than or the same as that of the 24 Vdc power supply:

- Power supplies in overvoltage category IV can be connected directly to the busbar system of a main low voltage distribution board.

  Schneider Electric AD power supplies are overvoltage category IV.

- Power supplies in an overvoltage category lower than IV cannot be connected directly to the busbar system of a main low voltage distribution board. A minimum of one circuit isolation transformer is therefore needed between the busbar system of a main low voltage distribution board and a control circuit that can be connected to the primary of the 24 Vdc power supply.

  Schneider Electric Phaseo ABL8 power supplies are overvoltage category II, like most standard power supplies.

The 24 Vdc SELV power supplies of the ULP system can be used to power other devices on condition that they have double insulation or reinforced insulation to retain the SELV nature of the power supply. These devices must not connect either the 0 V or the 24 Vdc to the local machine ground or the protective ground.

0 V Connection

0 V of power supply can be connected to local ground or be floating. The following table presents the use cases and their recommendations.

0 V connection	Requirements	Recommendations
0 V connected to ground	• TN-S earthing system • Meshed earth • The devices are powered with the same power supply. • The power supply is installed in the same electrical equipment as the devices. • One or more connections of 0 V to ground: 0 V of devices is not connected to ground in the installation comprising the power supply and the devices.	Check that the common mode voltage between phase and ground is not higher than 7 Vac. Otherwise, add one power supply to reduce the load.
Floating 0 V	If one or more of the requirements to connect 0 V to ground is not met, the 0 V of the power supply must be kept floating.	It is recommended to use an insulation monitoring device (Vigilohm IM20, for example) to detect the first phase-to-ground fault and improve continuity of service.

Power Supply Rating

Power supply rating rules are as follows:

- To design the power supply dedicated to communication modules, check the maximum short-circuit current (Icc). It must not exceed 20 A. This is the maximum short-circuit current which can be withstood by the ULP modules. For example, the Icc of the ABL8 power supply is limited to 14 A for a 10 A nominal current.
- The rating of the 24 Vdc power supply voltage for the furthest ULP module must be 24 Vdc +/-10% (21.6–26.4 Vdc).

  To comply with this rating range at the end of a Modbus cable distributing power, the 24 Vdc power supply output voltage must be regulated at the following value:

  - +/-3% (23.3–24.7 Vdc) for ABL8 power supplies.
  - +/-5% (22.8–25.2 Vdc) for AD power supplies.

Recommended 24 Vdc Power Supplies

The recommended 24 Vdc power supplies are:

- Schneider Electric Phaseo ABL8 power supplies (3 to 10 A, overvoltage category II), recommended for large installations.

- Schneider Electric AD power supplies (1 A, overvoltage category IV), recommended in the following cases:
  - For installation limited to a few IMUs.
  - As power supply of MicroLogic trip units in MasterPact NT/NW or ComPacT NS circuit breakers.

Characteristic	Phaseo ABL8 Power supply	AD Power supply
Illustration		
Overvoltage category	Category II per IEC 60947-1	• Category IV per IEC 62477-1 (Vac model) • Category III per IEC 62477-1 (Vdc model) • Category III per UL 61010-1
Input supply voltage AC	• 110–120 Vac • 200–500 Vac	• 110–130 Vac • 200–240 Vac
Input supply voltage DC	–	• 24–30 Vdc • 48–60 Vdc • 100–125 Vdc
Dielectric withstand strength	• Input/output: 4 kV RMS for 1 minute • Input/ground: 3 kV RMS for 1 minute • Output/ground: 0.5 kV RMS for 1 minute	• Input/output: ◦ 3 kV RMS for 1 minute (110–130 Vac and 200–240 Vac model) ◦ 3 kV RMS for 1 minute (110–125 Vdc model) ◦ 2 kV RMS for 1 minute (24–30 Vdc and 48–60 Vdc model) • Input/ground: 3 kV RMS for 1 minute • Output/ground: 1.5 kV RMS for 1 minute
Temperature	• 50 °C (122 °F) • 60 °C (140 °F) with 80% nominal load maximum	70 °C (158 °F)
Output Current	Limited to 10 A	1 A
Ripple	200 mV peak-peak	200 mV peak-peak
Output voltage setting for line loss compensation	24–28.8 Vdc	22.8–25.2 Vdc

NOTE: Install a control/isolation transformer for applications requiring an overvoltage current category III, and a surge arrester for overvoltage current category IV.

Power Supply Part Numbers

Power supply	Rating	Input-Output voltage	Part number
Schneider Electric AD power supply Primary overvoltage category IV Temperature: -25 °C to +70 °C (-13 ºF to +158 °F)	1 A	24/30 Vdc - 24 Vdc	LV454440
		48/60 Vdc - 24 Vdc	LV454441
		100/125 Vdc - 24 Vdc	LV454442
		110/130 Vac - 24 Vdc	LV454443
		200/240 Vac - 24 Vdc	LV454444

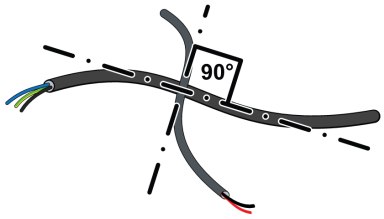
Power supply	Rating	Input-Output voltage	Part number
Schneider Electric Phaseo ABL8 power supply Primary overvoltage category II Temperature: 0–60 °C (0–140 °F) (derated to 80% of the current above 50 °C (122 ºF))	3 A	100/500 Vac - 24 Vdc	ABL8RPS24030
	5 A	100/500 Vac - 24 Vdc	ABL8RPS24050
	10 A	100/500 Vac - 24 Vdc	ABL8RPS24100

NOTE: Example of other compliant power supplies: Phoenix Contact TRIO POWER power supply unit, TRIO-PS-2G/1AC/24DC/10/B+D (part number 2903145).

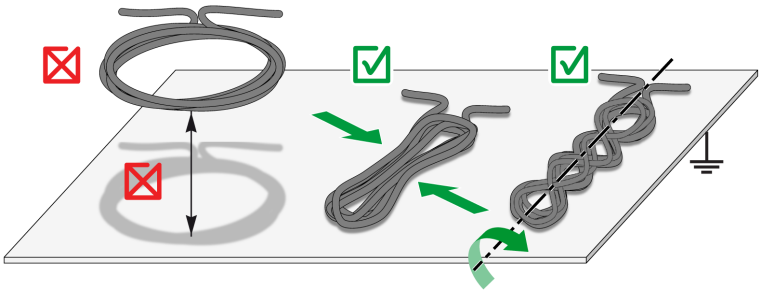
24 Vdc Power Supply Connections Rules

To reduce electromagnetic interference, follow these rules:

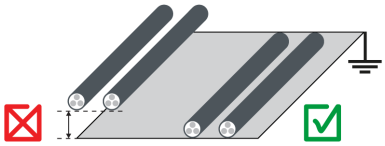
- The input and output wires of the 24 Vdc power supply must be physically separated as much as possible.
- The output wires of the 24 Vdc power supply must be twisted together.
- The output wires of the 24 Vdc power supply, communication cables, or line protected by a surge protection device (SPD) must cross over the power cables perpendicularly.



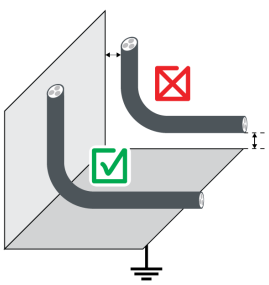
- The 24 Vdc power supply cables must be cut to length and be against the metallic frame of the earthed enclosure. Do not loop excess cable.



- Always flatten 24 Vdc power supply cables on the earthed metallic frame of cubicles to avoid ground loops.



- To route sensitive cable, follow corners inside enclosures, taking into account the cable bending radius.



24 Vdc Power Supply Cable Characteristics

The rules for a standard installation of the 24 Vdc power supply in the ULP system are as follows:

- Connect the power supply to a cable with one twisted pair.
- The minimum distance between power supply cable and other signals in the installation must be as follows:
  - Distance between power and control circuits = 100 mm (3.9 in)
  - Distance between power circuit and 24 Vdc or communication cables = 200 mm (7.9 in)
  - Distance between control circuit and 24 Vdc or communication cables = 100 mm (3.9 in)

To limit electromagnetic interference, apply the following additional installation rules:

- Connect the power supply to a one twisted-pair shielded cable.
- The cable shield must be connected to EMC clamps.
- The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation, for example, screw or DIN rail (for example, EMClip® SKHZ brass clamps from Indu-Sol).

24 Vdc Power Supply Load Balance

The power supply rating depends on the load balance, determined by the consumption of the devices in the IMU. Follow this procedure to verify that the power supply rating is correct:

Step	Action
1	Calculate the load balance of the power supply taking into account the ULP module consumption. Refer to ULP Module Consumption, page 56.
2	Measure the voltage on the last device connected to the power supply on the line.
3	Check that the measurement is compatible with the device tolerance.
4	In case of voltage drop, do one of the following: • Increase the cross-section of the power supply cable. • Make a loop to the power supply from the last cubicle in a daisy-chain architecture or the last device in the electrical equipment.

24 Vdc Power Supply Mode

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Use the same 24 Vdc SELV AD or Phaseo ABL8 power supply to supply power to all ULP modules of one IMU.

Failure to follow these instructions can result in equipment damage.

- The same 24 Vdc SELV power supply can be used to supply several IMUs, depending on the overall power requirements of the system.
- Use a separate 24 Vdc power supply to supply the MN/MX/XF voltage releases or the MCH gear motor.

Module	Power supply mode
IFE Ethernet interface for one circuit breaker	Must be connected to a 24 Vdc power supply and cannot be powered through its ULP port.
IFE Ethernet switchboard server	Must be connected to a 24 Vdc power supply and cannot be powered through its ULP port.
IFM Modbus-SL interface for one circuit breaker	Must be connected to a 24 Vdc power supply(1) and cannot be powered through its ULP port.
IO input/output application module for one circuit breaker	Must be connected to a 24 Vdc power supply and cannot be powered through its ULP port.
ULP port module for MasterPact MTZ circuit breakers	Must be connected to a 24 Vdc power supply and cannot be powered through its ULP port.
MicroLogic X control unit for MasterPact MTZ circuit breakers	Powered by the ULP port module.
EIFE embedded Ethernet interface for one MasterPact MTZ drawout circuit breaker	Powered by the ULP port module.
FDM121 front display module for one circuit breaker	• Must be connected to a power supply if alone or not located at the end of the ULP line. • Powered by the other ULP modules through the ULP cord if located at the end of the ULP line.
MicroLogic 5, 6, or 7 trip unit for ComPacT NSX circuit breakers	Powered by the other ULP modules through the ULP cord.
BSCM circuit breaker status control module for ComPacT NSX circuit breakers	Powered by the other ULP modules through the ULP cord.
MicroLogic trip unit for MasterPact NT/NW and ComPacT NS circuit breakers	Must be powered by a dedicated AD power supply.
BCM ULP circuit breaker communication module for MasterPact NT/NW and ComPacT NS circuit breakers	Powered by the other ULP modules through the ULP cord.

(1) The connection of an IFM interface to the 24 Vdc power supply depends on the IFM assembly:
- If the IFM interface is stacked to an IFE server, only the IFE server must be powered by a 24 Vdc power supply.
- If the IFM interfaces are stacked without IFE server, only one of the IFM interfaces must be powered by a 24 Vdc power supply.
- A single IFM interface must be powered by a 24 Vdc power supply.

24 Vdc Power Supply for MicroLogic Trip Units in MasterPact NT/NW and ComPacT NS Circuit Breakers

NOTICE

HAZARD OF NUISANCE TRIPPING IN NOISY ENVIRONMENT

Use a separate 24 Vdc AD power supply to supply the MicroLogic trip unit in MasterPact NT/NW or ComPacT NS circuit breakers and its optional M2C or M6C programmable contacts.

Failure to follow these instructions can result in nuisance tripping

One 24 Vdc SELV AD power supply can supply power to several MicroLogic trip units in MasterPact NT/NW or ComPacT NS circuit breakers, depending on the overall power requirements of the system:

- Up to ten MicroLogic trip units without M2C or M6C programmable contacts.
- Up to five MicroLogic trip units with M2C or M6C programmable contacts.

Rules for Connection to the Communication Network

What's in This Chapter

Connection to the Modbus-SL Network with IFM Interface 64
Modbus Connection Rules 67
Connection to the Ethernet Network with IFE Server and IFE/EIFE Interfaces 75

Connection to the Modbus-SL Network with IFM Interface

Introduction

Connect intelligent modular units to the Modbus network with the IFM Modbus-SL interface for one circuit breaker.

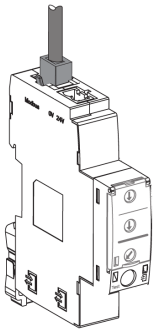
The 24 Vdc power supply terminal block delivered with the IFM interface is used to supply the IFM interface with power either in a daisy-chain or in a star connection.

In terms of power supply, the maximum number of IFM interfaces stacked to one IFE server is 11 in order to limit voltage drop.

In terms of Modbus communication, it depends on the performance requirement. As it takes approximately 500 ms at 19,200 Baud per device to refresh 100 registers, the more interfaces added the longer the minimum refreshment period. The minimum refreshment period depends on the number of IFM interfaces stacked to one IFE server. Multiply the time to refresh one device by the number of devices to find the minimum refreshment period expected in the application. For instance, an installation with eight IFM interfaces stacked to one IFE server at 19,200 Baud would take approximately 4 seconds to be read.

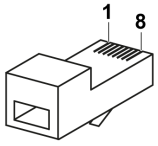
Connection of RJ45 Modbus Cable to the IFM Interface

The RJ45 Modbus cable connects to the Modbus-SL RJ45 port located on the top of the IFM interface.

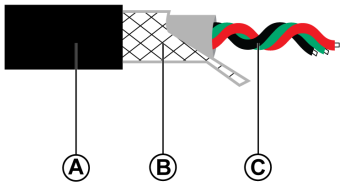


Pin Connection of the RJ45 Plug/Plug Modbus Cable

The RJ45 plug/plug Modbus cable (VW3A8306R••) has RJ45 plug connectors at both ends. The RJ45 connector connection is described in the following table.

RJ45 connector	Pin number	Pin	Wire color	Description
	4	D1	Red	RS 485 B/B' or Rx+/Tx+ signal
	5	D0	Black	RS 485 A/A' or Rx-/Tx- signal
	8	0 VL	Green	0 V for Modbus common and power supply

Composition of the RJ45 Plug/Plug Modbus Cable



A Outer sheath

B Shielding braid

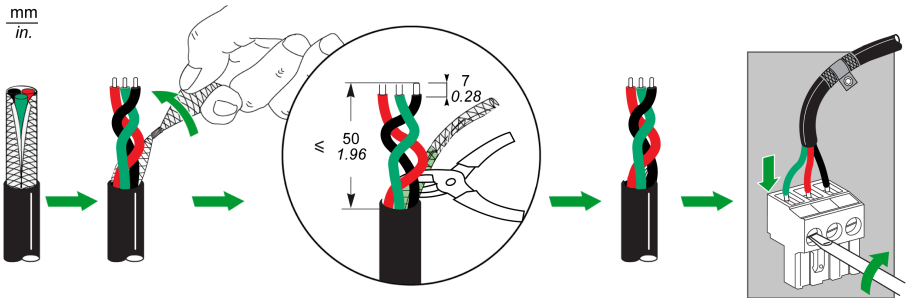
C Twisted communication wires (red/black/green)

IMPORTANT: The 0 VL cable (Modbus common) must be distributed along the entire length of the network, right up to the Modbus client.

Connection of the IFM Interface to an Open-Style Connector

The IFM interface can be connected to another Modbus server without Modbus RJ45 port (for example, a Smartlink device) by one of the following ways:

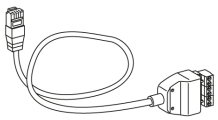
- With a LV434211 RJ45 to open connector Modbus adapter:
  1. Connect the wires to the open connector of the Modbus adapter, page 73.
  2. Connect the RJ45 connector of the Modbus adapter to the Modbus port of the IFM interface.
- With an RJ45 plug/plug Modbus cable (VW3A8306R••):
  1. Cut off an end of the RJ45 cable.
  2. Strip the cable sheath over a length less or equal to 50 mm (1.96 in).
  3. Cut off the shielding braid close to the cable sheath end.
  4. Connect the wires to terminals (for example, screw terminals or tap junctions):
     - Pin number 4 (D1): red wire
     - Pin number 5 (D0): black wire
     - Pin number 8 (0 VL): green wire
  5. Unstrip the cable insulation close to the cable end.
  6. Fix the cable to a grounding clamp.
  7. Connect the RJ45 connector of the ULP cable to the Modbus port of the IFM interface.



- With a Modbus serial link cable (VW3A8306D30) with one RJ45 plug connector and free wires at other end:
  1. Identify the three wires to be connected to a connector:
     - Pin number 4 (D1): blue wire
     - Pin number 5 (D0): white-blue wire
     - Pin number 8 (0 VL): brown wire
  2. Cut off the five other wires.
  3. Connect the three wires to terminals (for example, screw terminals or tap junctions).
  4. Connect the RJ45 connector of the Modbus serial link cable to the Modbus port of the IFM interface.
- With a Modbus cable with free wires at both ends:
  1. Identify the three wires to be connected to a connector:
     - Pin number 4 (D1)
     - Pin number 5 (D0)
     - Pin number 8 (0 VL)
  2. Cut off the other wires.
  3. At one cable end, connect the three wires to a Phoenix Contact RJ45 connector (VS-08-RJ45-5-Q/IP20 - 1656725).
  4. Connect the Phoenix Contact RJ45 connector to the Modbus port of the IFM interface.
  5. At the other cable end, connect the wires to terminals:
     - Screw terminals by using lugs then connect the lug with the shield to the ground.
     - Tap junctions by using a Phoenix Contact RJ45 connector (VS-08-RJ45-5-Q/IP20 - 1656725).

RJ45 to Open Connector Modbus Adapter

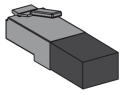
The RJ45 to open connector Modbus adapter can be used to connect an IFM interface to a Modbus device without RJ45 port.

Illustration	Description	Part number
	RJ45 to open connector Modbus adapter	LV434211

Modbus Line Termination

The Modbus cable communication pair has an impedance of 120 Ω or 150 Ω. The Modbus cable must therefore be terminated at each end by a Modbus line termination with an impedance of 120 Ω or 150 Ω.

The Modbus client is at one end of the Modbus cable and usually has a switchable termination impedance. At the other end of the Modbus cable, a Modbus line termination with an impedance of 120 Ω or 150 Ω must be connected.

Illustration	Description	Part number
	Modbus line termination (150 Ω)	VW3A8306R
	Modbus line termination (120 Ω + 1 nF)	VW3A8306RC

Modbus Connection Rules

Introduction

The Modbus client can be installed either:

- In the same electrical equipment as the IFM interfaces or in a separate section of electrical equipment from the IFM interfaces where the two sections of equipment are bolted together.
- In a separate section of the electrical equipment from the IFM interfaces where the two sections of equipment are not bolted together.

IFM interfaces with part number LV434000 and TRV00210 can be installed on the same Modbus-SL network, page 69.

Connection of IFM Interfaces to Modbus-SL Client

Connection to the Modbus-SL client depends on the number of IFM interfaces:

- To connect a single IFM interface, use the RJ45 Modbus T-junction, page 68.
- To connect several stacked IFM interfaces, use the RJ45 Modbus cable, page 68.
- To interconnect several isolated IFM interfaces, page 98, use one of the following:
  - The Modbus splitter block LU9GC3
  - The RJ45 Modbus T-junction

Modbus-SL Network Contained in Electrical Equipment

The Modbus-SL network is contained within the electrical equipment when both conditions below are fulfilled:

- The Modbus-SL network between the IFM interfaces is connected to the Modbus client (a PLC, for example) or to an IFE Ethernet switchboard server integrated in the electrical equipment.
- The Modbus-SL network between the IFM interfaces does not exit the electrical equipment to extend to another electrical equipment.

The Modbus client or the IFE server can be connected directly to the Modbus-SL network of the IFM interfaces in the electrical equipment.

Examples of a Modbus-SL network contained within the electrical equipment are provided:

- Wiring diagram including IFM interfaces grouped in islands and Modbus client installed in the electrical equipment, page 70
- Wiring diagram including IFM interfaces in daisy-chain or star connection and Modbus client installed in the electrical equipment, page 73
- Ethernet connection linking two pieces of electrical equipment, page 77.

Modbus-SL Network Not Contained in Electrical Equipment

The Modbus-SL network is not contained within the electrical equipment when either:

- The Modbus-SL network between the IFM interfaces is connected to a Modbus client outside the electrical equipment.

- The Modbus-SL network between the IFM interfaces exits the electrical equipment to extend to another electrical equipment or another section of electrical equipment where the two sections of equipment are not bolted together.

Connection rules are detailed in Modbus connection linking several pieces of electrical equipment, page 68.

