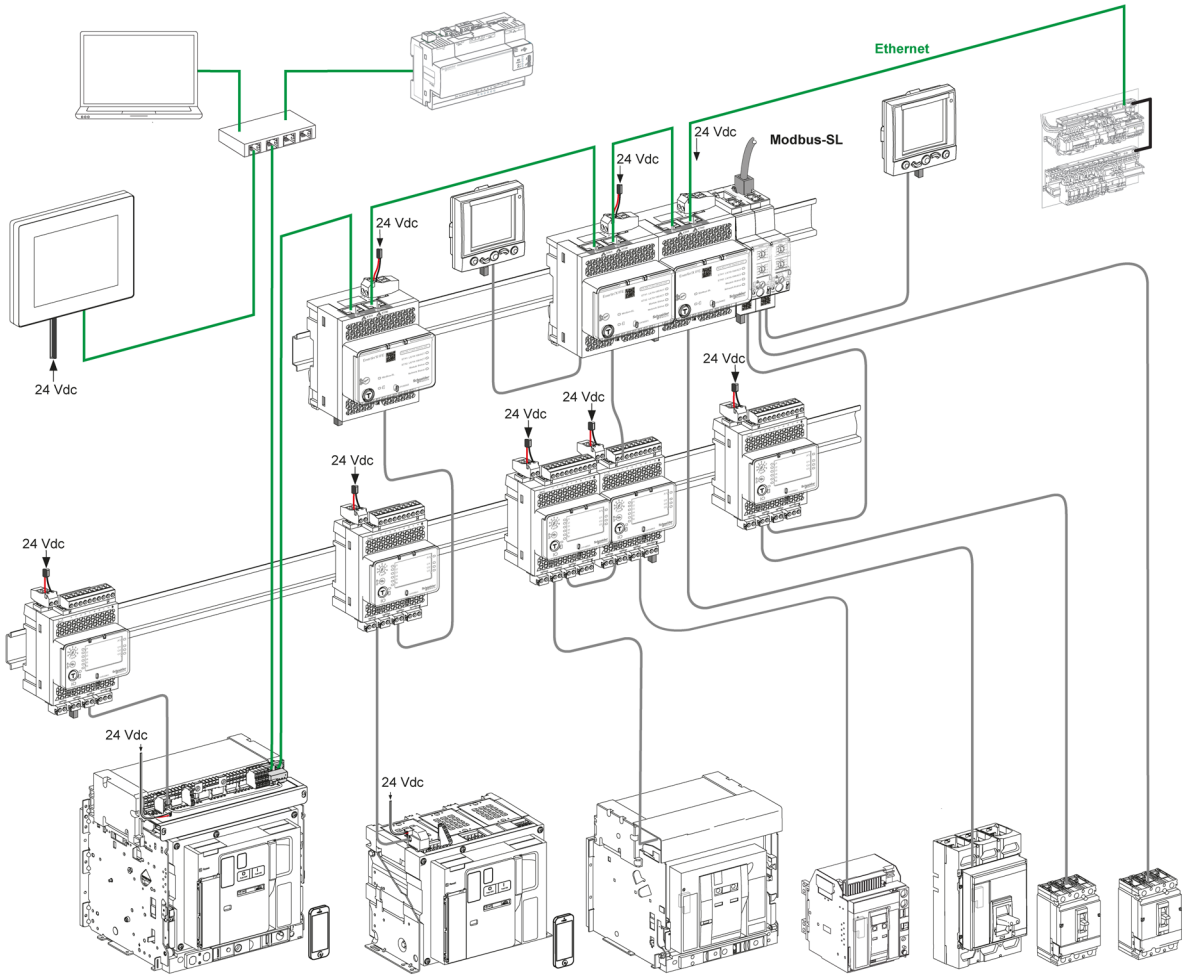
ULP System

ULP (Universal Logic Plug) System User Guide

07/2017



DOCA0093EN-02

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

Table of Contents

Safety Information

Important Information

NOTICE

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.