Examples are provided for wiring diagrams including IFM interfaces grouped in islands and Modbus client installed in a separate section of electrical equipment from the IFM interfaces where the two sections of equipment are not bolted together, page 70:

- With 0 V of power supply floating
- With 0 V of power supply connected to local ground

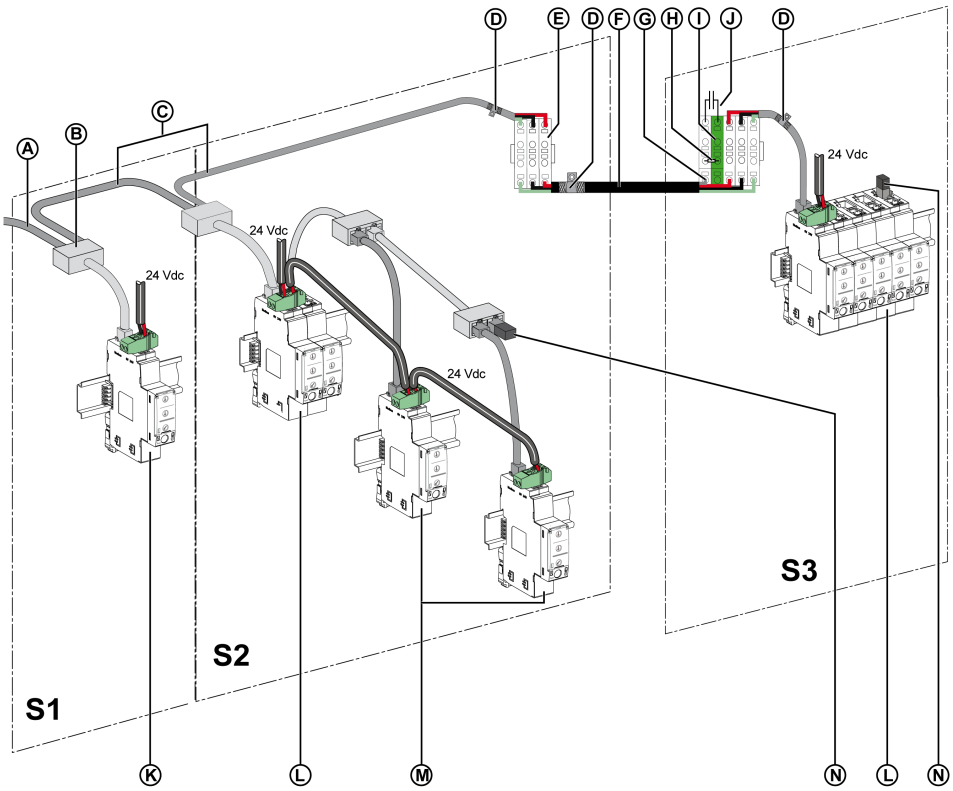
Modbus Connection Linking Several Pieces of Electrical Equipment

The rules below must be followed when the Modbus client is installed in a separate section of electrical equipment from the IFM interfaces where the two sections of equipment are not bolted together:

- Each Modbus segment installed in two sections of electrical equipment not bolted together includes a polarization at one point, and a Modbus line termination at each end:
  - The line polarization and a termination are integrated in the Modbus client.
  - A Modbus line termination must be connected at the other end (on the last IFM interface or other Modbus server).
- Maximum length (Lmax) of the Modbus trunk cable (excluding tap links):
  - Lmax = 500 m (1,640 ft) at 38,400 Baud
  - Lmax = 1,000 m (3,281 ft) at 19,200 Baud
- A grounding terminal block must be connected to the DIN rail (for example, Linergy part number NSYTRR24DPE or Phoenix Contact part number 3211809). The following components are connected to the ground terminal block:
  - A shield coupling capacitor (for example, Kemet part number C981U103MZVDAA7317).
  - A shield resistor (used to bleed off shield capacitor) with the same operating voltage rating as the shield coupling capacitor.
- The rules for power supply shield connection must be followed, page 55.

The following figure shows a Modbus link connecting three pieces of electrical equipment **S1**, **S2**, and **S3**:

- **S1** and **S2** are bolted together.
- **S3** is not bolted to **S1** and **S2**.



A Modbus cable coming from Modbus client

B RJ45 Modbus T-junction

C RJ45 Modbus cable

D Grounding clamp

E Shunt terminal block

F Modbus cable with drain wire and braided shield

G Drain wire of Modbus cable

H Shield resistor (used to bleed off shield capacitor)

I Grounding terminal block connected to DIN rail (for example, Linergy part number NSYTRR24DPE or Phoenix Contact part number 3211809)

J Shield coupling capacitor (for example, Kemet part number C981U103MZVDAA7317)

K Single IFM interface

L IFM interfaces grouped in islands with the stacking accessory

M IFM interfaces daisy-chained with the Modbus cable

N Modbus line termination

Modbus-SL Network Including IFM Interfaces with Part Number LV434000 and TRV00210

IFM interfaces with part number LV434000 or TRV00210 can be installed on the same Modbus-SL network:

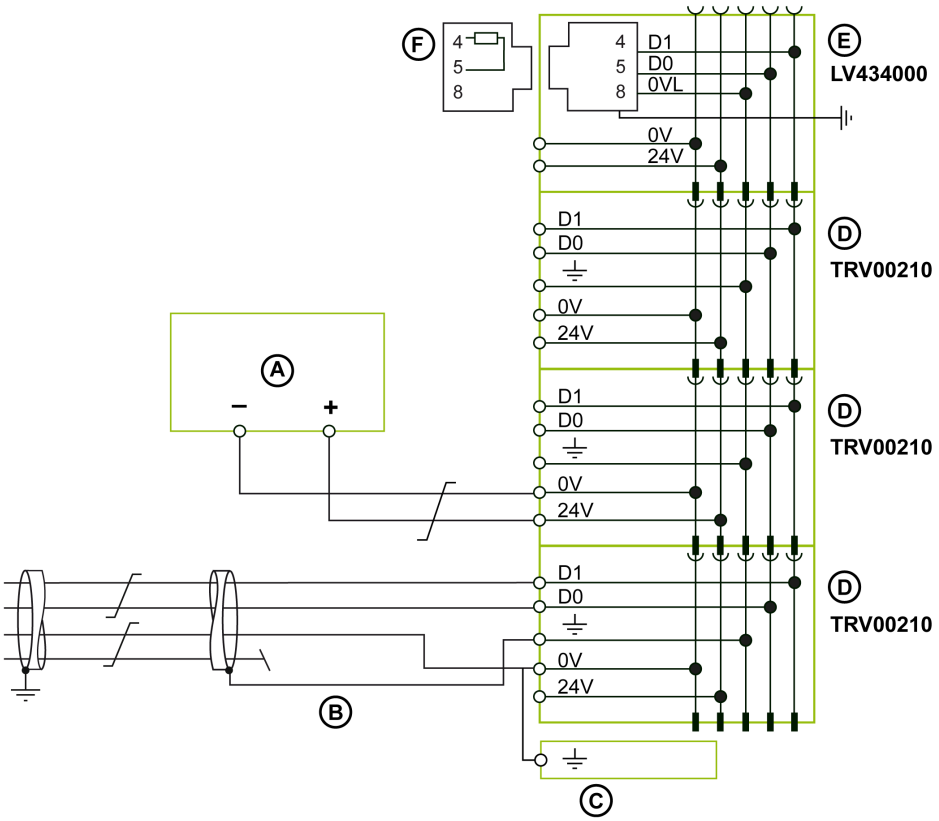
- Any IFM interface with part number TRV00210 present in a ULP system architecture can be replaced by an IFM Interface with part number LV434000.
- IFM interfaces with part number TRV00210 or LV434000 can be connected or stacked together.

Specific rules for ULP connection and power supply apply. Detailed information is described in the appendix related to IFM interface with part number TRV00210 and two-wire RS 485 isolated repeater module, page 120.

Example of Wiring Diagram Including IFM Interfaces Grouped in Islands and Modbus Client in the Electrical Equipment

The following wiring diagram is an example. It shows the connections for the Modbus cable and the 24 Vdc power supply:

- The IFM interfaces with part number LV434000 and TRV00210 are grouped in islands via stacking accessories.
- The Modbus client is installed in the same electrical equipment as the IFM interfaces.



A 24 Vdc power supply

B Modbus cable coming from Modbus client

C Functional ground terminal block

D IFM interface with part number TRV00210

E IFM interface with part number LV434000

F Modbus line termination

Examples of Wiring Diagram Including IFM Interfaces Grouped in Islands and Modbus Client in a Separate Section of Electrical Equipment

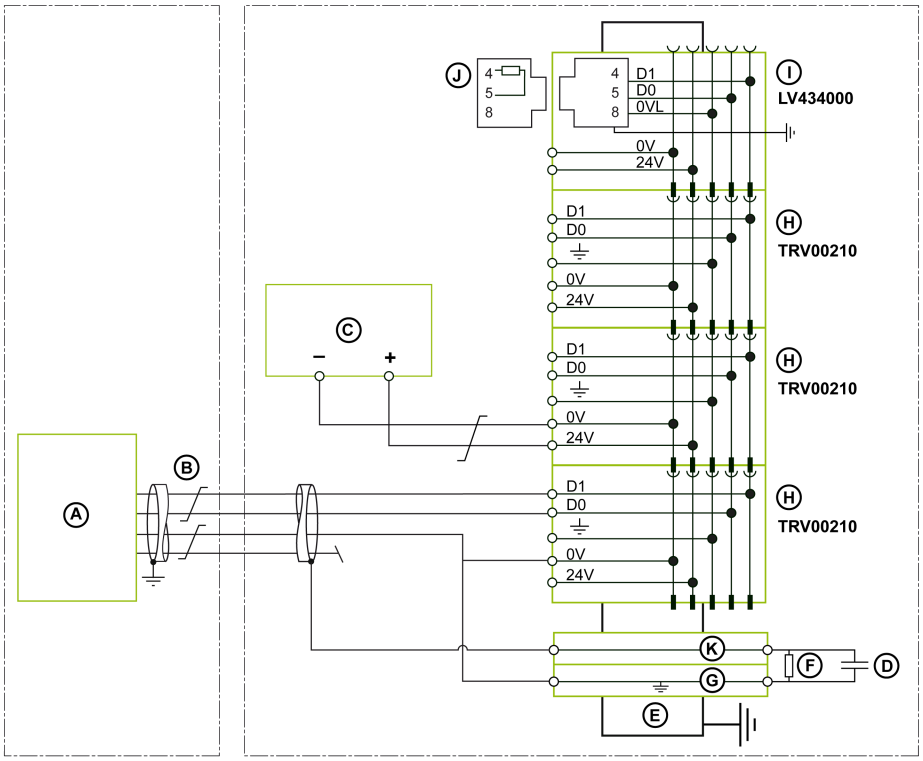
The following wiring diagrams are examples. They show the connections for the Modbus cable and the 24 Vdc power supply:

- The IFM interfaces with part number LV434000 and TRV00210 are grouped in islands via stacking accessories.

- The Modbus client is installed in a separate section of electrical equipment from the IFM interfaces where the two sections of electrical equipment are not bolted together.

Example 1: 0 V of power supply is floating.

Section 1 of electrical equipment **Section 2 of electrical equipment**



A Modbus client installed in a separate section of electrical equipment from the IFM interfaces where the two sections of equipment are not bolted together

B Shielded Modbus cable coming from Modbus client

C 24 Vdc power supply

D Shield coupling capacitor (for example, Kemet part number C981U103MZVDAA7317)

E DIN rail

F Shield resistor (used to bleed off shield capacitor)

G Grounding terminal block connected to DIN rail (for example, Linergy part number NSYTRR24DPE or Phoenix Contact part number 3211809)

H IFM interface with part number TRV00210

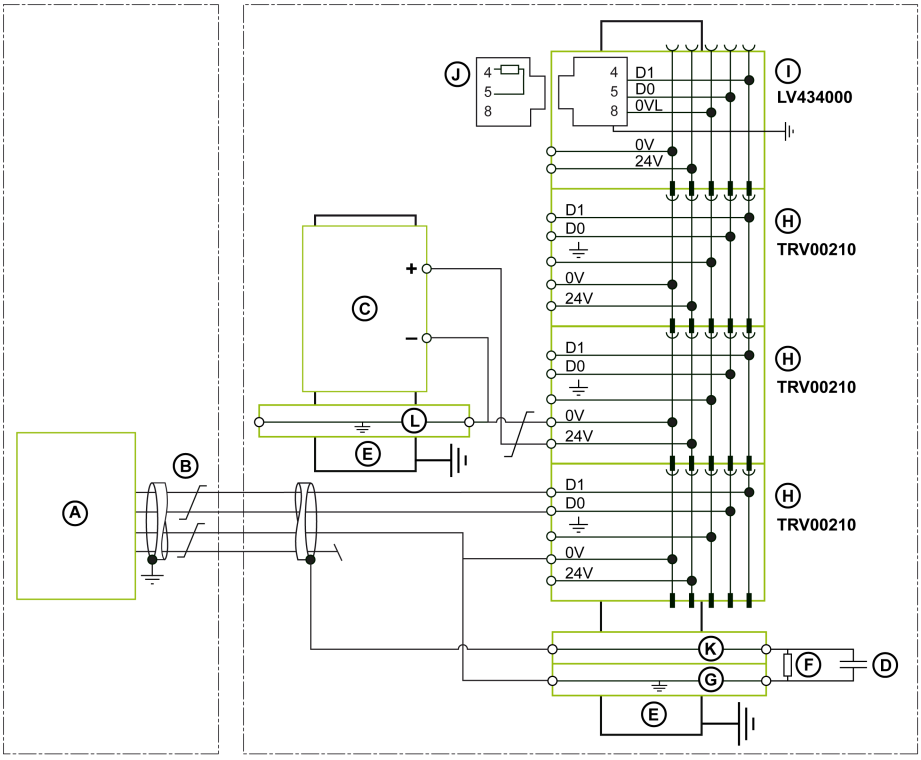
I IFM interface with part number LV434000

J Modbus line termination

K Terminal block connected to DIN rail (for example, Linergy part number NSYTRV24D)

Example 2: 0 V of power supply is connected to local ground.

Section 1 of electrical equipment **Section 2 of electrical equipment**



A Modbus client installed in a separate section of electrical equipment from the IFM interfaces where the two sections of equipment are not bolted together

B Shielded Modbus cable coming from Modbus client

C 24 Vdc power supply

D Shield coupling capacitor (for example, Kemet part number C981U103MZVDAA7317)

E DIN rail

F Shield resistor (used to bleed off shield capacitor)

G Grounding terminal block connected to DIN rail (for example, Linergy part number NSYTRR24DPE or Phoenix Contact part number 3211809)

H IFM interface with part number TRV00210

I IFM interface with part number LV434000

J Modbus line termination

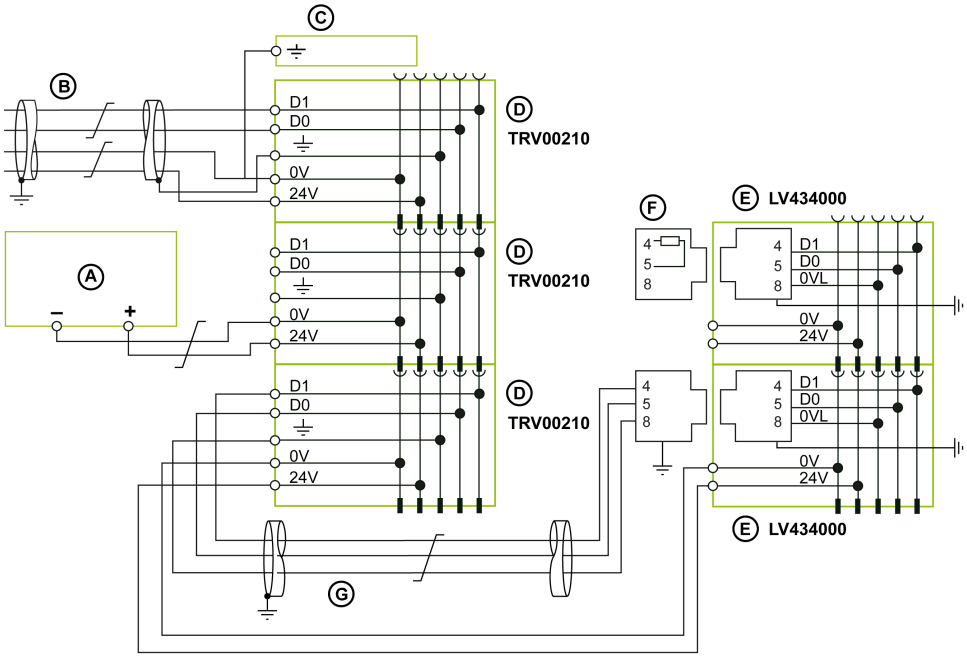
K Terminal block connected to DIN rail (for example, Linergy part number NSYTRV24D)

L Grounding terminal block connected to DIN rail (for example, Linergy part number NSYTRV22PE)

Example of Wiring Diagram Including IFM Interfaces in Daisy-Chain or Star Connection

The following wiring diagram is an example. It shows the connections for the Modbus cable and the 24 Vdc power supply:

- The IFM interfaces with part number LV434000 and TRV00210 are connected in a daisy-chain or in a star connection.
- The Modbus client is installed in the same electrical equipment as the IFM interfaces.



A 24 Vdc power supply

B Modbus cable coming from Modbus client

C Functional ground terminal block

D IFM interface with part number TRV00210

E IFM interface with part number LV434000

F Modbus line termination

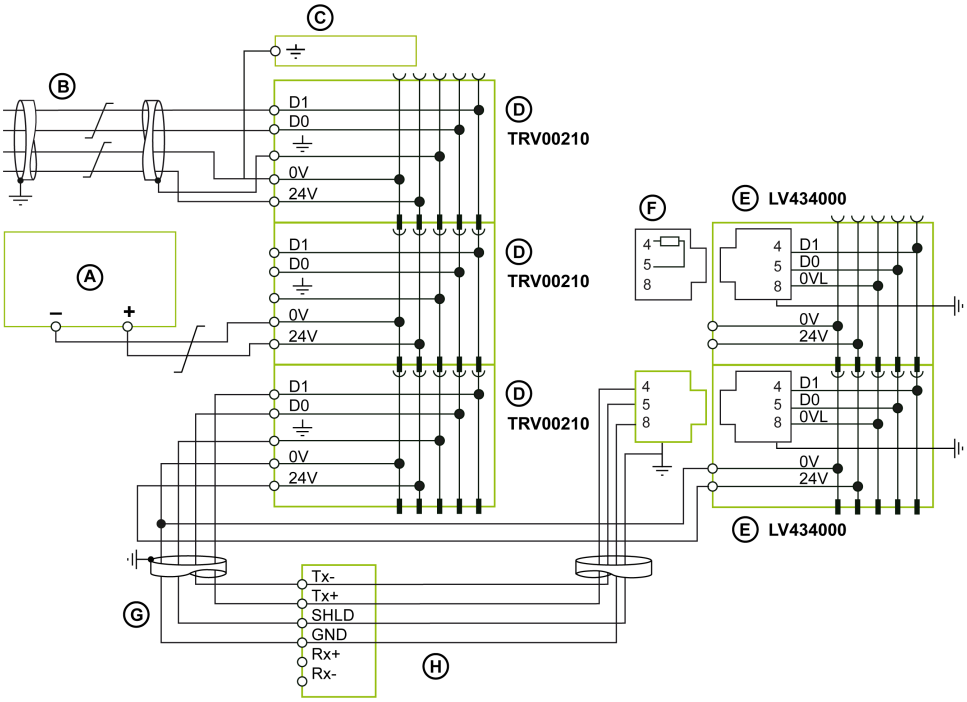
G Shielded, Category 5e or Category 6 Modbus cable

For information about cable shield management, refer to the rules for Modbus connection linking several pieces of electrical equipment, page 68.

Example of Wiring Diagram Including IFM Interfaces in Daisy-Chain or Star Connection Using a RJ45 to Open Connector Modbus Adapter

The following wiring diagram is an example. It shows the connections for the Modbus cable and the 24 Vdc power supply:

- The Modbus cable has free wires.
- The IFM interfaces with part number LV434000 and TRV00210 are connected in a daisy-chain or in a star connection.
- The Modbus client is installed in the same electrical equipment as the IFM interfaces.



A 24 Vdc power supply

B Modbus cable coming from Modbus client

C Functional ground terminal block

D IFM interface with part number TRV00210

E IFM interface with part number LV434000

F Modbus line termination

G Shielded Modbus cable with free wires connecting IFM interfaces with part number LV434000 to RJ45 to open connector Modbus adapter LV434211

H RJ45 to open connector Modbus adapter LV434211

Wiring rules:

- **0 VL** and **0V** of energized LV434000 IFM interface must follow auxiliary power supply rules detailed in ULP system power supply, page 55.
- Only one 0V shield connection of **SHLD** and **GND** terminals of LV434211 adapter must be connected to the Modbus client.

For information about cable shield management, refer to the rules for Modbus connection linking several pieces of electrical equipment, page 68.

Connection to the Ethernet Network with IFE Server and IFE/EIFE Interfaces

Introduction

Connect intelligent modular units to the Ethernet network with one of the following interfaces:

- IFE Ethernet interface for one circuit breaker
- IFE Ethernet switchboard server
- EIFE embedded Ethernet interface for one MasterPact MTZ drawout circuit breaker

General Rules for Ethernet Cable

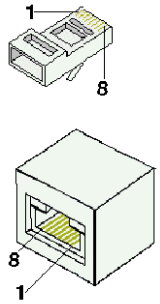
10Base-T/100Base-T Ethernet cable uses only two pairs of the four twisted pairs of wires that compose an Ethernet cable. These two pairs are orange (pins 1 and 2) and green (pins 3 and 6).

An Ethernet line cable must be screened (overall braided screen) and also screened by a foil (SF/UTP, that is, shielded foiled twisted pair).

The rules for standard Ethernet topology are as follows:

- There is no maximum number of devices per network.
- Transmission rate: 10–100 Mbps.
- Maximum permitted length between two IFE interfaces or between an EIFE and an IFE interface (in case of daisy chain): 100 m (328 ft).
- Cable type: Category 5e SFTP (shielded foiled twisted pair) or Category 6 SFTP.

Ethernet RJ45 Pin Connection

RJ45 connector	Pin number	Pair number	Wire color
	1	Pair 1	White-orange
	2	Pair 1	Orange
	3	Pair 2	White-green
	4	Pair 3	Reserved
	5		
	6	Pair 2	Green
	7	Pair 4	Reserved
	8		

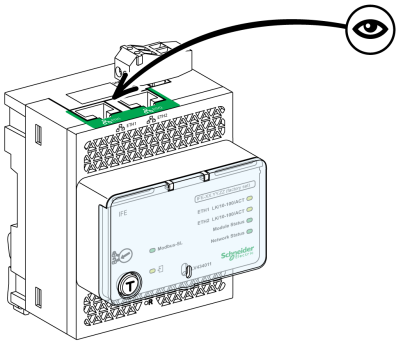
Ethernet Connection on IFE Interface or IFE Server

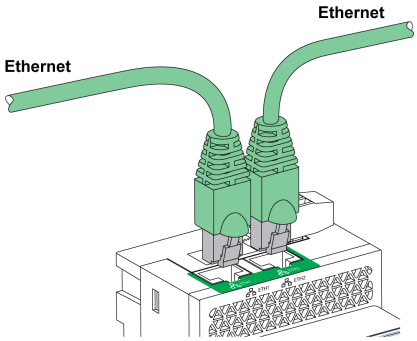
NOTICE

HAZARD OF EQUIPMENT DAMAGE

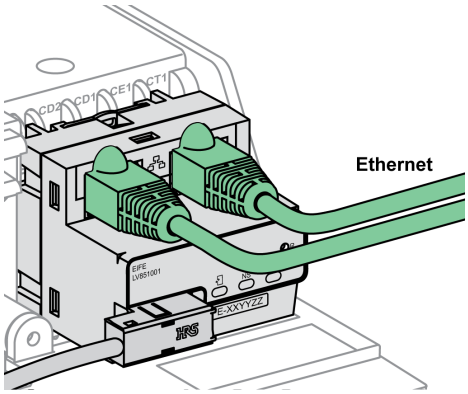
- Never connect an Ethernet device to an RJ45 ULP port.
- The RJ45 ULP ports of the IFE interface are for ULP modules only.
- Any other use can damage the IFE interface or the device connected to the IFE interface.

Failure to follow these instructions can result in equipment damage.





Ethernet Connection on EIFE Interface



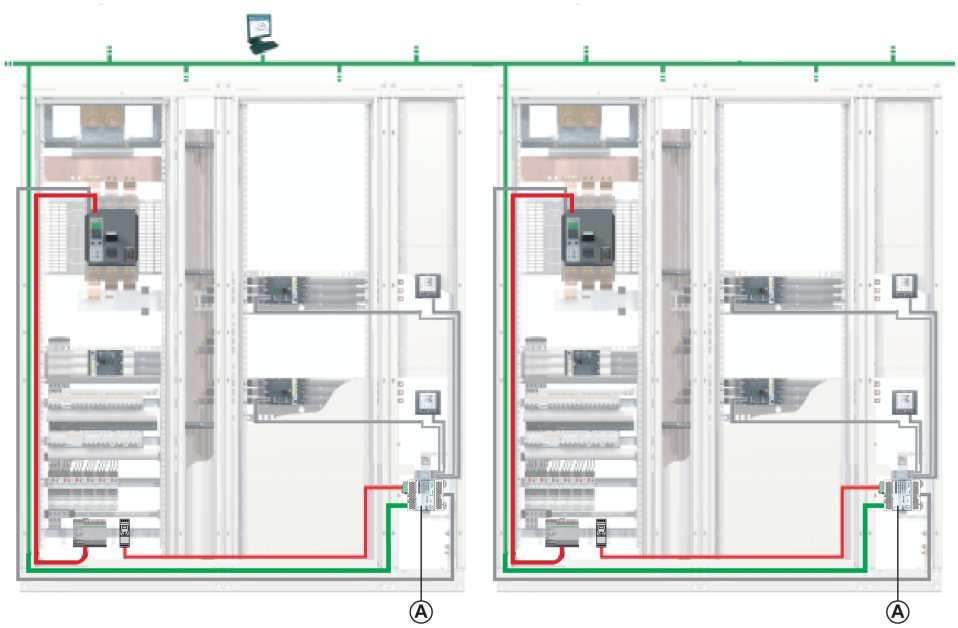
General Wiring Recommendations

- Do not bend or damage the cables:
  - Minimum bending radius is 10 times the cable diameter.
  - Avoid sharp angles of paths or passages of the cable.
- Identify the logical name and the logical address of each device.

Ethernet Connection Linking Two Pieces of Electrical Equipment

Two remote pieces of electrical equipment can be linked by an Ethernet connection, regardless of the distance or the ground equipotentiality between the two pieces of electrical equipment. In this case, the Modbus-SL network is contained within electrical equipment.

The following figure shows an Ethernet link connecting two pieces of electrical equipment, via IFE servers.



A IFE server

Cable	Description
	Ethernet network
	ULP network
	24 Vdc power supply

Connection of the IFE server to the Modbus-SL network inside the electrical equipment is shown in detail in the wiring diagram for Ethernet server, page 86.

ULP System Architectures

What's in This Chapter

Presentation of ULP System Architectures 79
Standalone Architecture 81
Centralized Modbus Architecture 83
Daisy-Chained Distributed Modbus Architecture 91
Tap-Linked Distributed Modbus Architecture 98
Ethernet Architectures 109

Presentation of ULP System Architectures

Introduction

The ULP system architecture is defined by the way in which the Ethernet or Modbus-SL network interconnects the intelligent modular units (IMUs).

The various possible ULP system connections define five architectures.

- Standalone architecture, page 81: the IMUs are not communicating to communication interfaces (IFE, EIFE, or IFM interfaces).
- Centralized Modbus architecture, page 83: the IMUs are communicating to communication interfaces (IFE servers and IFM interfaces). The IFE servers and IFM interfaces are grouped in islands, mounted side-by-side on a DIN rail and interconnected by the stacking accessory.
- Distributed Modbus architecture: the IMUs are communicating to IFM interfaces. The IFM interfaces are distributed as close as possible to the ULP modules in the IMU and linked by the Modbus cable.

  There are two possible configurations for the distributed Modbus architecture:

  - Daisy-chained distributed Modbus architecture, page 91
  - Tap-linked distributed Modbus architecture, page 98

  Both these distributed architectures can be combined to form a mixed architecture.
- Daisy-chained Ethernet architecture, page 111: the IMUs are communicating to IFE or EIFE interfaces. The IFE and EIFE interfaces are distributed as close as possible to the ULP modules in the IMU and linked by the Ethernet cable.
- Star Ethernet architecture, page 109: the IMUs are communicating to IFE or EIFE interfaces. The IFE or EIFE interfaces are distributed as close as possible to the ULP modules in the IMU and linked by the Ethernet cable to the switch.

The distributed and centralized architectures can be combined to adapt to the electrical installation and its restrictions.

The ULP system architectures follow rules for building low-voltage switchboards in compliance with IEC 61439-1 and IEC 61439-2 standards.

Choice of Architecture

The following table lists the advantages and disadvantages of ULP system architectures:

Architecture	Advantages	Disadvantages
Centralized Modbus	• Ease of wiring due to the stacking accessory. • Ease of maintenance due to the grouping of IFM interfaces in the islands. • Option of connecting other Modbus devices through tap links, on the unused connectors of IFM interfaces in the islands. • Minimized Modbus cable length. • IFM interfaces could be stacked to an IFE server to get Modbus data through Ethernet.	Need for a dedicated place in the cubicle where the IFM interfaces can be grouped.
Daisy-chained distributed Modbus	• No need for a dedicated place in the cubicle where the IFM interfaces can be grouped.	• Additional wiring needed for daisy-chaining the Modbus cable between the IFM interfaces. • Longer Modbus cable. • Space taken up in the cubicle by the upstream Modbus cables and downstream ULP cords.
Tap-linked distributed Modbus	• No need for a dedicated place in the cubicle where the IFM interfaces can be grouped.	• Additional wiring needed for daisy-chaining the Modbus cable between the IFM interfaces.

Architecture	Advantages	Disadvantages
	• Ease of wiring by using a Modbus splitter block: up to eight IFM interfaces installed in several cubicles and connected to one Modbus splitter block.	• In the case of an architecture with shunt terminal block, need for a shunt terminal block at the top of each cubicle.
Daisy-chained Ethernet	• Ease of wiring by using only an Ethernet cable. • Plug-and-play. • No need for a dedicated place in the cubicle.	• Additional wiring needed for daisy-chaining the Ethernet cable between the IFE or EIFE interfaces. • Long Ethernet cable. • Space taken up in the cubicle by the upstream Ethernet cables and downstream ULP cords. • Need two Ethernet ports (like on the IFE interface). • Dependability in case of device detected failure.
Star Ethernet	• Dependability in case of device detected failure. • Ease of wiring by using only an Ethernet cable. • Plug-and-play. • No need for a dedicated place in the cubicle. • Need only one Ethernet port.	• Long cables and space taken by Ethernet cables in the cubicle. • Space taken up in the cubicle upstream by the Ethernet cables and downstream by the RJ45 plug/plug ULP cords.

Standalone Architecture

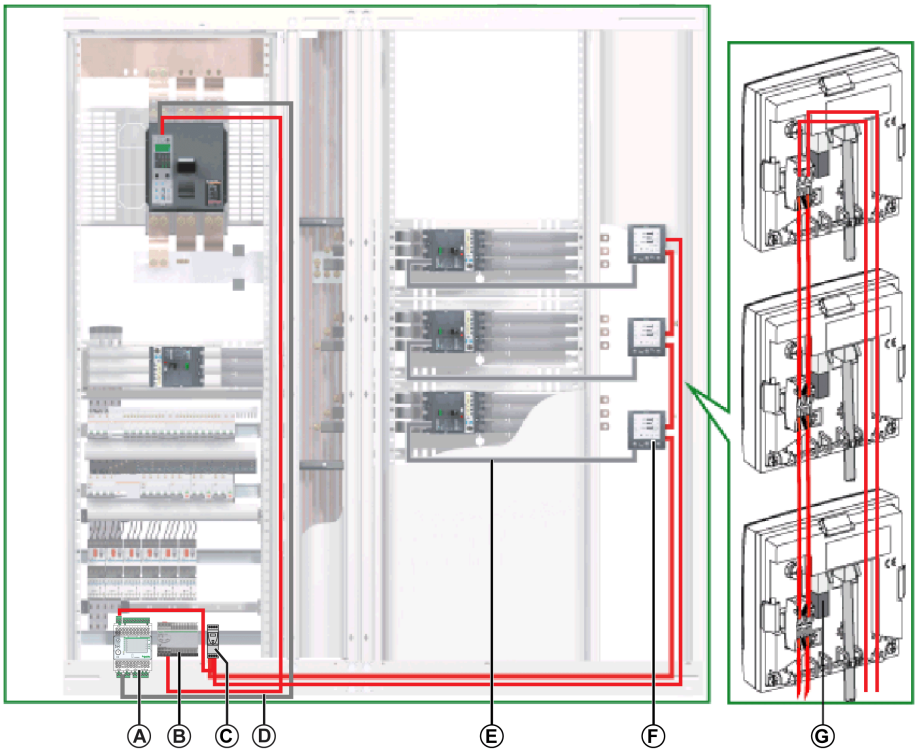
Introduction

When the intelligent modular units are not communicating to communication interfaces (IFE, EIFE, or IFM interfaces), the architecture is classified as standalone.

Standalone Architecture

The following figure shows an example of a standalone architecture with IMUs consisting of an FDM121 front display module for one circuit breaker or an IO input/output application module for one circuit breaker and a compatible circuit breaker equipped with a MicroLogic trip unit.

The IMUs do not communicate to communication interfaces and do not therefore include an IFE or IFM interface. Power the IMUs by using an external power supply connected to the FDM121 display.



A IO module

B 24 Vdc AD power supply for MicroLogic trip units in MasterPact NT/NW or ComPacT NS circuit breakers

C 24 Vdc ABL8 power supply for ULP modules

D Circuit breaker BCM ULP cord

E NSX cord

F FDM121 display

G ULP line termination

Cable	Description
	ULP network
	24 Vdc power supply

For FDM121 display mounting options, refer to QGH80971, *Enerlin'X FDM121 - Front Display Module for One Circuit Breaker - Instruction Sheet*.

The 24 Vdc power supply is selected from the list of recommended 24 Vdc power supplies, page 58. The power supply rating must be selected according to IMU consumption.

Centralized Modbus Architecture

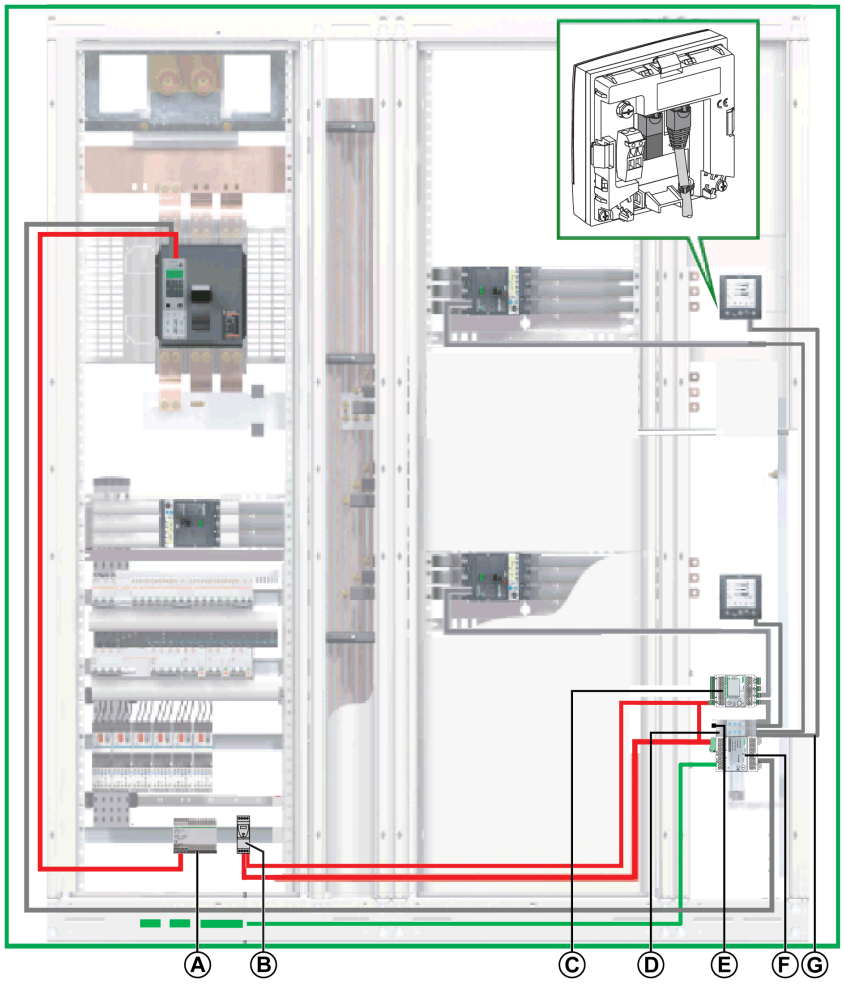
Introduction

In a centralized Modbus architecture, the intelligent modular units (IMUs) are communicating to communication interfaces (IFE servers or IFM interfaces). The IFE servers and IFM interfaces are grouped in islands, mounted side-by-side on a DIN rail, and interconnected by the stacking accessory, page 131.

Centralized Modbus Architecture

The following figure shows an example of a centralized Modbus architecture with three IMUs:

- An IMU consisting of a ComPacT NS circuit breaker, and an IFE Ethernet switchboard server to get an Ethernet connection.
- An IMU consisting of a ComPacT NSX circuit breaker, an IFM interface, and an FDM121 display.
- An IMU consisting of a ComPacT NSX circuit breaker, an IO module, an IFM interface, and an FDM121 display.



A 24 Vdc AD power supply for MicroLogic trip units in MasterPact NT/NW or ComPacT NS circuit breakers

B 24 Vdc ABL8 power supply for ULP modules

C IO module

D IFM interfaces grouped with stacking accessories

E Modbus line termination

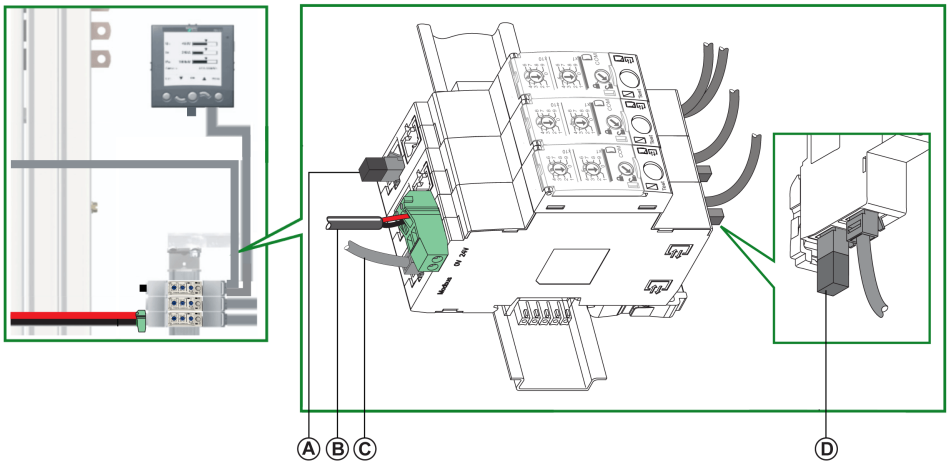
F IFE server

G RJ45 plug/plug ULP cord

Cable	Description
	Ethernet network
	ULP network
	24 Vdc power supply

Modbus Cable Connection

If there is no IFE server in the centralized architecture, connect the Modbus cable as shown in the following figure.



A Modbus line termination

B 24 Vdc power supply

C Modbus cable coming from Modbus client

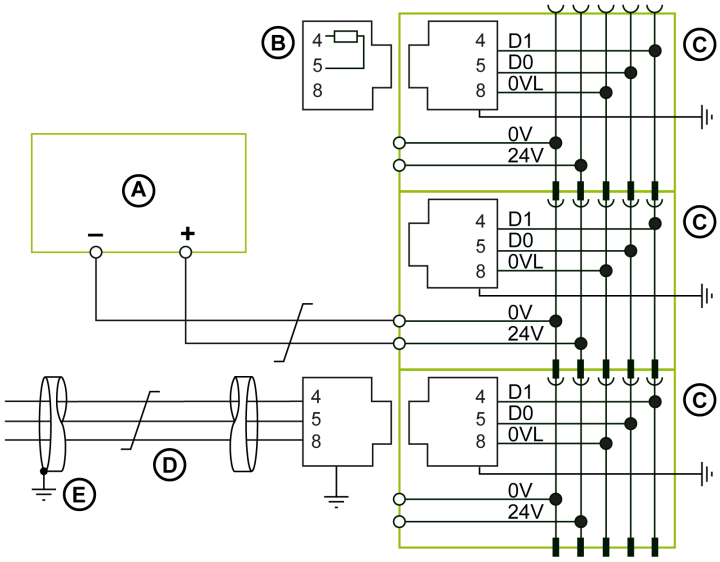
D ULP line termination

Cable	Description
	Modbus network
	ULP network
	24 Vdc power supply

The Modbus cable coming from the Modbus client is connected to an IFM interface. It ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).

Wiring Diagram

The following wiring diagram shows the connections for the Modbus cable and the 24 Vdc power supply:



A 24 Vdc power supply

B Modbus line termination

C IFM interface

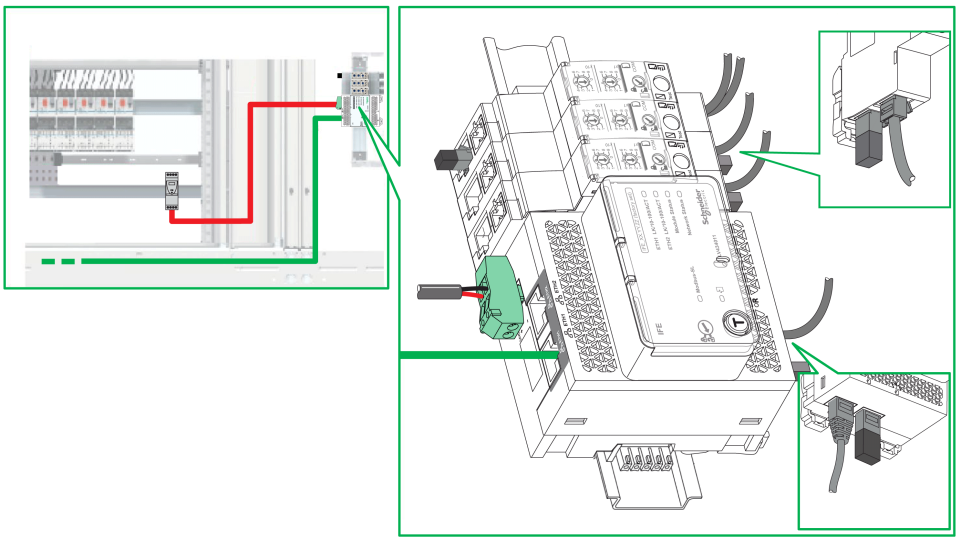
D Modbus cable coming from Modbus client

E Ground connection at end of Modbus cable when the Modbus client is installed in the same electrical equipment as the IFM interfaces to which it is connected

For information about cable shield management, refer to the rules for Modbus connection linking several pieces of electrical equipment, page 68.