About the Book

At a Glance

Document Scope

The aim of this guide is to provide installers and maintenance personnel with the 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™ 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 and switch-disconnectors from 630 to 1600 A
- Masterpact™ MTZ2 circuit breakers and switch-disconnectors from 800 to 4000 A
- Masterpact™ MTZ3 circuit breakers and switch-disconnectors from 4000 to 6300 A

Related Documents

Title of Documentation	Reference Number
Compact NSX - Circuit Breakers and Switch-Disconnectors - User Guide	LV434100 (FR) LV434101 (EN) LV434102 (ES)
Compact NSX DC - Circuit Breakers and Switch-Disconnectors - User Guide	DOCA0066EN DOCA0066ES DOCA0066FR DOCA0066ZH
Compact NSX Micrologic 5 and 6 Electronics Trip Units - User Guide	LV434103 (FR) LV434104 (EN) LV434105 (ES)
Compact NSX - Modbus Communication Guide	DOCA0091EN DOCA0091ES DOCA0091FR DOCA0091ZH
Compact NSX 100-630 A Catalogue	LVPED208001EN LVPED208001FR
Compact NS 630b-1600 - Circuit Breakers and Switch-Disconnectors - User Guide	51201639AA (FR) 51201640AA (EN)
Compact NS 630b-3200 A Catalogue	LVPED211021EN LVPED211021FR
Masterpact NT - Circuit Breakers and Switch-Disconnectors - User Guide	GHD12555AA (FR) GHD12556AA (EN)
Masterpact NW - Circuit Breakers and Switch-Disconnectors - User Guide	GHD12557AA (FR) GHD12558AA (EN)
Masterpact NT/NW, Compact NS - Modbus Communication Guide	DOCA0054EN DOCA0054ES DOCA0054FR DOCA0054ZH
Masterpact NT/NW 100-630 A Catalogue	LVPED208008EN LVPED208008FR
Masterpact MTZ1 - Circuit Breakers and Switch-Disconnectors - User Guide	DOCA0100EN DOCA0100FR DOCA0100ES DOCA0100ZH

Title of Documentation	Reference Number
Masterpact MTZ2/MTZ3 - Circuit Breakers and Switch-Disconnectors - User Guide	DOCA0101EN DOCA0101FR DOCA0101ES DOCA0101ZH
Masterpact MTZ Micrologic X - Control Unit - User Guide	DOCA0102EN DOCA0102FR DOCA0102ES DOCA0102ZH
Masterpact MTZ - Modbus Communication Guide	DOCA0105EN DOCA0105FR DOCA0105ES DOCA0105ZH
Masterpact MTZ Catalogue	LVPED216026EN LVPED216026FR
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 DOCA0106FR DOCA0106ES DOCA0106ZH
Enerlin'X IFE - Ethernet Interface for One Circuit Breaker - Instruction Sheet	QGH13473
Enerlin'X IFE - Ethernet Interface for One Circuit Breaker - 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 Circuit Breaker - User Guide	DOCA0055EN DOCA0055ES DOCA0055FR DOCA0055ZH
Enerlin'X FDM121 - ULP Display for One Circuit Breaker - Instruction Sheet	GHD16275AA
Enerlin'X FDM121 - ULP Display for One Circuit Breaker - User Guide	DOCA0088EN DOCA0088ES DOCA0088FR DOCA0088ZH
Maintenance Kit for Compact NSX Circuit Breakers - Instruction Sheet	GHD16349AA
Masterpact NT/NW, Compact NS, PowerPact P- and R-Frame Communication Option - Installation Manual	EAV3608000
Ecoreach Online Help	DOCA0069EN
Enerlin'X Catalogue	LVCATENLX_EN