IFE Ethernet Switchboard Server Power Supply

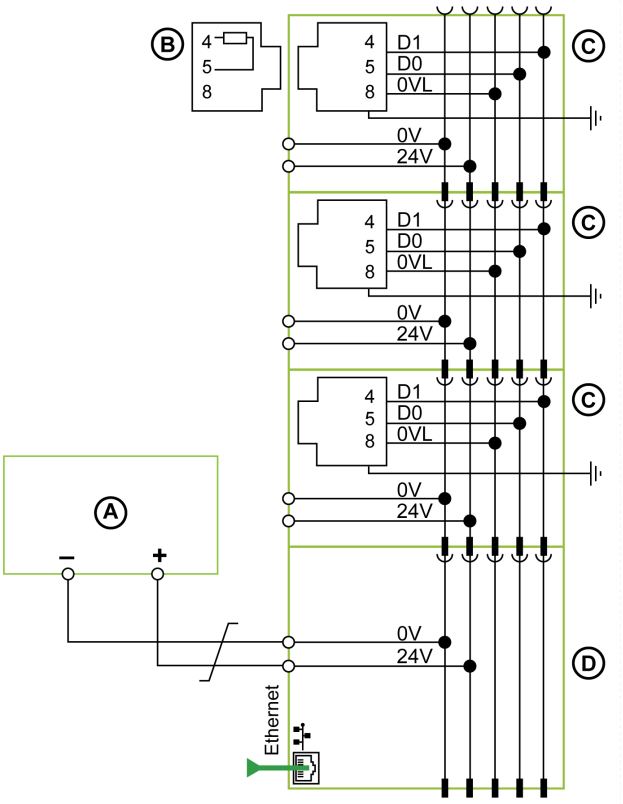
When the IFE server is stacked to the IFM interfaces, the 24 Vdc power supply of the IFE server and the serial line Modbus communication are distributed to the IFM interfaces.



Cable	Description
	Ethernet network
	ULP network
	24 Vdc power supply

Wiring Diagram for IFE Ethernet Switchboard Server

The following wiring diagram shows the connections for the IFE server and the 24 Vdc power supply in detail:



A 24 Vdc power supply

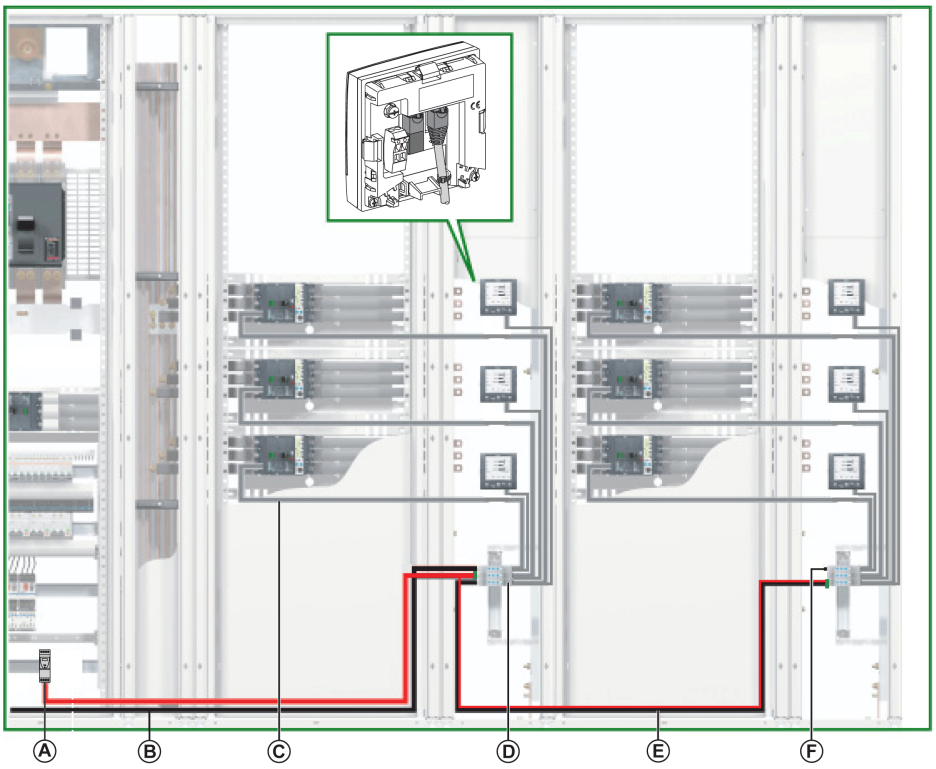
B Modbus line termination

C IFM interface

D IFE server

Case of a Single Power Supply Segment

The following figure shows a centralized Modbus architecture with two cubicles and a single power supply segment:



A 24 Vdc ABL8 power supply for ULP modules

B Modbus cable coming from Modbus client

C NSX cord

D IFM interface

E Modbus cable running to second cubicle

F Modbus line termination

Cable	Description
	Modbus network
	ULP network
	24 Vdc power supply

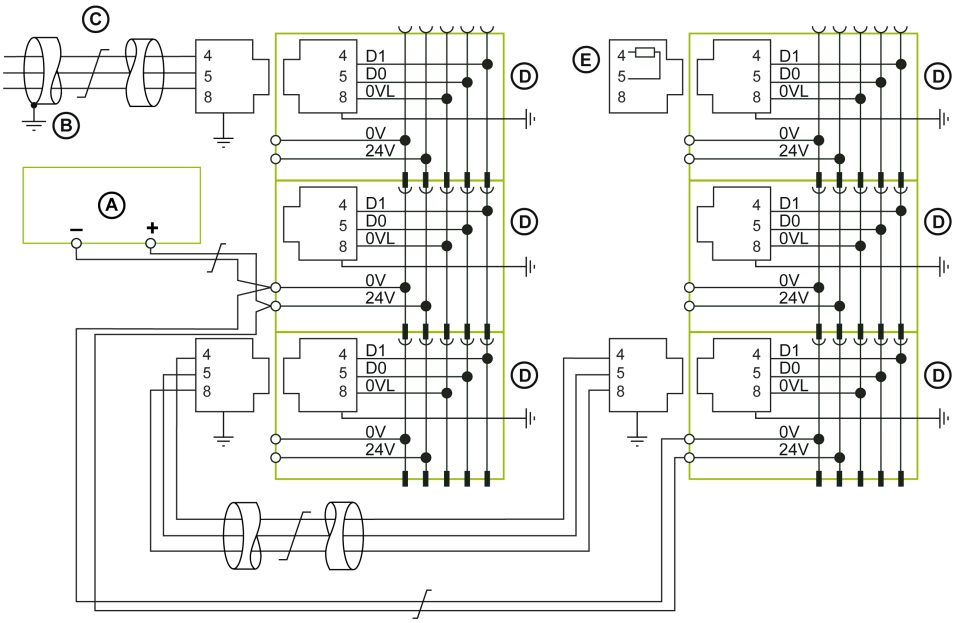
Modbus Cable Connection with a Single Power Supply Segment

- The Modbus cable coming from the Modbus client is connected to an IFM interface. It ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).
- The Modbus cable running to the second cubicle can be connected to any IFM interface in the group. It ensures continuity of the Modbus signal to the second cubicle and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).

  The 24 Vdc power supply cable running to the second cubicle can be connected to any IFM interface in the group. It ensures continuity of the 24 Vdc power supply to the second cubicle.

Wiring Diagram with a Single Power Supply Segment

The following wiring diagram shows the connections for the Modbus cables and the 24 Vdc power supply in the case of a single power supply segment:



A 24 Vdc power supply

B Ground connection at end of Modbus cable when the Modbus client is installed in the same electrical equipment as the IFM interfaces to which it is connected

C Modbus cable coming from Modbus client

D IFM interface

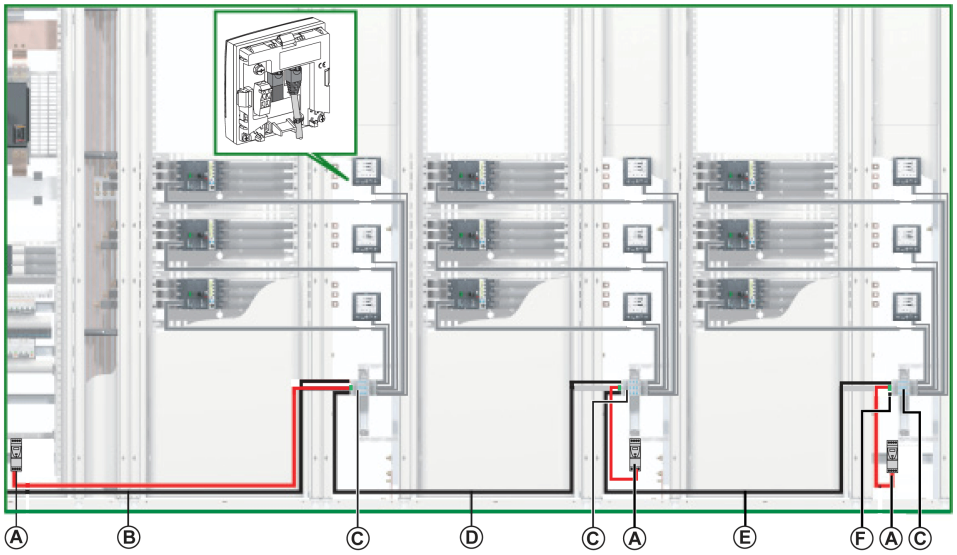
E Modbus line termination

For more information, refer to Modbus connection linking several pieces of electrical equipment, page 68.

Case of Several Power Supply Segments

When more than one 24 Vdc power supply is needed (refer to segmented power supply, page 55), then several power supply segments are used along the Modbus cable.

The following figure shows a centralized Modbus architecture with three power supply segments:



A 24 Vdc ABL8 power supply for ULP modules

B Modbus cable coming from Modbus client

C IFM interfaces grouped with stacking accessories

D Modbus cable running to second cubicle

E Modbus cable running to third cubicle

F Modbus line termination

Cable	Description
	Modbus network
	ULP network
	24 Vdc power supply

Connection of Modbus Cable with Several Power Supply Segments

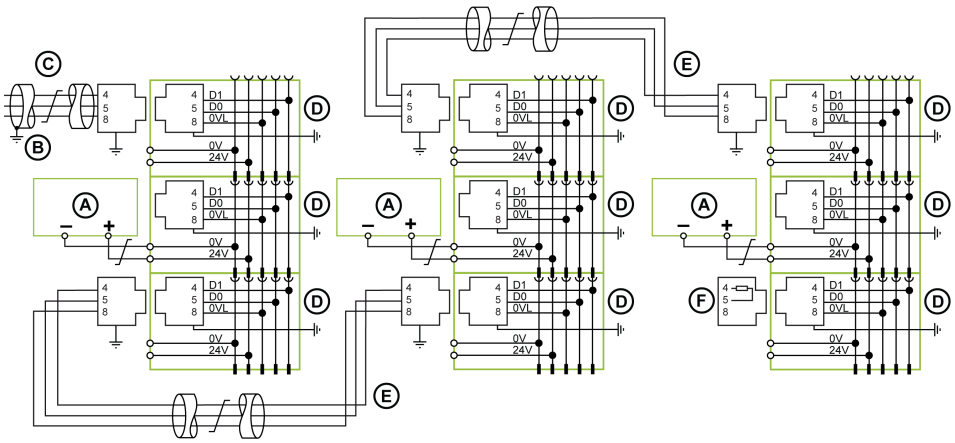
- The Modbus cable coming from the Modbus client ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).
- The Modbus cable running to the second cubicle ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).

  A separate 24 Vdc power supply is connected to the second cubicle.
- The Modbus cable running to the third cubicle ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).

  A separate 24 Vdc power supply is connected to the third cubicle.

Wiring Diagram with Several Power Supply Segments

The following wiring diagram shows the connections for the Modbus cables and the 24 Vdc power supply in the case of several power supply segments:



A 24 Vdc power supply

B Ground connection at end of Modbus cable when the Modbus client is installed in the same section of electrical equipment as the IFM interfaces to which it is connected

C Modbus cable coming from Modbus client

D IFM interface

E Modbus cable between pieces of electrical equipment

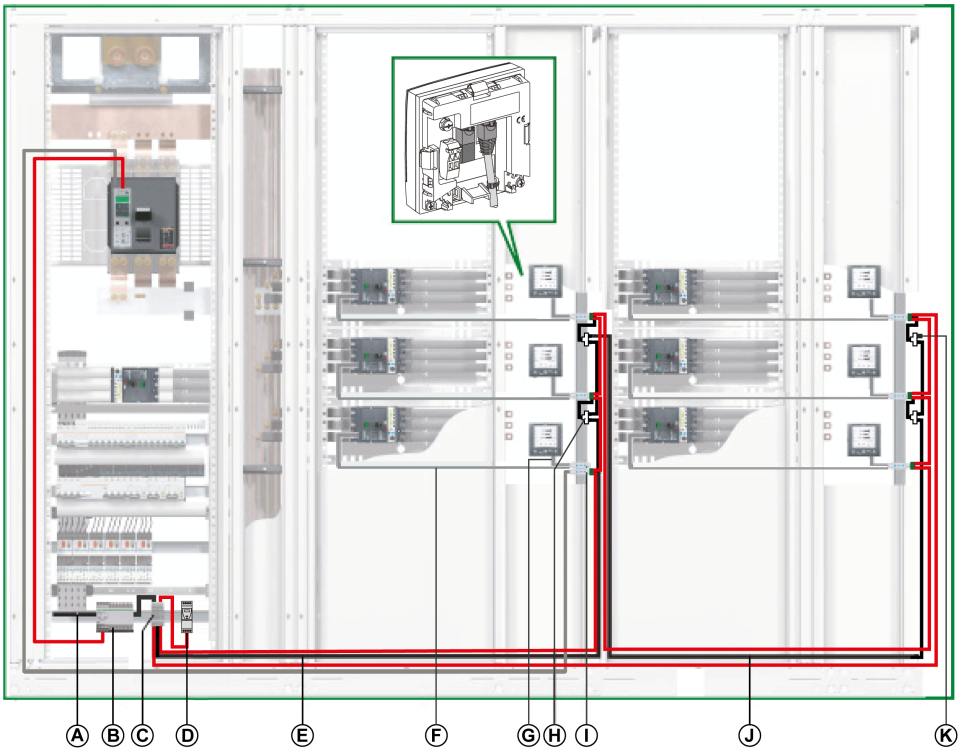
F Modbus line termination

For information about cable shield management, refer to the rules for Modbus connection linking several pieces of electrical equipment, page 68.

Daisy-Chained Distributed Modbus Architecture

The following figure shows an example of a daisy-chained distributed Modbus architecture with seven IMUs:

- An IMU consisting of a ComPacT NS circuit breaker and an IFM interface.
- Six IMUs consisting of a ComPacT NSX circuit breaker, an IFM interface, and an FDM121 display each.



A Modbus cable coming from Modbus client

B 24 Vdc AD power supply for MicroLogic trip units in MasterPact NT/NW or ComPacT NS circuit breakers

C Shunt terminal block on the incoming supply

D 24 Vdc ABL8 power supply for ULP modules

E Modbus cable running to first cubicle

F NSX cord

G RJ45 plug/plug ULP cord

H RJ45 Modbus T-junction

I IFM interface

J Modbus cable running to second cubicle

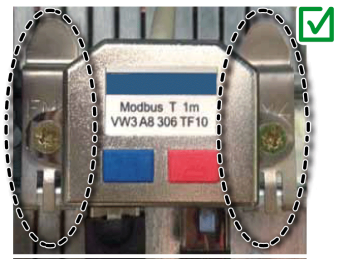
K Modbus line termination

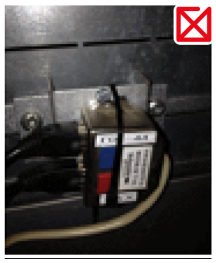
Cable	Description
▬▬▬	Modbus network
▬▬▬	ULP network
▬▬▬	24 Vdc power supply

For a distributed Modbus architecture, an RJ45 Modbus T-junction can be used to connect the upstream Modbus cable and the downstream Modbus cable.

NOTE: Recommendations for installing the Modbus T-junction:

- To route cables of the Modbus T-junction, take into account the cable bending radius.
- The Modbus T-junction must be installed on DIN rail using EMC clamps. Avoid excessive mechanical stress on the case when screwing the T-junction to the DIN rail.



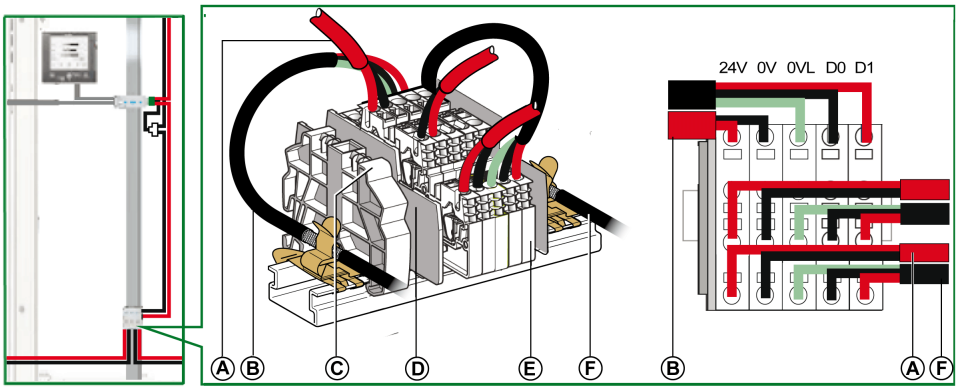


Shunt Terminal Block on the Incoming Supply

The shunt terminal block on the incoming supply can connect the Modbus cable and the power supply for all the IMUs.

The shunt terminal block consists of four 5-channel spring terminal blocks.

The following figure shows the shunt terminal block on the incoming supply in detail:



A 24 Vdc power supply

B Modbus cable coming from Modbus client

C Clip-on plastic end stop

D End plate

E Spring terminal block

F Modbus cable running to first cubicle

The following table lists the part numbers for the shunt terminal block:

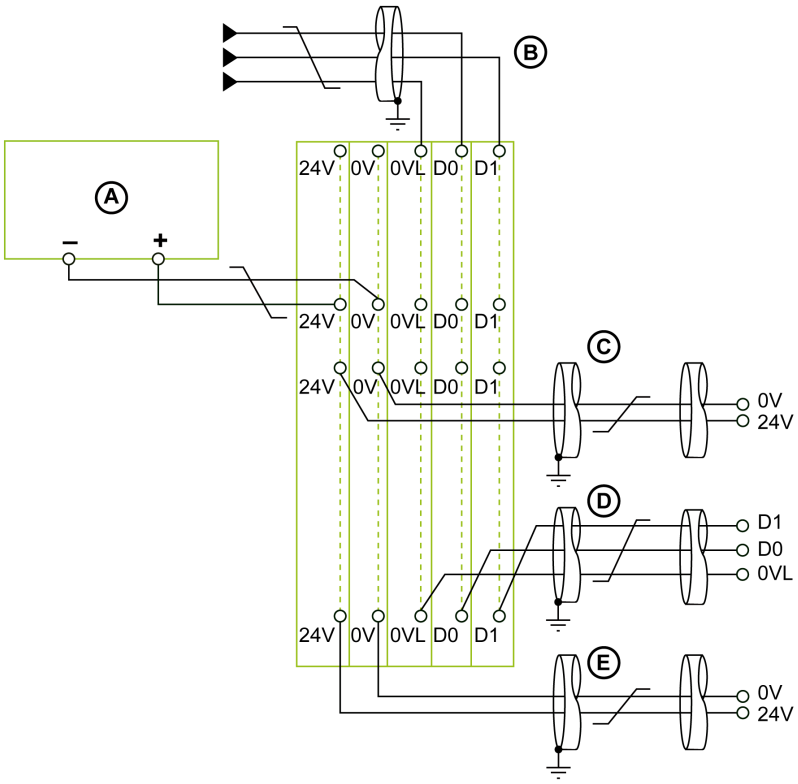
Component	Nominal cross-section	Part number
5-channel spring terminal block	2.5 mm^2 (14 AWG)	NSYTRR24D+NSYTRALV24 (gray)
End plate	–	AB1 RRNACE244
Clip-on plastic end stop	–	AB1 AB8R35

Modbus Cable Connection

- The Modbus cable coming from the Modbus client ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).
- The Modbus cable running to the first cubicle ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail) for the cubicle.

  The 24 Vdc power supply running to the first cubicle ensures continuity of the power supply.
- The unused channel on the shunt terminal block can be used to connect another Modbus server in the electrical equipment (a PM800 communicating power meter, for example).

Wiring Diagram of Shunt Terminal Block on the Incoming Supply



A 24 Vdc power supply

B Modbus cable coming from Modbus client

C 24 Vdc power supply cable running from Modbus servers

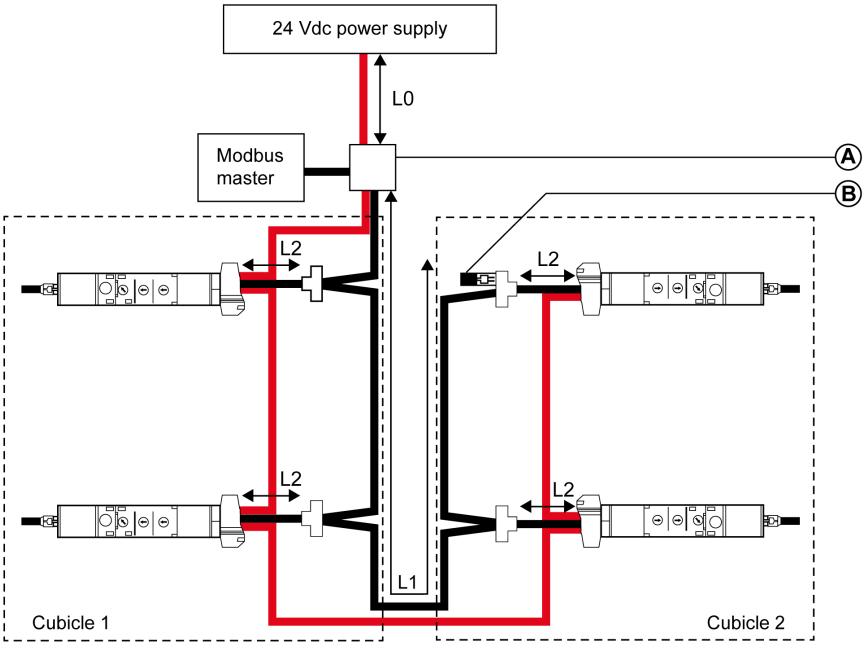
D Modbus cable running to Modbus servers

E 24 Vdc power supply cable running to Modbus servers

NOTE: For information about shield connection, refer to the 24 Vdc power supply cable characteristics, page 61.