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Chapter 1
ULP System

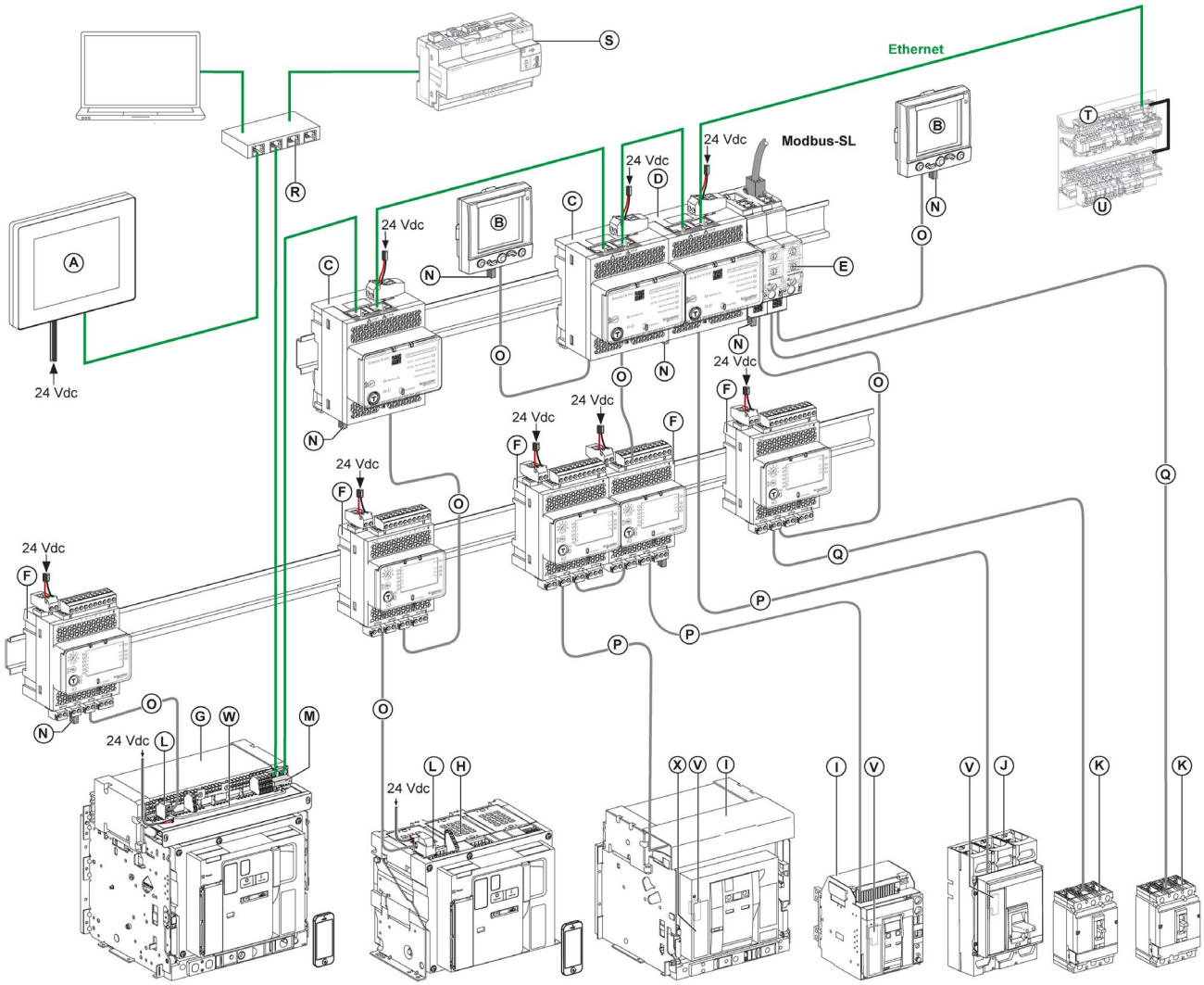
What Is in This Chapter?

This chapter contains the following topics:

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 ULP display 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 male/male ULP cord	✓
P	Circuit breaker BCM ULP cord	✓
Q	NSX cord	✓
R	Ethernet switch	–
S	Com'X 200/210/510 energy server	–
T	Acti9 Smartlink SI B Ethernet	–
U	Acti9 Smartlink Modbus	–
V	BCM ULP circuit breaker communication module	✓
W	Cord between ULP port module and EIFE interface	✓
X	Micrologic trip unit	✓

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 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 Ecoreach software *(see page 28)*.
- A Modbus communication link for access and remote monitoring with the IFM interface.
- Local display of measurements and operating assistance data with the FDM121 display (not compatible with Masterpact MTZ circuit breakers).