Modbus Cable Lengths for a Single Power Supply Segment

The following figure shows the Modbus cable lengths in detail for a daisy-chained distributed Modbus architecture with a single power supply segment:



A Shunt terminal block on the incoming supply

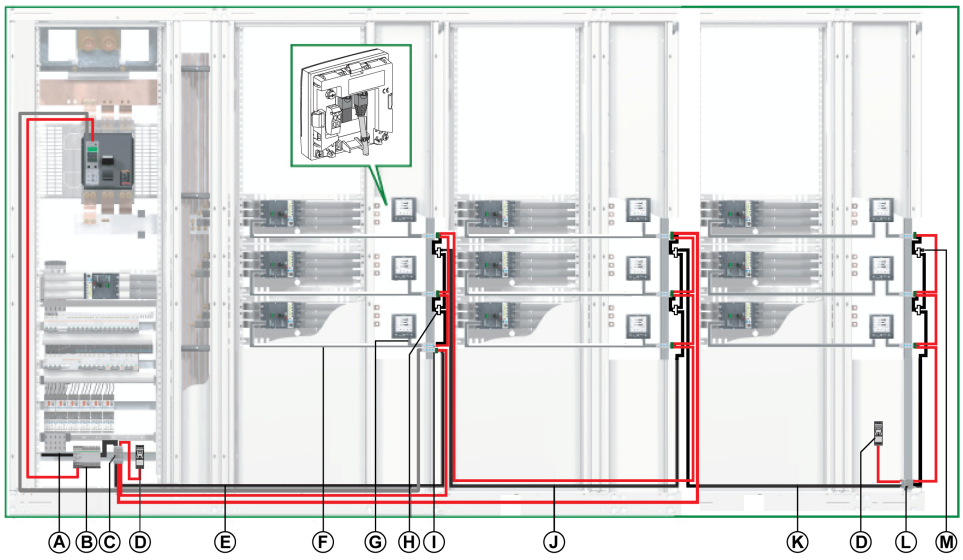
B Modbus line termination

The total length of all L2s must be less than L1.

Case of Several Power Supply Segments

When more than one 24 Vdc power supply is needed (refer to segmented power, page 55), then several power supply segments are used along the Modbus cable.

The following figure shows a daisy-chained distributed Modbus architecture with two power supply segments:



A Modbus cable coming from Modbus client

B 24 Vdc AD power supply for MicroLogic trip units in MasterPact NT/NW or ComPacT NS circuit breakers

C Shunt terminal block on the incoming supply

D 24 Vdc ABL8 power supply for ULP modules

E Modbus cable running to first cubicle

F NSX cord

G RJ45 plug/plug ULP cord

H RJ45 Modbus T-junction

I IFM interface

J Modbus cable running to second cubicle

K Modbus cable running to third cubicle

L Shunt terminal block on the cubicle incomer

M Modbus line termination

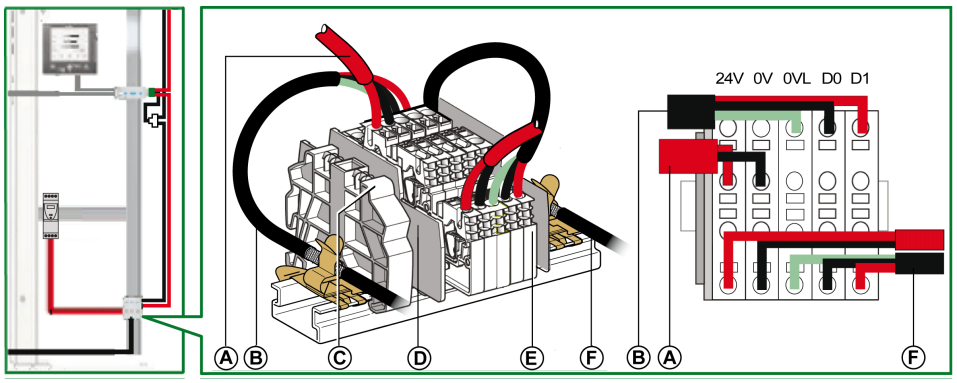
Cable	Description
	Modbus network
	ULP network
	24 Vdc power supply

Shunt Terminal Block on the Incomer of the Third Cubicle

The shunt terminal block on the incomer of the third cubicle can be used to connect a new 24 Vdc power supply to power the IMUs in the third cubicle.

The shunt terminal block consists of four 5-channel spring terminal blocks.

The following figure shows the shunt terminal block on the incomer of the third cubicle in detail:



A 24 Vdc power supply

B Modbus cable coming from second cubicle

C Clip-on plastic end stop

D End plate

E Spring terminal block

F Modbus cable rising up the third cubicle

Modbus Cable Connection

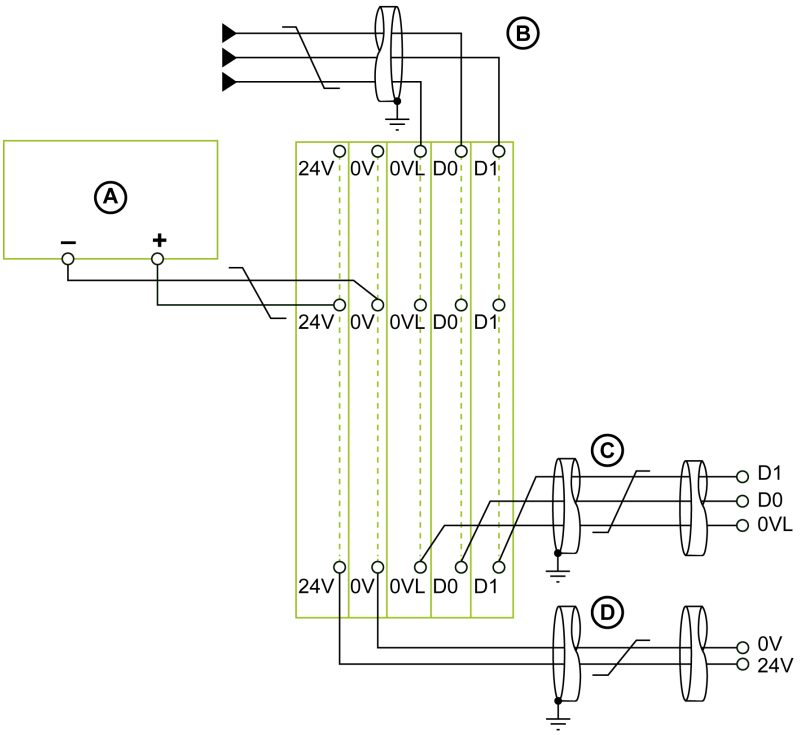
- The Modbus cable from the Modbus client ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).
- The Modbus cable running to the first cubicle ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail) for the cubicle.

  The 24 Vdc power supply running to the first cubicle ensures continuity of the power supply for the cubicle.
- The Modbus cable running to the second cubicle ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail) for the second cubicle.

  The 24 Vdc power supply running to the second cubicle ensures continuity of the power supply for the second cubicle.
- The Modbus cable running to the third cubicle ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).

  A separate 24 Vdc power supply is connected to the third cubicle.

Wiring Diagram of Shunt Terminal Block on the Incomer of the Third Cubicle



A 24 Vdc power supply

B Modbus cable coming from second cubicle

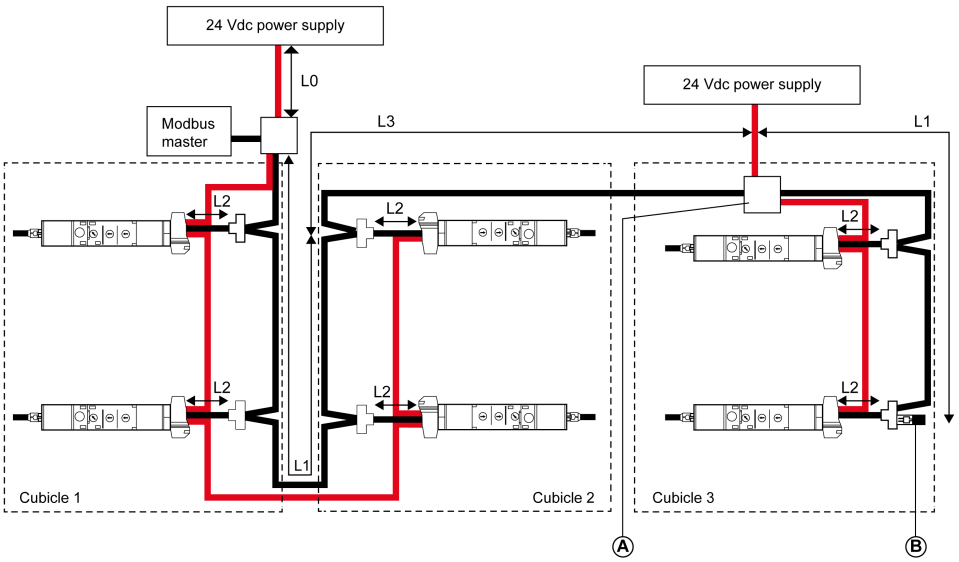
C Modbus cable rising up the third cubicle

D 24 Vdc power supply cable rising up the third cubicle

NOTE: For information about shield connection, refer to the 24 Vdc power supply cable characteristics, page 61.

Modbus Cable Lengths for Several Power Supply Segments

The following figure shows the Modbus cable lengths in detail for a daisy-chained distributed Modbus architecture with several power supply segments:



A Shunt terminal block on the cubicle incomer

B Modbus line termination

Modbus cable L3 ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).

The total length of all L2s must be less than L1 in the corresponding installation.

Tap-Linked Distributed Modbus Architecture

Introduction

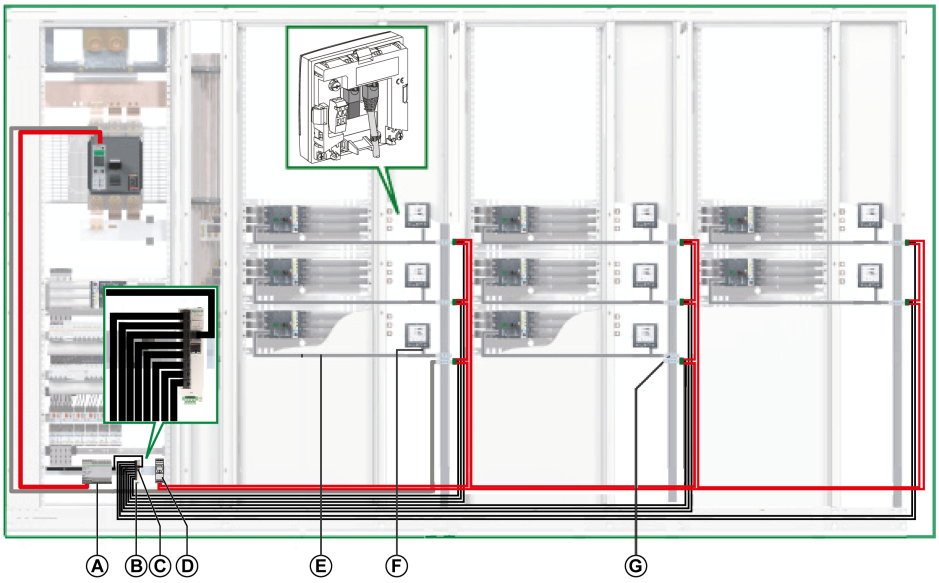
The tap-linked distributed Modbus architecture can be one of the following:

- A Modbusspitter block distributes Modbuscable-up to eight IFM interfaces.
- The main segment of the Modbus cable has a shunt terminal block on the incomer of each cubicle and the IFM interfaces are connected on a tap link cable.

Tap-Linked Distributed Modbus Architecture With Modbus Splitter Block

The following figure shows an example of a tap-linked distributed Modbus architecture with nine IMUs:

- An IMU consisting of a ComPacT NS circuit breaker and an IFM interface.
- Eight IMUs consisting of a ComPacT NSX circuit breaker, an IFM interface, and an FDM121 display each.



A 24 Vdc AD power supply for MicroLogic trip units in MasterPact NT/NW or ComPacT NS circuit breakers

B Modbus splitter box

C Modbus line termination

D 24 Vdc ABL8 power supply for ULP modules

E NSX cord

F RJ45 plug/plug ULP cord

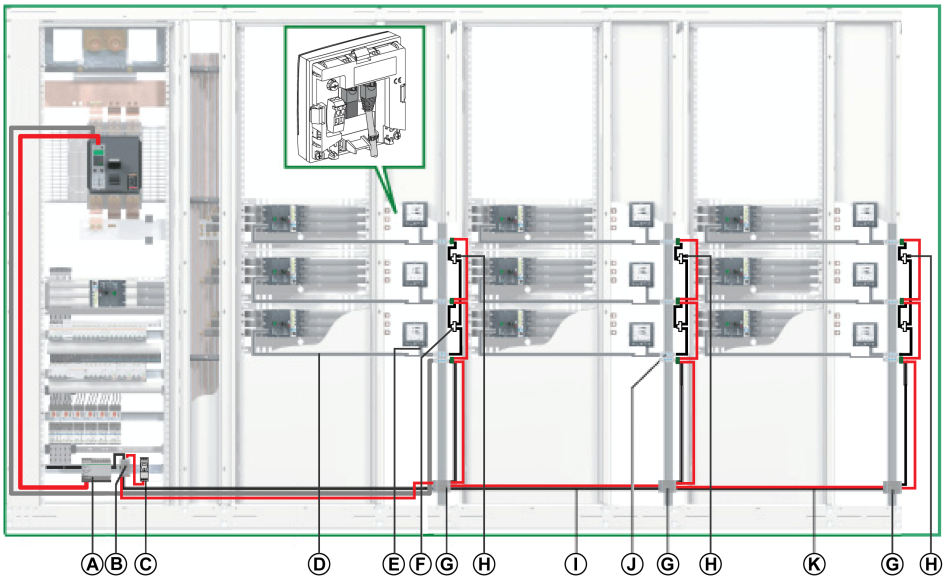
G IFM interface

Cable	Description
	Modbus network
	ULP network
	24 Vdc power supply

Tap-Linked Distributed Modbus Architecture With Modbus T-junctions

The following figure shows an example of a tap-linked distributed Modbus architecture with ten IMUs:

- An IMU consisting of a ComPacT NS circuit breaker and an IFM interface.
- Nine IMUs consisting of a ComPacT NSX circuit breaker, an IFM interface, and an FDM121 display each.



A 24 Vdc AD power supply for MicroLogic trip units in MasterPact NT/NW or ComPacT NS circuit breakers

B Shunt terminal block on the incoming supply

C 24 Vdc ABL8 power supply for ULP modules

D NSX cord

E RJ45 plug/plug ULP cord

F RJ45 Modbus T-junction

G Shunt terminal block on the cubicle incomer

H Modbus line termination

I Modbus cable running to the second cubicle

J IFM interface

K Modbus cable running to the third cubicle

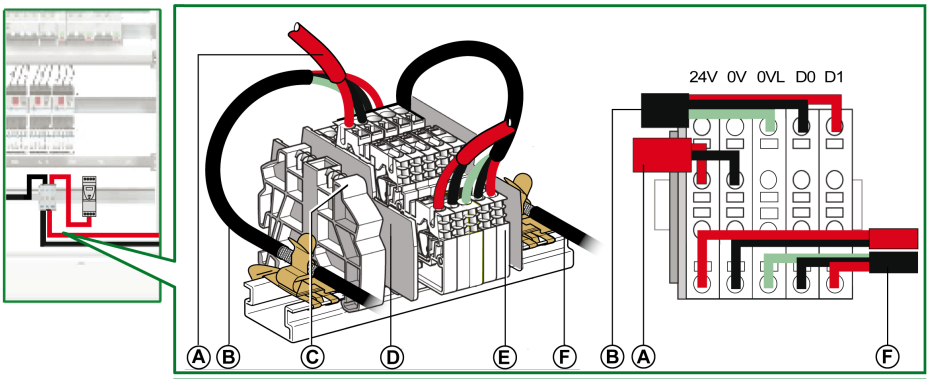
Cable	Description
	Modbus network
	ULP network
	24 Vdc power supply

Shunt Terminal Block on the Incoming Supply

The shunt terminal block on the incoming supply can be used to connect the Modbus cable and the power supply for all the IMUs.

The shunt terminal block consists of four 4-channel spring terminal blocks and one functional ground terminal block offering grounding of the Modbus cable shielding by connection to the DIN rail.

The following figure shows the shunt terminal block on the incoming supply.



A 24 Vdc power supply

B Modbus cable coming from Modbus client

C Clip-on plastic end stop

D End plate

E Spring terminal block

F Modbus cable running to first cubicle

The following table lists the part numbers for the shunt terminal block:

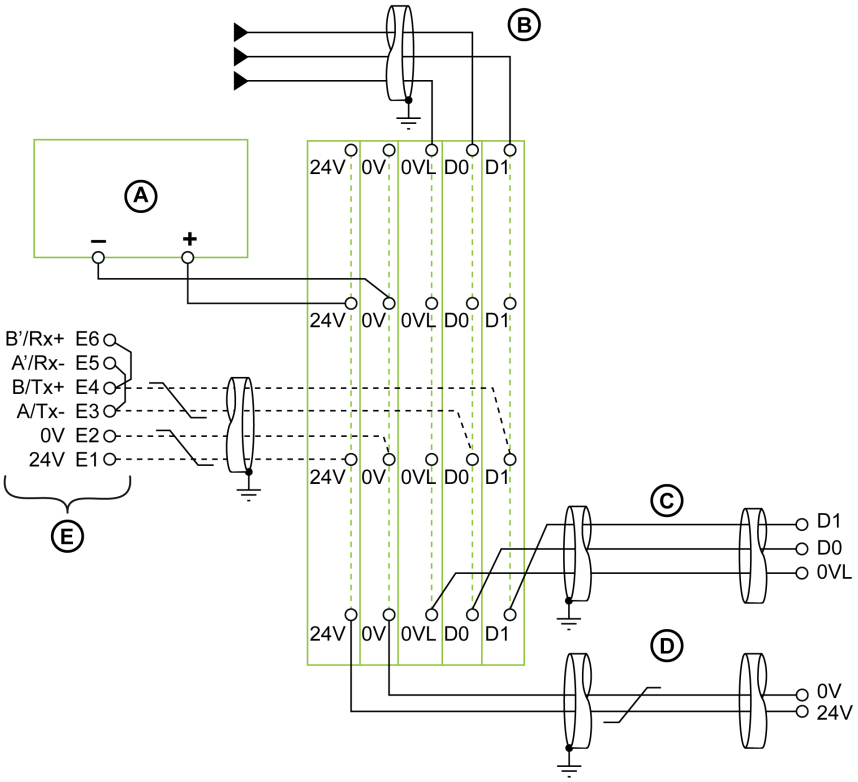
Component	Nominal cross-section	Part number
4-channel spring terminal block	2.5 mm^2 (14 AWG)	NSYTRR24D+NSYTRALV24 (gray)
End plate	–	AB1 RRNACE244
Clip-on plastic end stop	–	AB1 AB8R35

Modbus Cable Connection

- The Modbus cable coming from the Modbus client ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).
- The Modbus cable running to the first cubicle ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail) for the cubicle.

  The 24 Vdc power supply running to the first cubicle ensures continuity of the power supply.
- The unused channel on the shunt terminal block can be used to connect another Modbus server in the electrical equipment (a PM800 communicating power meter, for example).

Wiring Diagram of Shunt Terminal Block on the Incoming Supply



A 24 Vdc power supply

B Modbus cable coming from Modbus client

C Modbus cable running to first cubicle

D 24 Vdc power supply cable running to first cubicle

E Modbus server (for example, MasterPact NT/NW circuit breaker)

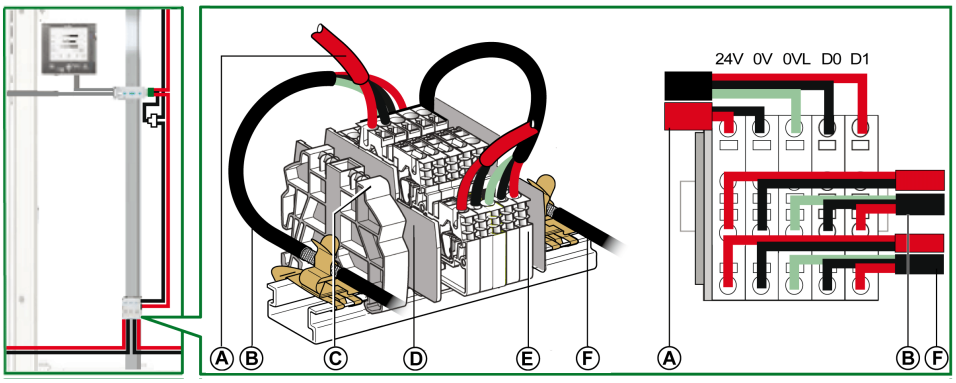
NOTE: For information about shield connection, refer to the 24 Vdc power supply cable characteristics, page 61.

Shunt Terminal Block on the Cubicle Incomer

The shunt terminal block on the cubicle incomer distributes the Modbus signal and the 24 Vdc power supply to the cubicles in the electrical equipment.