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

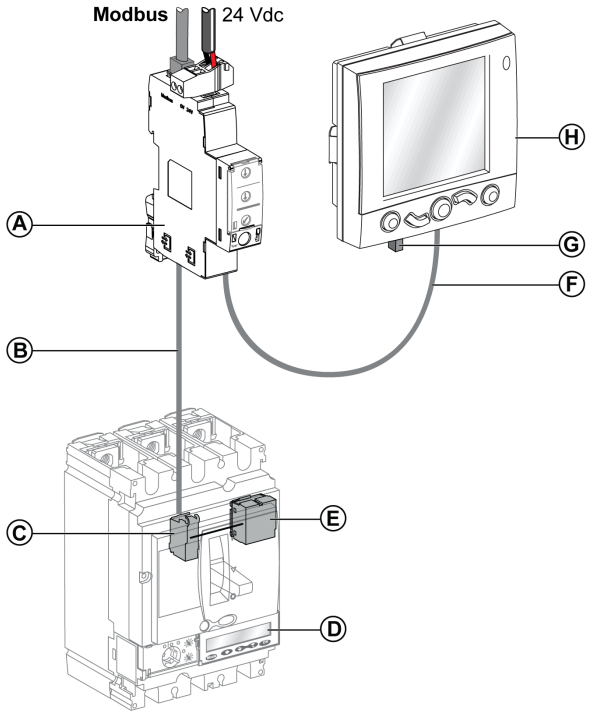
- Optimize energy consumption by zone or by application, according to the load peaks or priority zones.
- Improve electrical equipment management.

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 intelligent modular unit (IMU).

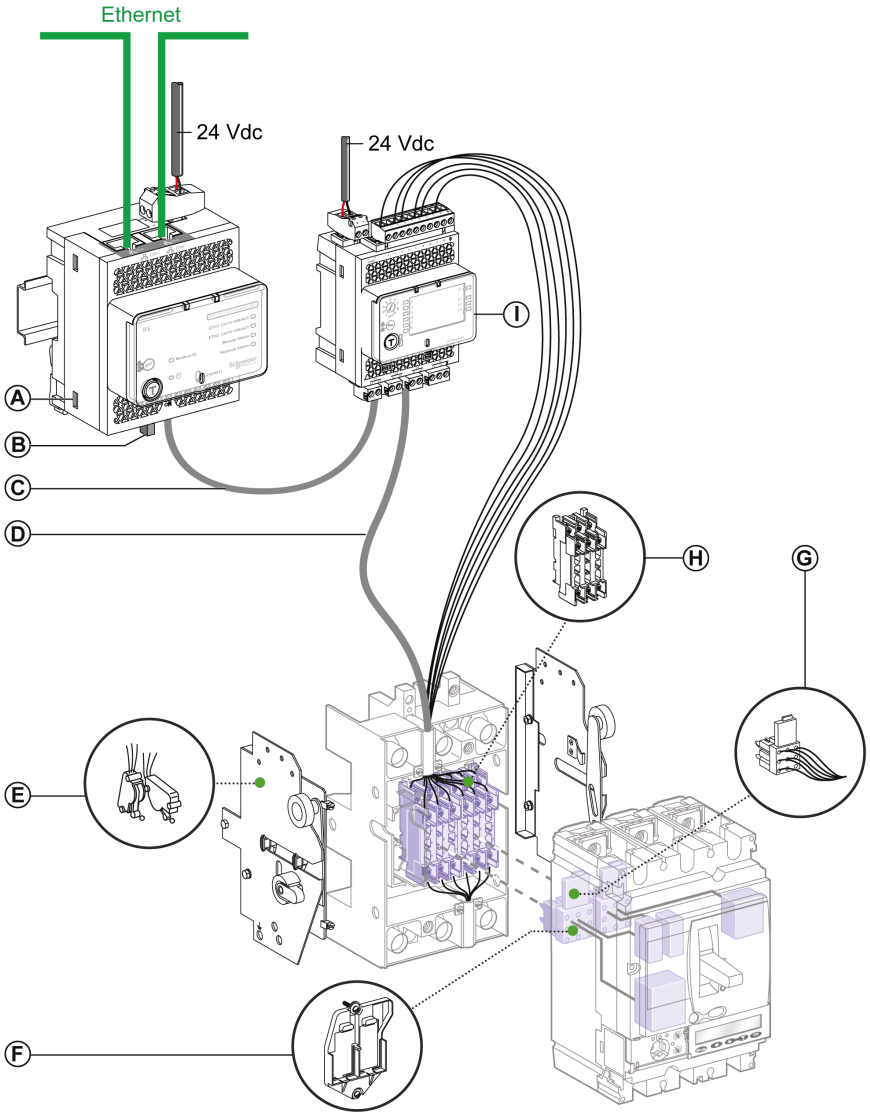
Examples of IMUs with Compact NSX Circuit Breaker

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 male/male ULP cord
G ULP line termination
H FDM121 ULP display for one circuit breaker

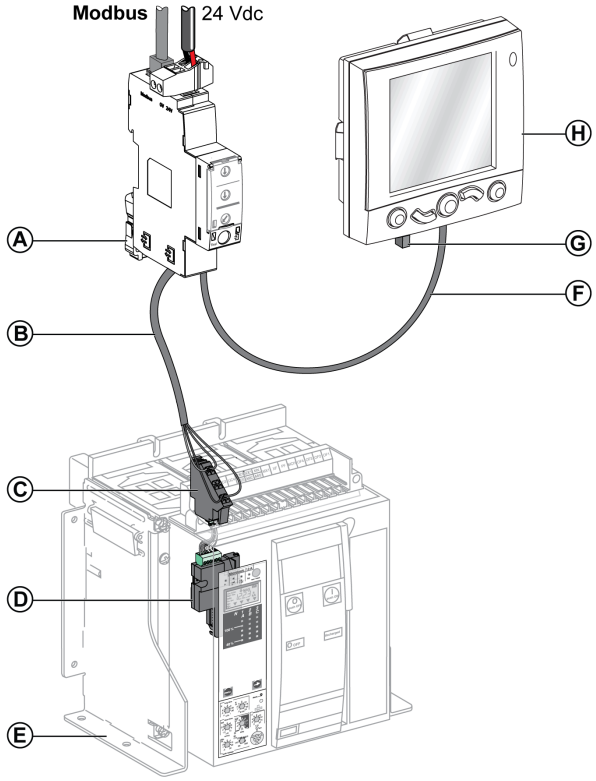
Example 2: IMU composed of a drawout Compact NSX circuit breaker connected to one IO module for cradle management and an IFE interface.



A IFE Ethernet interface for one circuit breaker
B ULP line termination
C RJ45 male/male ULP cord
D NSX cord
E Two-position CE/CD (connected/disconnected) position auxiliary switches
F Support for two moving connectors
G 9-wires moving connector
H 9-wires fixed connector for base
I IO input/output application module for one circuit breaker