The shunt terminal block is created using four 5-channel spring terminal blocks.

The following figure shows the shunt terminal block on the cubicle incomer.



A Modbus cable rising up the cubicle

B Upstream Modbus cable

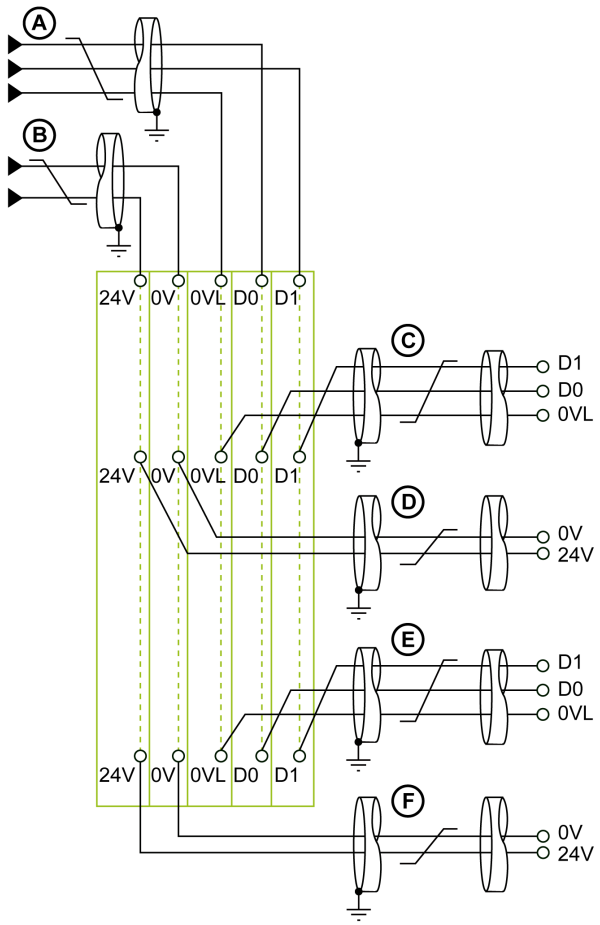
C Clip-on plastic end stop

D End plate

E Spring terminal block

F Downstream Modbus cable

Wiring Diagram of Shunt Terminal Block on the Cubicle Incomer



A Upstream Modbus cable

B Upstream 24 Vdc power supply cable

C Modbus cable rising up the cubicle

D 24 Vdc power supply cable rising up the cubicle

E Downstream Modbus cable

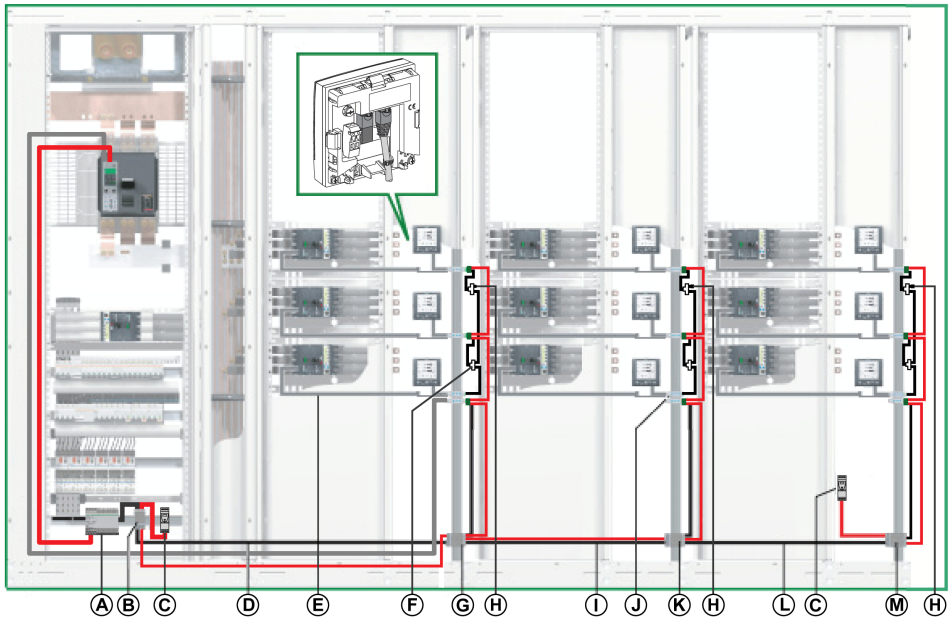
F Downstream 24 Vdc power supply cable

NOTE: For information about shield connection, refer to the 24 Vdc power supply cable characteristics, page 61.

Case of Several Power Supply Segments

When more than one 24 Vdc power supply is needed (refer to segmented power supply, page 55), then several power supply segments are used along the Modbus cable.

The following figure shows a tap-linked distributed Modbus architecture with two power supply segments:



A 24 Vdc AD power supply for MicroLogic trip units in MasterPact NT/NW or ComPacT NS circuit breakers

B Shunt terminal block on the incoming supply

C 24 Vdc ABL8 power supply for ULP modules

D Modbus cable running to the first cubicle

E NSX cord

F RJ45 Modbus T-junction

G Shunt terminal block on the incomer of the first cubicle

H Modbus line termination

I Modbus cable running to the second cubicle

J IFM interface

K Shunt terminal block on the incomer of the second cubicle

L Modbus cable running to the third cubicle

M Shunt terminal block on the incomer of the third cubicle

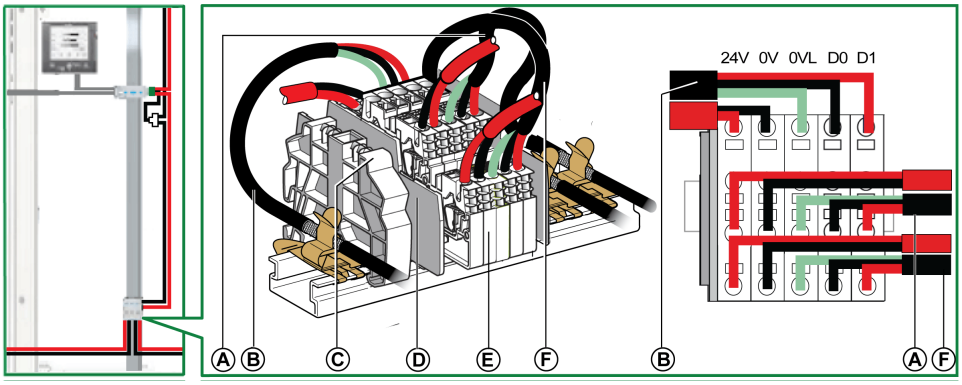
Cable	Description
	Modbus network
	ULP network
	24 Vdc power supply

Shunt Terminal Block on the Incomer of the Second Cubicle

The shunt terminal block on the incomer of the second cubicle is created using four 4-channel spring terminal blocks and one functional ground terminal block offering grounding of the Modbus cable shielding by connection to the DIN rail.

For the shunt terminal block part numbers, refer to the appropriate component, page 100.

The following figure shows the shunt terminal block on the incomer of the second cubicle in detail:



A Modbus cable rising up the second cubicle

B Modbus cable coming from the first cubicle

C Clip-on plastic end stop

D End plate

E Spring terminal block

F Modbus cable running to the third cubicle

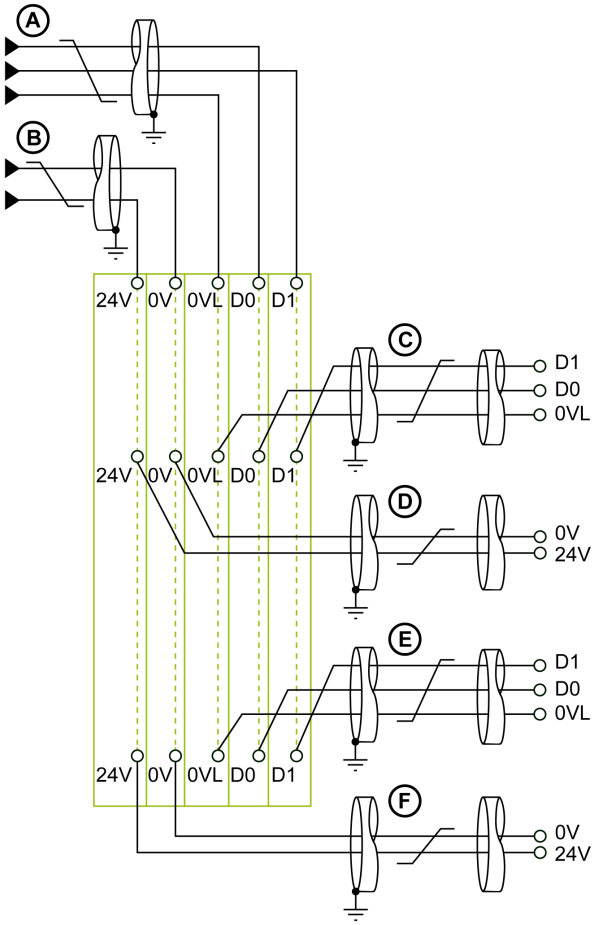
Modbus Cable Connection

- The Modbus cable coming from the shunt terminal block on the incomer of the first cubicle ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail) for the second cubicle.

  The 24 Vdc power supply coming from the shunt terminal block on the incomer of the first cubicle ensures continuity of the power supply for the second cubicle.
- The Modbus cable running to the third cubicle ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).

  The 24 Vdc power supply running to the third cubicle ensures continuity of the power supply.

Wiring Diagram of Shunt Terminal Block on the Incomer of the Second Cubicle



A Modbus cable coming from first cubicle

B 24 Vdc power supply cable coming from first cubicle

C Modbus cable rising up second cubicle

D 24 Vdc power supply cable rising up second cubicle

E Modbus cable running to third cubicle

F 24 Vdc power supply cable running to third cubicle

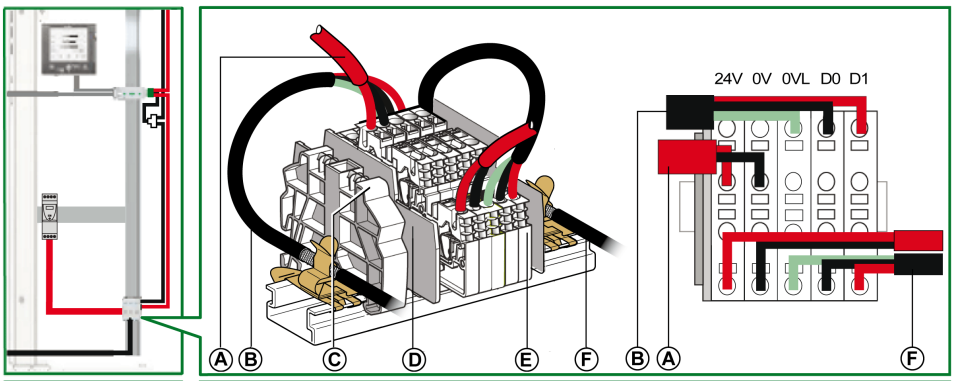
NOTE: For information about shield connection, refer to the 24 Vdc power supply cable characteristics, page 61.

Shunt Terminal Block on the Incomer of the Third Cubicle

The shunt terminal block on the incomer of the third cubicle can be used to connect a new 24 Vdc power supply to power the IMUs in the third cubicle.

The shunt terminal block is created using four 4-channel spring terminal blocks and one functional ground terminal block offering grounding of the Modbus cable shielding by connection to the DIN rail.

The following figure shows the shunt terminal block on the incomer of the third cubicle.



A 24 Vdc power supply

B Modbus cable coming from the shunt terminal block on the incomer of the second cubicle

C Clip-on plastic end stop

D End plate

E Spring terminal block

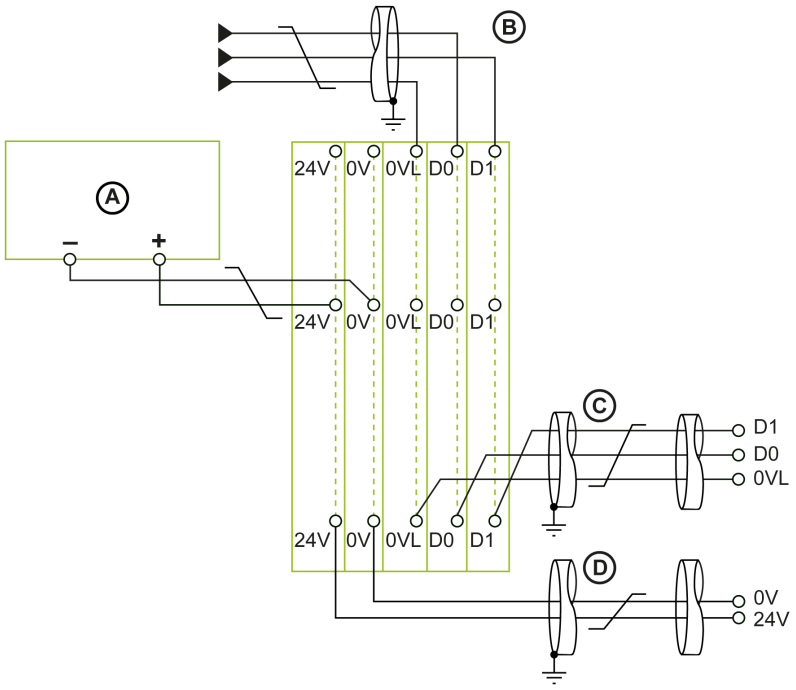
F Modbus cable rising up the third cubicle

Modbus Cable Connection

- The Modbus cable coming from the shunt terminal block on the incomer of the second cubicle ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail).
- The Modbus cable rising up the third cubicle ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps. The brass clamps must have suitable diameter for the cable type and fixings compatible with the installation (for example, screw or DIN rail) for the third cubicle.

  The 24 Vdc power supply rising up the third cubicle ensures continuity of the power supply for the third cubicle.

Wiring Diagram of Shunt Terminal Block on the Incomer of the Third Cubicle



A 24 Vdc power supply

B Modbus cable coming from second cubicle

C Modbus cable rising up third cubicle

D 24 Vdc power supply cable rising up third cubicle

NOTE: For information about shield connection, refer to the 24 Vdc power supply cable characteristics, page 61.

Ethernet Architectures

Introduction

Choosing an Ethernet topology depends on the requirements of the communication architecture:

- A star communication network offers an architecture with high dependability.
- A daisy-chain architecture offers a competitive architecture.

Ethernet High Dependability

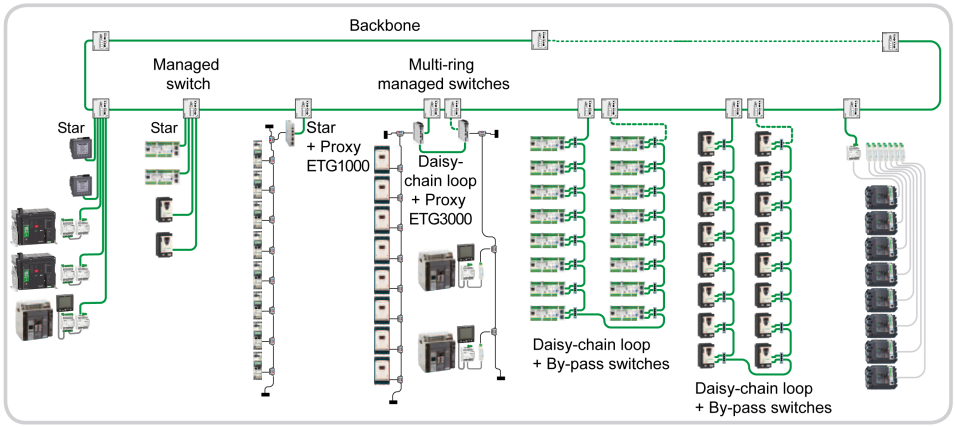
In the case of Ethernet high dependability, the architecture is event tolerant.

A high dependability Ethernet architecture is based around a event tolerant backbone ring (either optic fiber or copper) to which all the subsystems are connected via managed switches.

This communication architecture solution increases process availability with a high level of redundancy and performance. It is entirely based on devices with native Ethernet TCP or Ethernet/IP protocols, for power and motor management architecture. This architecture embeds the best performance for supporting RSTP protocols, and covers all detected events in communication.

This solution also allows power monitoring facilities with new communicating devices supporting web servers.

The following diagram shows an example of a high dependability architecture:



Cable	Description
	Ethernet network
	Modbus network
	ULP network

Star Communication Architecture

The star communication architecture has a high level of dependability.

A star network is a Local Area Network (LAN) in which all nodes (that is, devices) are directly connected to a common central node (that is, the managed switch). Every device is indirectly connected to every other through the managed switch. In a star network, a cable problem isolates the device that links it to the switch, but only that device is isolated. All the other devices continue to function normally, except that they are not able to communicate with the isolated device.

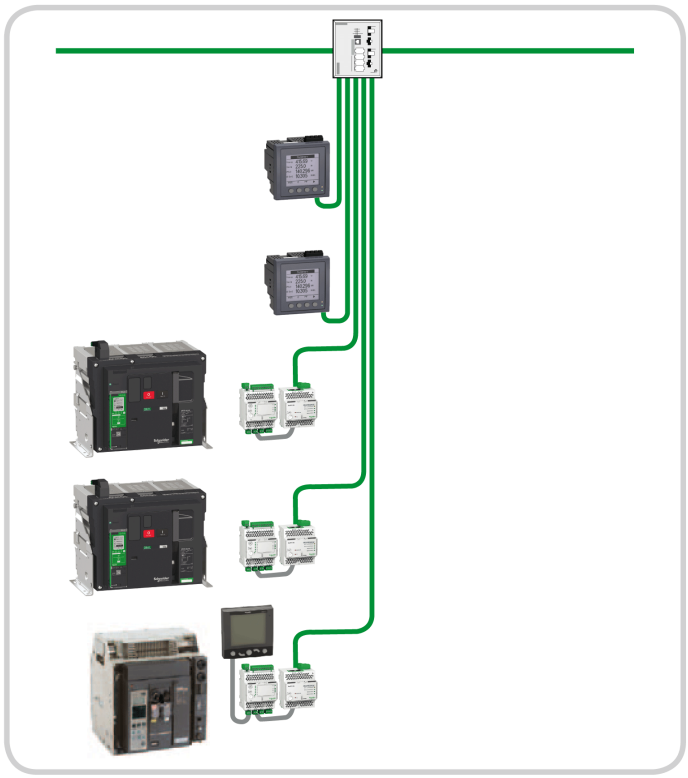
If any device is inoperative, none of the other devices are affected. But if the switch is inoperative, the entire network suffers degraded performance or complete detected failure.

The example of the star architecture in the following diagram uses IFE interfaces and power meters which are directly connected to the managed switch. This switch is the central node and provides a common connection point for all devices (peripheral nodes) connected in the star.

The star topology reduces the damage caused by line problem. If this occurs, a problem of a transmission line linking any peripheral node to the central node results in the isolation of that peripheral node from all others, but the remaining systems are unaffected.

The managed switch makes the connection between the devices and the HiPER-Ring managed backbone.

The following diagram shows a star architecture:



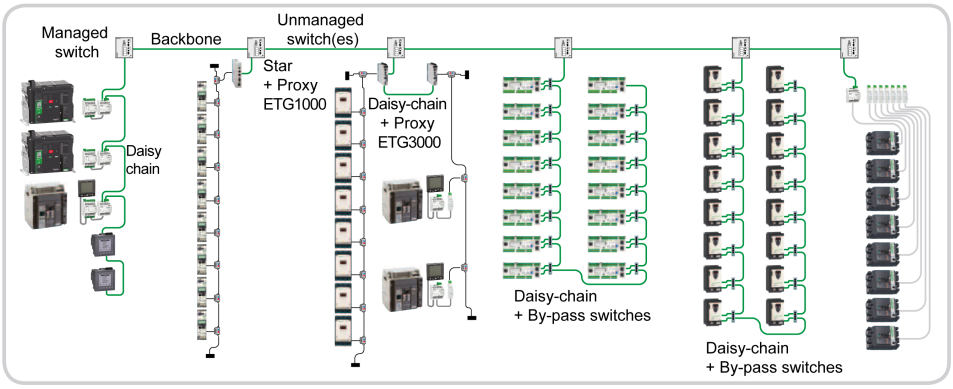
The following table presents the benefits of a star architecture for the user:

User values	Characteristics	Validity in the architecture	Benefit for the user
Dependability	Tolerant to first switch problem	–	✓
	Tolerant to first node problem	✓	
	Tolerant to second node problem	✓	
	Tolerant to several node problems	✓	
	One or more common modes	–	
	Additional problem modes	✓	
Operability	Withdrawability of one functional unit	✓	✓
	Withdrawability of two functional units	✓	
	Withdrawability of several functional units	✓	

Ethernet Competitive Architecture

A competitive architecture is an optimized and recommended reference for some dedicated applications where redundancy is not required.

The following diagram shows a competitive architecture:



Cable	Description
	Ethernet network
	Modbus network
	ULP network

Daisy Chain Communication Architecture

A daisy chain communication architecture is a competitive architecture.

A daisy chain is an interconnection of devices, peripherals, or network nodes in series, one after another. It is connected to the bus backbone via an unmanaged switch.

The daisy chain is a simple architecture, but devices must have two Ethernet communication ports.