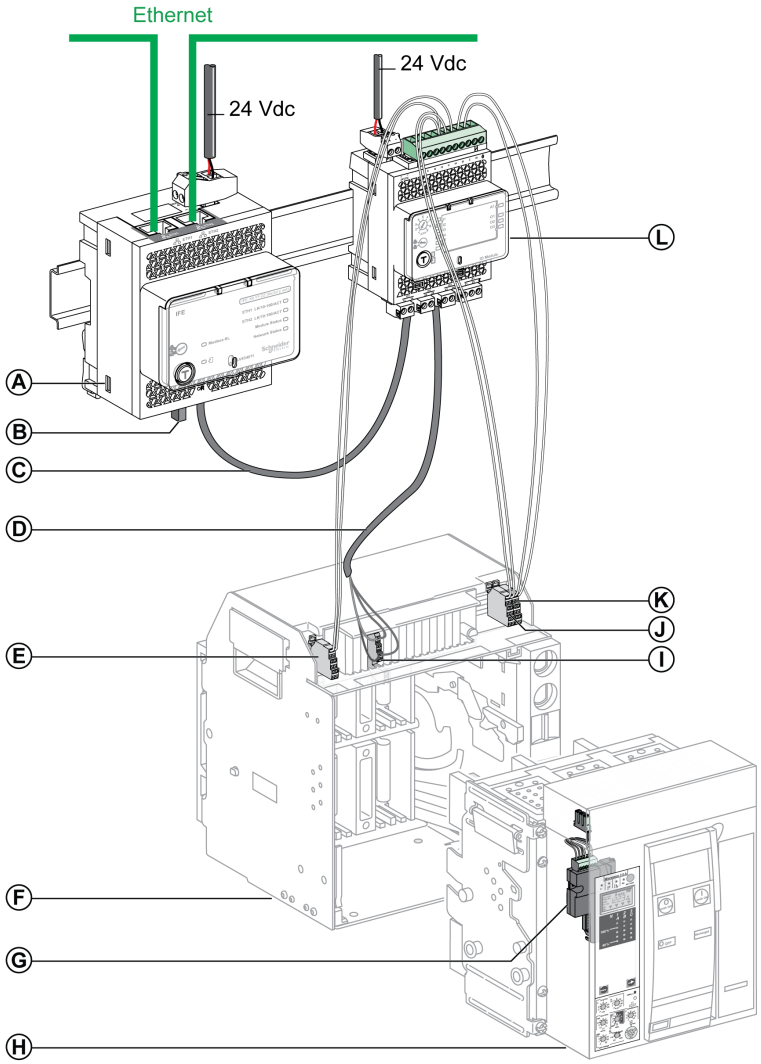
Examples of IMUs with Masterpact NT/NW Circuit Breaker

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 male/male ULP cord
G ULP line termination
H FDM121 ULP display for one circuit breaker

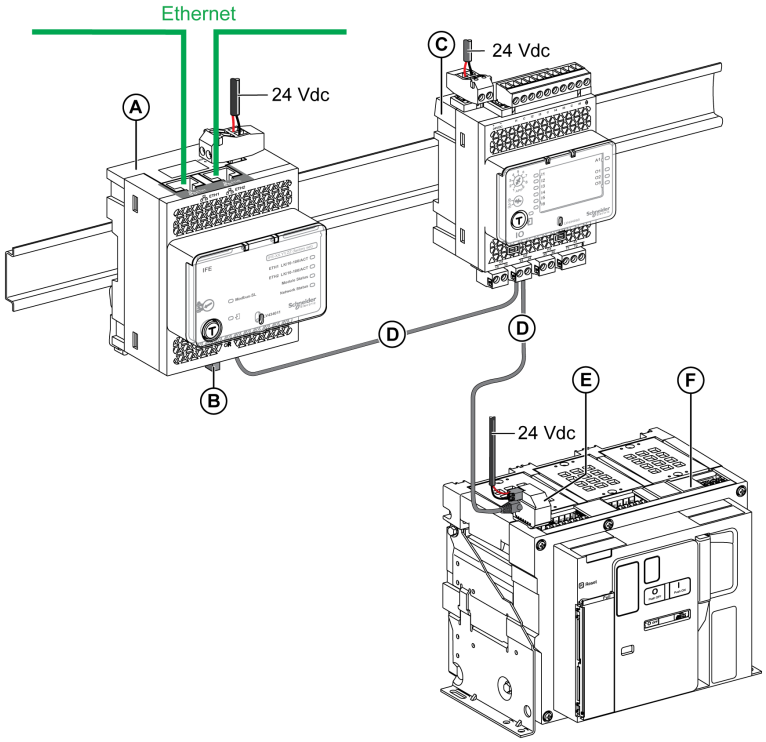
Example 2: IMU composed of a drawout Masterpact NT circuit breaker connected to one IO module for cradle management and an IFE interface.