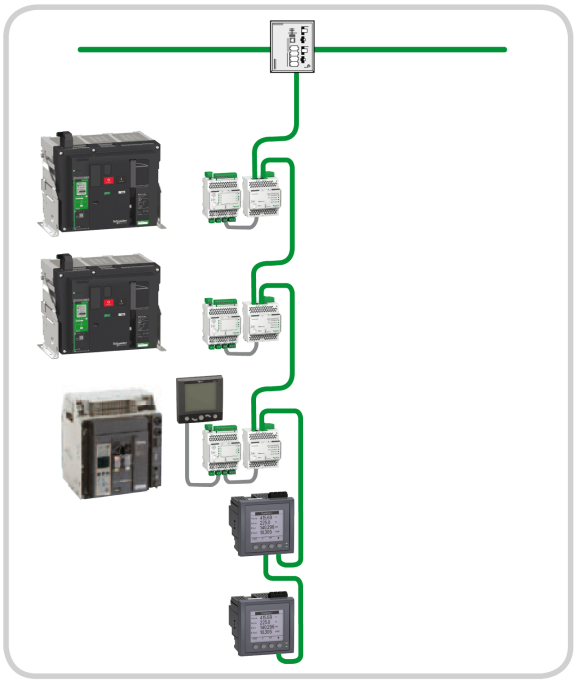
If any device becomes inoperative, or if a cable problem occurs, it will isolate devices that are connected after the problem. The remaining devices (between the switch and the cable problem) continue to operate normally, but they are not able to communicate with the isolated devices.

But if the switch is inoperative, the entire daisy chain network suffers a complete detected failure.

This type of architecture for connecting devices is recommended in the case of competitive global architecture.

NOTE: Power meters are always connected at the end of the daisy chain, after the IFE interface, so that if a loss of communication occurs at the power meter level, there is no impact on communication with low voltage circuit breakers.

The following diagram shows a daisy-chain architecture:



Cable	Description
	Ethernet network
	ULP network

The following table presents the benefits of a daisy-chain architecture for the user:

User values	Characteristics	Validity in the architecture	Benefit for the user
Dependability	Tolerant to first switch problem	–	–
	Tolerant to first node problem	–	
	Tolerant to second node problem	–	
	Tolerant to several nodes problems	–	
	One or more common modes	–	
	Additional problem modes	–	
Operability	Withdrawability of one functional unit	✓	✓
	Withdrawability of two functional units	✓	
	Withdrawability of several functional units	✓	

Appendices

What's in This Part

Technical Characteristics 114
IFM Interface with Part Number TRV00210 120

Technical Characteristics

What's in This Chapter

Technical Characteristics of USB Maintenance Interface 115
RJ45 Plug/Plug ULP Cord Characteristics 117
Part Numbers for ULP System Components 118

Technical Characteristics of USB Maintenance Interface

Environmental Characteristics

Characteristic		Value
Conforming to standards		• IEC/EN 60947-1 • IACS E10
Certification		CE and C-Tick marking
Ambient temperature	Storage	-40 °C to +85 °C (-40 °F to +185 °F)
	Operation	-10 °C to +55 °C (-14 °F to +131 °F)
Relative humidity	Conforming to IEC/EN 60068-2-78	4 days, 40 °C (104 °F), 93% RH, energized
Protective treatment	Conforming to IEC/EN 60068-2-30	6 cycles of 24 hours, 25/55 °C (77/131°F), 95% RH, energized
Pollution		3
Corrosive atmosphere	Conforming to IEC 60068-2-60	4 gases (H_2S, SO_2, NO_2, Cl_2)
Level of pollution	Access to hazardous parts and water penetration	Splashing outside the protective cover: IP4•
	Conforming to IEC/EN 60947-1 and IEC/EN 60529	Connectors: IP3•
	Conforming to IEC 62262/EN 50102	External mechanical impacts: IK05
Flame resistance	Conforming to IEC/EN 60947-1 and IEC/EN 60695-2-11	• 650 °C (1202 °F) 30 s/30 s on de-energized insulating parts • 960 °C (1760 °F) 30 s/30 s on de-energized insulating parts
	Conforming to UL94	V0

Mechanical Characteristics

Characteristic		Value
Shock resistance	Conforming to NF EN 22248 (free fall, in packaging)	H = 90 cm (35.4 in)
	Conforming to IEC 60068-2-27	15 g (0.53 oz)/11 ms 1/2 sinusoidal
Resistance to sinusoidal vibration	Conforming to IEC/EN 60068-2-6	1 g (0.035 oz)/5-150 Hz

Electrical Characteristics

Characteristics		Value
Power supply		24 Vdc -20%/+10% (19.2–26.4 Vdc)
Consumption	Typical	60 mA/24 Vdc at 20 °C (68 °F)
	Maximum with Bluetooth	100 mA/19.2 Vdc at 60 °C (140 °F)
Resistance to electromagnetic discharges	Conforming to IEC/EN 61000-4-2	• 4 kV (direct) • 8 kV (air)
Immunity to radiated electromagnetic interference	Conforming to IEC/EN 61000-4-3	10 V/m
Immunity to electrical fast transients/burst	Conforming to IEC/EN 61000-4-4	• 2 kV (power) • 8 kV (signal)

Characteristics		Value
Immunity to conducted RF fields	Conforming to IEC/EN 61000-4-6	10 V
Immunity to surges	Conforming to IEC/EN 61000-4-5	• Input and Output DC power ports: ◦ Differential mode: 0.5 kV ◦ Common mode: 0.5 kV • Signal ports: Common mode: 1 kV

Physical Characteristics

Characteristic	Value
Dimensions (W x D x H)	Without power supply terminal block: 112 x 164 x 42 mm (4.4 x 6.5 x 1.6 in)
Mounting	• DIN rail • Magnetic
Weight	408 g (14.4 oz)

RJ45 Plug/Plug ULP Cord Characteristics

Characteristics

The common characteristics of ULP cords are as follows:

- Shielded cable with four twisted-pairs, 0.15 mm^2 (26 AWG) cross-section, with typical impedance of 100 Ω
- Shielded RJ45 plug connector at both ends, cable shielding connected to the connector cover (connector conforming to standard IEC 60603-7-1)
- Color and order of internal wires conforming to standard EIA/TIA568B.2 (refer to RJ45 pin connection, page 51)
- Insulation voltage of the outer sheath: 300 V(1)
- Bending radius: 50 mm (1.97 in)(1)

(1) Cable must be compliant with installation requirements for voltage and temperature ratings. It is the responsibility of the user to select the correct cable for the specific installation.

Part Numbers for ULP System Components

The following table lists the part numbers for the components of the ULP system.

Component	Description	Part number
NSX cord	L = 0.35 m (1.15 ft)	LV434200
	L = 1.3 m (4.27 ft)	LV434201
	L = 3 m (9.84 ft)	LV434202
Isolated NSX cord	L = 1.3 m (4.27 ft), U > 480 Vac (cord with RJ45 socket connector)	LV434204
BCM ULP circuit breaker communication module	–	33106
Circuit breaker BCM ULP cord	L = 0.35 m (1.15 ft)	LV434195
	L = 1.3 m (4.26 ft)	LV434196
	L = 3 m (9.84 ft)	LV434197
	L = 5 m (16.4 ft)	LV434198
BSCM circuit breaker status control module	–	LV434205
FDM121 front display module for one circuit breaker	–	TRV00121
Surface-mounting accessory for FDM121 display	–	TRV00128
IFM Modbus-SL interface for one circuit breaker	–	LV434000
IFE Ethernet interface for one circuit breaker	–	LV434001
IFE Ethernet switchboard server	–	LV434002
EIFE embedded Ethernet interface spare part for one for MasterPact MTZ1 drawout circuit breaker	–	LV851100SP
EIFE embedded Ethernet interface full spare part kit for MasterPact MTZ2/MTZ3 drawout circuit breaker	–	LV851200SP
ULP port module for MasterPact MTZ2/MTZ3 fixed circuit breaker	–	LV850061SP
ULP port module for MasterPact MTZ2/MTZ3 drawout circuit breaker	–	LV850062SP
ULP port module for MasterPact MTZ1 fixed circuit breaker	–	LV850063SP
ULP port module for MasterPact MTZ1 drawout circuit breaker	–	LV850064SP
IO input/output application module for one circuit breaker	–	LV434063
Two-wire RS 485 isolated repeater module	–	TRV00211
Stacking accessory	Ten stacking accessories	TRV00217
Service Interface kit	Service Interface, 24 Vdc external power supply unit, and associated cables	LV485500
Maintenance kit	USB maintenance interface, 24 Vdc external power supply unit, and associated cables	TRV00910
USB maintenance interface	–	TRV00911
Power supply unit for USB maintenance interface	–	TRV00915

Component	Description	Part number
MicroLogic test cable for USB maintenance interface	–	TRV00917
RJ45 plug/plug ULP cord	L = 0.3 m (0.98 ft) (ten cords)	TRV00803
	L = 0.6 m (1.97 ft) (ten cords)	TRV00806
	L = 1 m (3.28 ft) (five cords)	TRV00810
	L = 2 m (6.56 ft) (five cords)	TRV00820
	L = 3 m (9.8 ft) (five cords)	TRV00830
	L = 5 m (16.4 ft) (one cord)	TRV00850
RJ45 to open connector Modbus adapter	L = 0.2 m (0.66 ft)	LV434211
Modbus serial link cable with one RJ45 plug connector and free wires at other end	L = 0.3 m (0.98 ft)	VW3A8306D30
RJ45 socket connector	Ten RJ45 socket connectors	TRV00870
ULP line termination	Ten ULP line terminations	TRV00880
Modbus line termination	Two Modbus line terminations (150 Ω)	VW3A8306R
	Two Modbus line terminations with impedance of 120 Ω + 1 nF	VW3A8306RC
24 Vdc power supply	24/30 Vdc - 24 Vdc - 1 A - overvoltage category IV	LV454440
	48/60 Vdc - 24 Vdc - 1 A - overvoltage category IV	LV454441
	100/125 Vdc - 24 Vdc - 1 A - overvoltage category IV	LV454442
	110/130 Vac - 24 Vdc - 1 A - overvoltage category IV	LV454443
	200/240 Vac - 24 Vdc - 1 A - overvoltage category IV	LV454444
	100/500 Vac - 24 Vdc - 3 A - overvoltage category II	ABL8RPS24030
Cable for Modbus serial link (two RJ45 plug connectors)	L = 0.3 m (0.98 ft)	VW3A8306R03
	L = 1 m (3.28 ft)	VW3A8306R10
	L = 3 m (9.8 ft)	VW3A8306R30
Modbus splitter block	Ten RJ45 ports and one screw terminal block	LU9GC3
RJ45 Modbus T-junction	L = 0.3 m (0.98 ft)	VW3A8306TF03
	L = 1 m (3.28 ft)	VW3A8306TF10
Shunt terminal block	4-channel spring terminal block (gray)	NSYTRR24D+NSYTRALV24
	4-channel functional ground terminal block (green/yellow)	NSYTRR24DPE
	2-channel functional ground terminal block (green/yellow)	NSYTRV22PE
	End plate	NSYTRACRE24
	Clip-on plastic end stop	AB1AB8R35
	Phoenix Contact: Pluggable connector MSTB 2.5/5-STF-5.08	1778014
	Phoenix Contact: Base unit on DIN rail UMSTBVK 2.5/5-GF-5.08	1787953
	Phoenix Contact: Optional cable housing for pluggable connector KGG-MSTB 2.5/5	1803895

IFM Interface with Part Number TRV00210

What's in This Chapter

IFM Interface with Part Number TRV00210 121
Two-Wire RS 485 Isolated Repeater Module 131

IFM Interface with Part Number TRV00210

Introduction

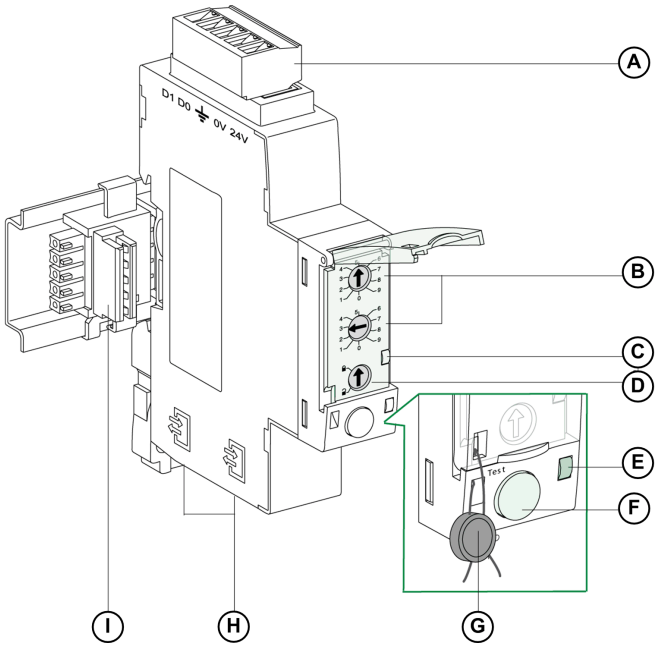
The IFM interface with part number TRV00210 is substituted by the IFM interface with part number LV434000.

The following table shows the specificities for each IFM interface.

Characteristics	IFM interface TRV00210	IFM interface LV434000
Circuit breaker compatibility	• MasterPact NT/NW • ComPacT NS • ComPacT NSX	• MasterPact NT/NW • ComPacT NS • ComPacT NSX • MasterPact MTZ
Modbus connector	5-pin	RJ45
Cable	Free-ends Modbus cable	RJ45 Modbus cables
Modbus circuit	D0, D1, common C, power supply	D0, D1, 0 VL common
Connection of the 0 V common to a ground terminal block	Yes, ground terminal block required.	No, given that 0 VL is isolated.
Modbus isolation	Two-wire RS 485 isolated repeater required	No repeater required
Modbus line termination	Screwed	RJ45

The specific features of IFM interface with part number TRV00210, including rules for ULP connection and power supply, are detailed in this appendix.

Hardware Description



A 5-pin screw type connector (Modbus connection and power supply)

B Modbus address rotary switches

C Modbus traffic LED

D Modbus locking pad

E ULP LED

F Test button

G Mechanical lock

H Two RJ45 ULP ports

I Stacking accessory

Connection to the Modbus-SL Network with IFM Interface

Introduction

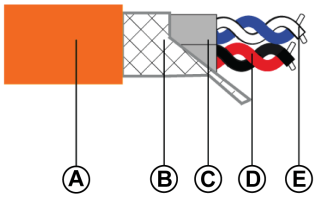
Use the Modbus cable, page 130 to interconnect the intelligent modular units comprising IFM interfaces TRV00210, supply them with power, and connect them to the Modbus client.

In terms of power supply, to limit voltage drop, the maximum number of IFM interfaces stacked to one IFE server is 11.

In terms of Modbus communication, it depends on the performance requirement. As it takes approximately 500 ms at 19,200 Baud per device to refresh 100 registers, the more interfaces added the longer the minimum refreshment period. The minimum refreshment period depends on the number of IFM interfaces stacked to one IFE server. Multiply the time to refresh one device by the number of devices to find the minimum refreshment period expected in the application. For instance, an installation with eight IFM interfaces stacked to one IFE server at 19,200 Baud would take approximately 4 seconds to be read.

Composition of the Modbus Cable

The following figure shows the Modbus cable:



A Outer sheath

B Shielding braid

C Twisted-pair sheaths

D Communication pair (white/blue)

E Power supply pair (red/black)

The characteristics of the Modbus cable are as follows:

- Shielded cable with two twisted-pairs:
  - One pair with 0.25 mm^2 (24 AWG) cross-section for the RS 485 signal (D0, D1).
  - One pair with 0.5 mm^2 (20 AWG) cross-section for the power supply (0 V, 24 Vdc).
- Shielding braid to be connected to the ground terminal of the 5-pin connector on the IFM interface.
- External diameter: 8.7–9.6 mm (0.35–0.38 in).
- Color of outer sheath: orange.

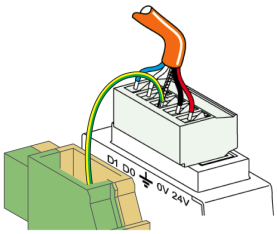
The 0 V terminal of the power supply pair is also the Modbus common, that is, the 0 V for the RS 485 signal (D0, D1).

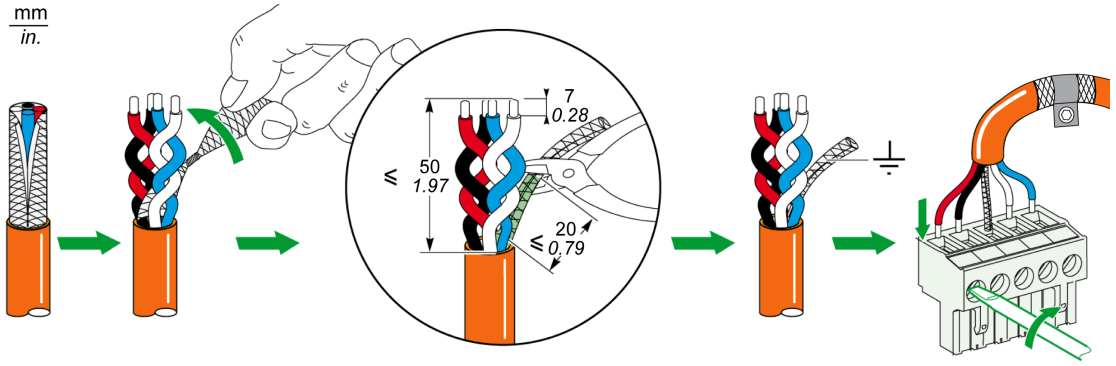
The 0 V cable (Modbus common) must be distributed along the entire length of the network, right up to the Modbus client.

Other Modbus cable part numbers are given in appendix, page 130.

Connection of Modbus Cable to the IFM Interface

Each point on the 5-pin connector on the IFM interface has a specific marking to make it easier to connect the Modbus cable.

Connector	Marking	Color	Description	Unsheathed length	Stripped length
	**D1**	Blue	RS 485 B/B' or Rx+/Tx+ signal	≤50 mm (1.96 in)	7 mm (0.27 in)
	D0	White	RS 485 A/A' or Rx-/Tx- signal		
	⏚	–	Modbus cable shielding braid, connected to the local machine ground in the IFM interface	≤20 mm (0.79 in) (1)	7 mm (0.27 in)
	0V	Black	0 V for Modbus common and power supply	≤50 mm (1.96 in)	7 mm (0.27 in)
	24V	Red	24 Vdc for the power supply		



(1) To ensure that the shielding is effective against high-frequency disturbances, keep the shielding braid between the Modbus cable and the ground terminal as short as possible.

NOTE: Do not connect more than two wires in the same terminal on the 5-pin connector on the IFM interface.

Connection of the 0 V Terminal on IFM Interface to the Functional Ground Terminal Block

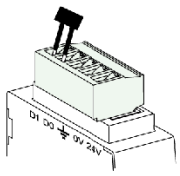
The 0 V terminal on IFM interfaces is connected to the functional ground terminal block at only one point of the Modbus line (first stacked IFM interface or at the Modbus client if IFM interfaces are not stacked with IFE server). No other devices must have 0 V connected to ground.

Modbus Line Termination

The Modbus cable communication pair has a typical impedance of 120 Ω. The Modbus cable must therefore be terminated at each end by a Modbus line termination with a 120 Ω impedance.

The Modbus client is at one end of the Modbus cable and usually has a switchable termination impedance. At the other end of the Modbus cable, a Modbus line termination with a 120 Ω impedance must be connected.

To obtain a 120 Ω impedance at high frequency without loading the cable with DC, optimize the Modbus line termination in the form of an RC cell: 120 Ω in series with a 1 nF capacitor and two 10 cm (3.9 in) wires for direct connection (between D0 and D1) to the 5-pin connector on the last IFM interface.

Illustrations	Description	Part number
	Two Modbus line termination (120 Ω + 1 nF)	VW3A8306DRC

General Rules for Modbus Cable Length

The maximum permitted length for the Modbus network (for the trunk cable, excluding tap links) is 500 m (1,640 ft) at 38,400 Baud and 1,000 m (3,281 ft) at 19,200 Baud.

The Modbus cable connecting the IFM interfaces in the ULP system incorporates both the Modbus communication network and the 24 Vdc power supply. Because of the stresses caused by a drop in the supply voltage, more restrictive limitations are imposed:

- The voltage drop between the power supply and the furthest point, both on the +24 V wire and on the 0 V wire, must be limited to 4 Vdc (2 Vdc on the +24 Vdc wire and 2 Vdc on 0 V wire).

  A minimum supply of 24 Vdc -20% (19.2 Vdc) is thus obtained on the last IFM interface, with a 24 Vdc power supply regulated at:

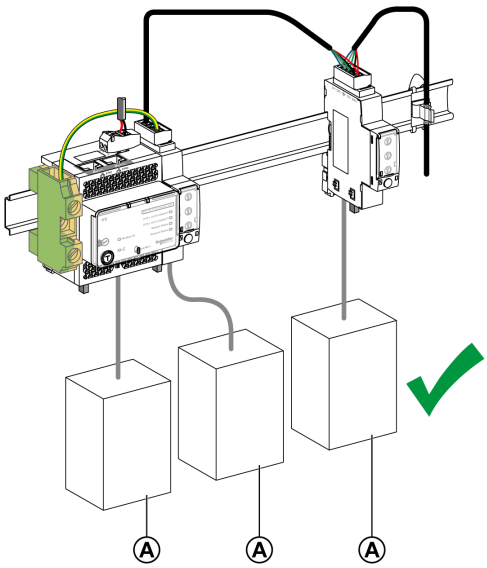
  - +/-3% (23.3–24.7 Vdc) for 3 A power supplies.
  - +/-5% (22.8–25.2 Vdc) for 1 A power supplies.
- For optimum quality of the Modbus communication, the voltage on the 0 V terminal on each IFM interface (Modbus common) must not vary by more than +/-4 Vdc compared to the 0 V voltage of any other Modbus device in the installation. This restriction further limits length when the Modbus equipment is divided between a number of power supply segments.

  The Modbus cable length depends on the architecture in the ULP system.

Rules for ULP Connection and Power Supply

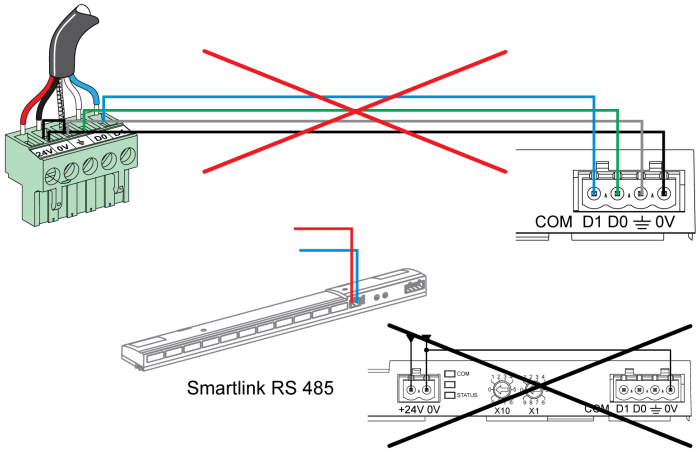
Power Supply Connection Rules

- The 0 V terminal on IFM interfaces is connected to a functional ground terminal block at only one point of the Modbus line. This point of the Modbus line is either the first stacked IFM or the Modbus client if IFM interfaces are not stacked with IFE server. No other devices must have 0 V connected to ground.



A ComPacT NSX, ComPacT NS, or MasterPact NT/NW circuit breaker

- If no IFM interface is installed on the ULP system, 0 V must be connected to a ground terminal block at power supply level. No other devices must have 0 V connected to ground.
- No Modbus device with dedicated 0 V Modbus (for example, Acti 9 Smartlink device) must be connected to an IFM interface. The IFM interface has indeed no dedicated 0 V Modbus. The following diagram illustrates this rule for Acti 9 Smartlink devices:



- If no IFM interface or ComPacT NSX circuit breaker is installed on the ULP system, it is recommended to have a floating auxiliary power supply. Do not connect terminals + and - of the 24 Vdc auxiliary power supply output to ground.

Segmented Power Supply

Segmented power supplies are required in the following cases:

- When the IMUs communicate over Modbus by using the IFM interface, the Modbus cable distributes the 24 Vdc power.
  - If the length of the Modbus cable is such that the voltage drop is excessive (for example, cable longer than 15 m (49.2 ft) with a 3 A power supply), independently powered Modbus cable segments must be created:
  - Only the 24 Vdc wire is interrupted between two segments
  - The continuity of the 0 V wire (which is also the Modbus common) must be assured along the entire length of the Modbus network.
  - The maximum number of power supply segments is three segments for a single Modbus network.
- When an installation consists of a number of Modbus networks, one 24 Vdc power supply must be used for each Modbus network.
  - Since the 0 V of the 24 Vdc power supply is also the Modbus common, the power supplies must be separated to make the Modbus networks independent from one another.

Connection of the 0 V Circuit

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

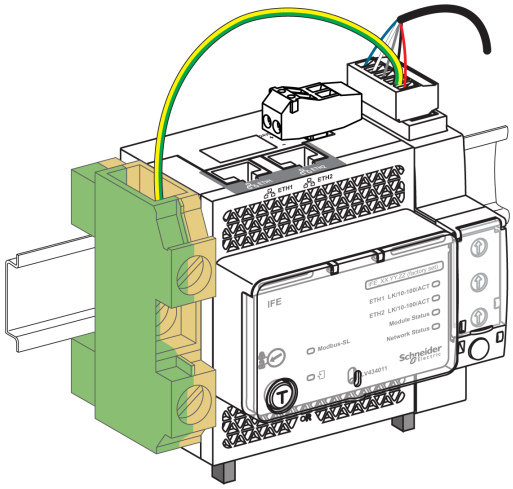
Connect the 0 V circuit (Modbus common and 0 V of the 24 Vdc power supply) to the protective earth ground.

Failure to follow these instructions will result in death or serious injury.

The rules for connection of the 0 V circuit must be followed:

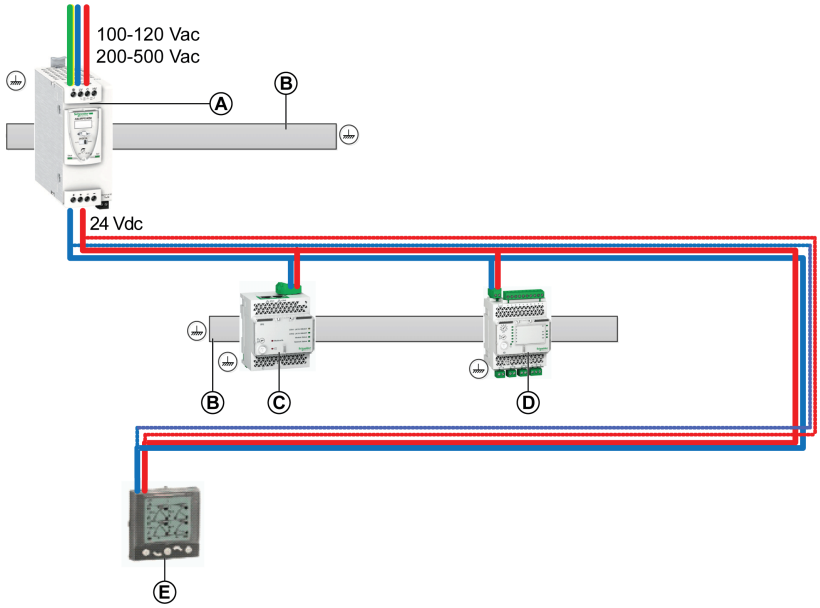
- For the power supply and for all ULP modules of an IMU, a stainless steel DIN rail is recommended rather than an aluminum one in order to provide the most consistent ground. Each DIN rail must be connected to the protective ground.
- If no IFM interface is installed on the ULP system, 0 V must be connected to a ground terminal block at power supply level. No other devices must have 0 V connected to ground.

- If there is at least one IFM interface in the architecture, connection on IFM interfaces must be done as follows:
  - If one or several IFM interfaces are stacked on an IFE server, then at least one of the IFM interfaces must have a jumper on its connector between the 0 V terminal and the protective ground.



> **NOTICE**
>
> **HAZARD OF SIGNIFICANT CURRENT LOOP ON THE SYSTEM**
>
> When IFM interfaces are present in the architecture, do not connect the 0 V of the power supply on the stainless steel DIN rail.
>
> **Failure to follow these instructions can result in equipment damage.**

  - Do not connect the 24 Vdc of the 24 Vdc power supply to the protective ground.
  - In architectures with one or several IFM interfaces, no power supply should be grounded if there are one or several power supply segments on a single Modbus network.



A 24 Vdc ABL8 power supply for ULP modules

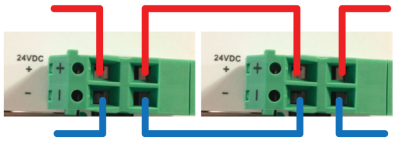
B Stainless steel DIN rail

C IFE interface or IFE server

D IO module

E FDM121 display

The following figure shows the daisy-chain power supply:



- In architectures without IFM interface, the power supply on the second and third segments should be grounded.

Modbus Cable Connection

- The Modbus cable coming from the Modbus client ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 Vdc wire is not connected when the Modbus client is powered separately.
- The Modbus cable running to the first cubicle ensures continuity of the Modbus signal (D0, D1, and 0 V) and the 24 Vdc power supply for the cubicle.
- The unused channel on the shunt terminal block can be used to connect another Modbus server in the electrical equipment (a PM800 communicating power meter, for example).

  NOTE: The same rules apply when connecting the Modbus cable to a terminal block as for its connection to the 5-pin connector on the IFM interface (same order of connection, same unsheathed length, and same stripped length). For more information, refer to the connection of IFM interface, page 123.

Modbus Cable Characteristics

Introduction

When a Modbus cable other than Schneider Electric part number 50965 is used, it must have the following characteristics:

- Shielded cable with two twisted-pairs:
  - One communication pair for the RS 485 signal, with typical impedance of 120 Ω and minimum cross-section 0.25 mm^2 (24 AWG). The recommended colors for the wires are white and blue.
  - One 24 Vdc power supply pair. The cross-section depends on the current to be carried and the length of the Modbus cable required, with the following restrictions: 0.32 mm^2 (22 AWG) minimum for a 1 A 24 Vdc power supply, and 0.5 mm^2 (20 AWG) minimum for a 3 A 24 Vdc power supply.

    The recommended colors for the wires are black and red.
- Shielding braid, with shielding drain wire (for connecting the shield to the ground terminal on the 5-pin connector of the IFM Modbus-SL interface for one circuit breaker).
- Nominal insulation voltage of the outer sheath: 300 V minimum.

Cable must be compliant with installation requirements for voltage and temperature ratings. It is the responsibility of the user to select for correct cable for the specific installation.

Connection Rules

The Modbus cable recommended below must follow the rules and recommendations for connection defined in this guide.

Part Numbers

The following table lists two recommended Modbus cable part numbers:

Type of installation	24 Vdc rating	Cross-section of power supply pair	Part number	Comment
Installation limited to a few IMUs	1 A	0.34 mm^2 (22 AWG)	Belden part number 3084A1	External diameter limited to 7 mm (0.27 in) for ease of wiring
Large installation: all topologies	3 A	0.75 mm^2 (18 AWG)	Belden part number 7895A1	Recommended cable with shielding drain wire and 9.6 mm (0.38 in) diameter

Two-Wire RS 485 Isolated Repeater Module

Introduction

The IFM interface with part number TRV00210 is not isolated. A two-wire RS 485 isolated repeater module must be used to electrically isolate a 2-wire RS 485 Modbus network inside the electrical equipment from a two-wire RS 485 Modbus network outside the electrical equipment.

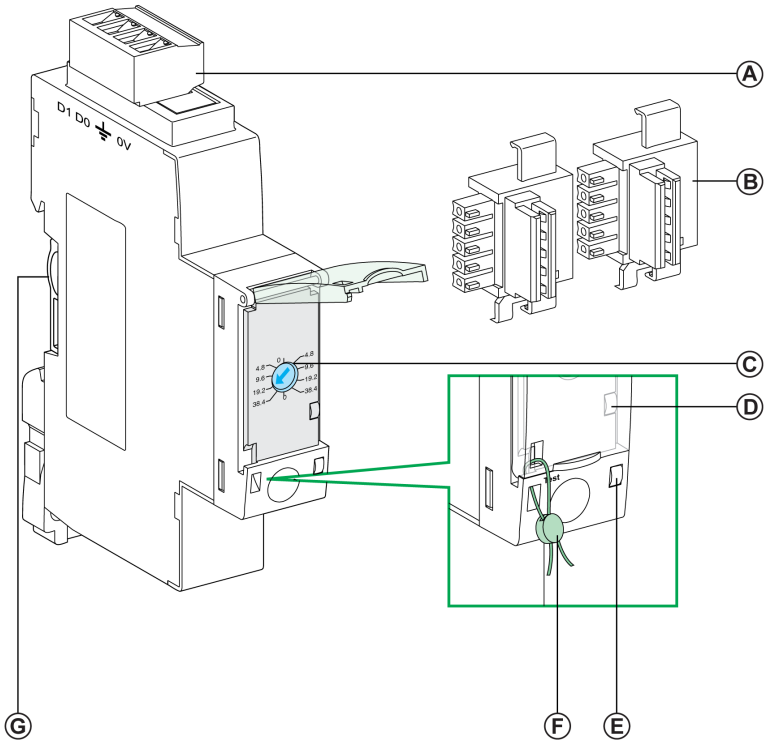
For information on installation, refer to S1A2181101, *Two-Wire RS 485 Isolated Repeater - Instruction Sheet*.

Hardware Compatibility

The two-wire RS 485 isolated repeater module is compatible with IFM interface with part number TRV00210.

IFM interface with part number LV434000 does not require the use of a two-wire RS 485 isolated repeater module in a Modbus network.

Hardware Description



A Modbus 4-pin connector

B 2 stacking accessories (supplied with the repeater)

C Rotary switch (to set the transmission speed and format)

D Modbus traffic LED

E Status LED

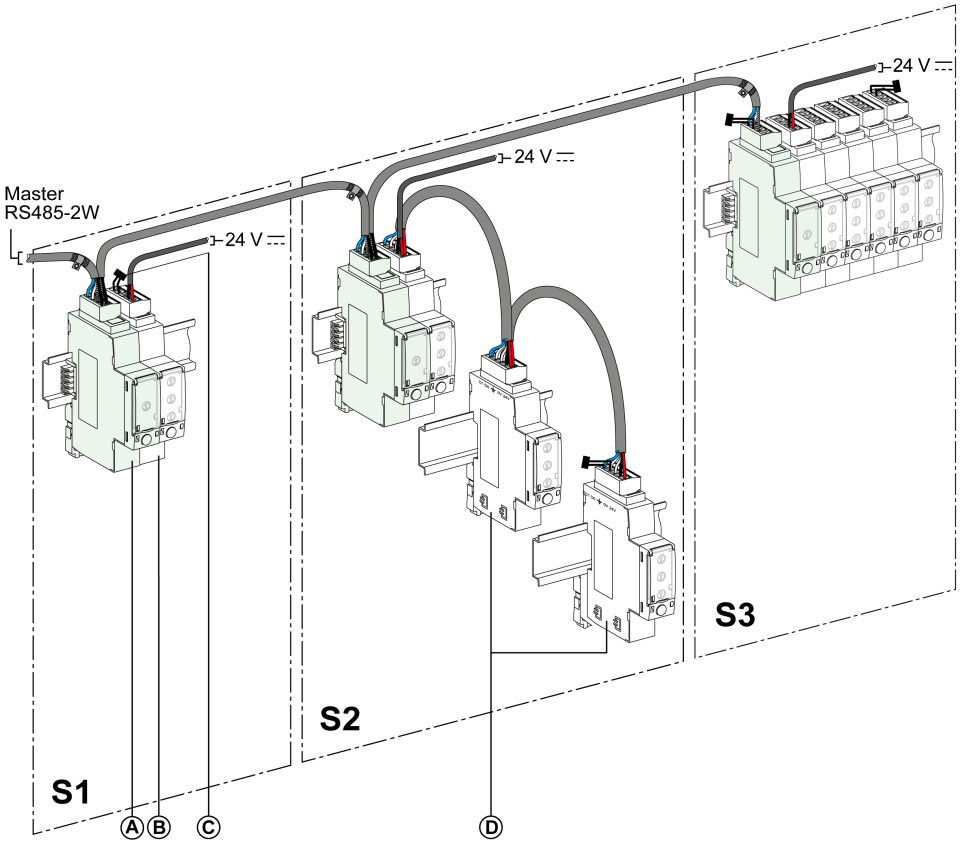
F Mechanical lock

G Stacking accessory connection

Modbus Connection Linking Two Pieces of Electrical Equipment

When the Modbus network is not contained within the electrical equipment, the two-wire RS 485 isolated repeater module must be inserted between the Modbus network inside the electrical equipment and the Modbus network outside the electrical equipment.

The following figure shows a Modbus link connecting three pieces of electrical equipment **S1**, **S2**, and **S3** via two-wire RS 485 isolated repeater modules. In this example, the Modbus 0 V terminal must be connected to the Modbus client at only one point of the Modbus line, and no other devices must have 0 V connected to ground.



A Two-wire RS 485 isolated repeater module

B IFM interfaces grouped in islands with the stacking accessory

C Modbus line termination

D IFM interfaces daisy-chained with the Modbus cable

These rules must be followed:

- Each isolated Modbus segment must include a polarization at one point, and a Modbus line termination at each end:
  - On the segment outside the electrical equipment, the line polarization and a termination are integrated in the Modbus client, and a Modbus line termination must be connected at the other end, that is, on the last two-wire RS 485 isolated repeater module (the one on electrical equipment **S3** in this case).
  - On the segment inside the electrical equipment, the polarization and a Modbus line termination must be integrated in the two-wire RS 485 isolated repeater module.

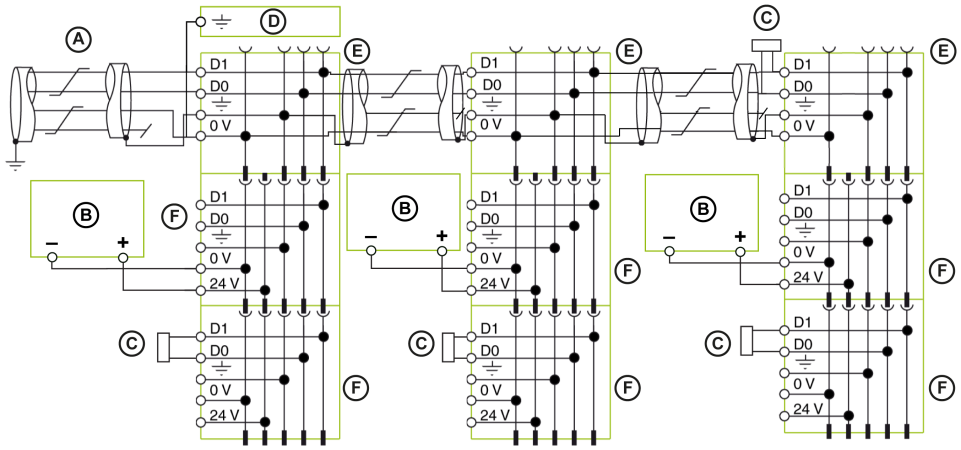
    A Modbus line termination must be connected at the other end, that is, on the last IFM interface or other Modbus server (on the last IFM interface in pieces of electrical equipment **S1** and **S2** in this case).

- Maximum length (Lmax) of the Modbus trunk cable (excluding tap links):
  - Lmax = 500 m (1,640 ft) at 38,400 Baud
  - Lmax = 1,000 m (3,281 ft) at 19,200 Baud

Case of Several Power Supply Segments In Several Pieces of Electrical Equipment

It is mandatory to install a two-wire RS 485 isolated repeater in each electrical equipment when the Modbus network is distributed in several pieces of electrical equipment.

The following figure shows an example of a centralized Modbus architecture installed in three pieces of electrical equipment:



A Modbus cable coming from Modbus client

B 24 Vdc power supply

C Modbus line termination

D Functional ground terminal block

E Two-wire RS 485 isolated repeater

F IFM interface with part number TRV00210

Technical Characteristics of Two-Wire RS 485 Isolated Repeater Module

Environmental Characteristics

Characteristic		Value
Conforming to standards		• IEC/EN 60947-1 • IACS E10 • UL 508 • CSA C22.2 no.14-10
Certification		• CE and C-Tick marking • UL 508 - Industrial Control Equipment • CSA no. 142-M1987 - Process Control Equipment • CAN/CSA C22.2 no. 0-M91 - General requirements - Canadian Electrical Code Part • CAN/CSA C22.2 no. 14-05 - Industrial Control Equipment
Ambient temperature	Storage	-40 °C to +85 °C (-40 °F to +185 °F)

Characteristic		Value
	Operation	-25 °C to +70 °C (-13 °F to +158 °F)
Relative humidity	Conforming to IEC/EN 60068-2-78	4 days, 40 °C (104 °F), 93% RH, energized
Protective treatment	Conforming to IEC/EN 60068-2-30	6 cycles of 24 hours, 25/55 °C (77/131°F), 95% RH, energized
Pollution		3
Corrosive atmosphere	Conforming to IEC 60068-2-60	4 gases (H_2S, SO_2, NO_2, Cl_2)
Level of pollution	Access to hazardous parts and water penetration	Splashing outside the protective cover: IP4•
	Conforming to IEC/EN 60947-1 and IEC/EN 60529	Connectors: IP2•
		Other module parts: IP3•
	Conforming to IEC 62262/EN 50102	External mechanical impacts: IK05
Flame resistance	Conforming to IEC/EN 60947-1 and IEC/EN 60695-2-11	• 650 °C (1202 °F) 30 s/30 s on de-energized insulating parts • 960 °C (1760 °F) 30 s/30 s on de-energized insulating parts
	Conforming to UL94	V0

Mechanical Characteristics

Characteristic		Value
Shock resistance	Conforming to NF EN 22248 (free fall, in packaging)	H = 90 cm (35.4 in)
	Conforming to IEC 60068-2-27	15 g (0.53 oz)/11 ms 1/2 sinusoidal
Resistance to sinusoidal vibration	Conforming to IEC/EN 60068-2-6	1 g (0.035 oz)/5-150 Hz

Electrical Characteristics

Characteristics		Value
Power supply		24 Vdc -20%/+10% (19.2–26.4 Vdc)
Consumption	Typical	15 mA/24 Vdc at 20 °C (68 °F)
	Maximum	19 mA/19.2 Vdc to 24 Vdc at 60 °C (140 °F)
Resistance to electromagnetic discharges	Conforming to IEC/EN 61000-4-2	• 4 kV (direct) • 8 kV (air)
Immunity to radiated electromagnetic interference	Conforming to IEC/EN 61000-4-3	10 V/m
Immunity to electrical fast transients/burst	Conforming to IEC/EN 61000-4-4	• 2 kV (power) • 8 kV (signal)
Immunity to radiated fields	Conforming to IEC/EN 61000-4-6	10 V
Immunity to surges	Conforming to IEC/EN 61000-4-5	• Input and Output DC power ports: ◦ Differential mode: 0.5 kV ◦ Common mode: 0.5 kV • Signal ports: Common mode: 1 kV

Physical Characteristics

Characteristic		Value
Dimensions (W x D x H)	Without power supply terminal block	18 x 72 x 89 mm (0.7 x 2.8 x 3.5 in)
	With power supply terminal block	18 x 72 x 99 mm (0.7 x 2.8 x 3.9 in)
Mounting		DIN rail
Weight		90 g (3.17 oz)

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As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

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