A IFE Ethernet interface for one circuit breaker or IFE Ethernet switchboard server
B ULP line termination
C RJ45 male/male 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

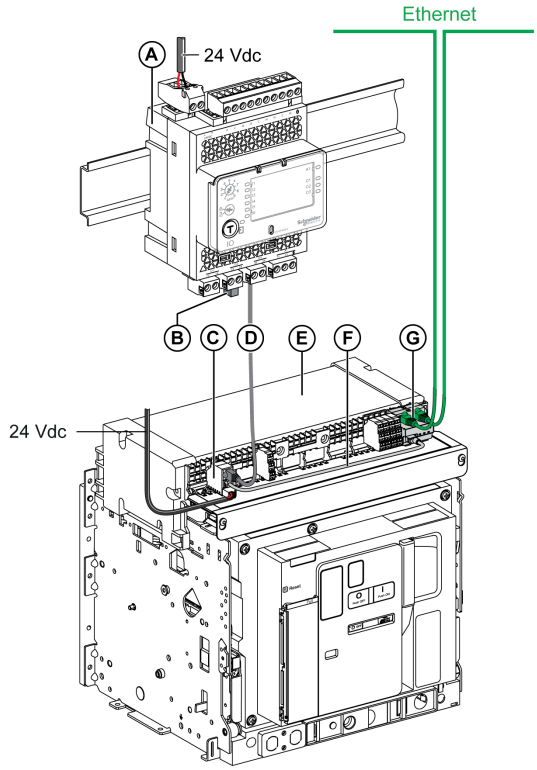
Examples of IMUs with Masterpact MTZ Circuit Breaker

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 male/male 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.



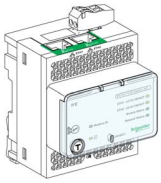
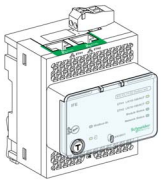
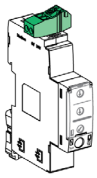
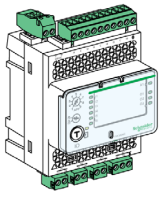
A IO input/output application module for one circuit breaker
B ULP line termination
C ULP port module
D RJ45 male/male ULP cord
E Masterpact MTZ drawout circuit breaker
F Cord between ULP port module and EIFE interface
G EIFE embedded Ethernet interface for one Masterpact MTZ drawout circuit breaker

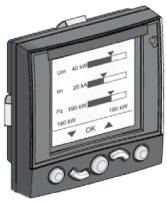
ULP Modules and Accessories

ULP Modules

ULP modules can be grouped in categories:

- Generic ULP modules which are compliant with all circuit breakers as presented in the following table.
- ULP modules specific to Compact NSX circuit breakers *(see page 22)*.
- ULP modules specific to Masterpact NT/NW and Compact NS circuit breakers *(see page 25)*.
- ULP modules specific to Masterpact MTZ circuit breakers *(see page 26)*.

ULP module	Description	Part number
IFE Ethernet interface for one circuit breaker *(see page 104)* 	Ethernet interface for Compact NSX, Compact NS, Masterpact NT/NW, and Masterpact MTZ circuit breakers. The IFE interface enables IMUs containing these circuit breakers to be connected to an Ethernet network. The IFE interface provides Ethernet access to a single circuit breaker which has a corresponding IP address.	LV434001
IFE Ethernet switchboard server *(see page 104)* 	Ethernet interface for Compact NSX, Compact NS, Masterpact NT/NW, and Masterpact MTZ circuit breakers and Ethernet switchboard server for Modbus-SL (serial line) connected devices. The IFE server enables IMUs containing these circuit breakers to be connected to an Ethernet network. The IFE server provides Ethernet access to one or several circuit breakers. Several circuit breakers on a Modbus network are connected via the IFE server master Modbus port. The maximum number of IFM interfaces stacked to one IFE server and the impact on the system are detailed in the composition rules of an intelligent modular unit *(see page 38)*.	LV434002
IFM Modbus-SL interface for one circuit breaker *(see page 112)* 	An IFM interface is required for connection of a Compact NSX, Compact NS, Masterpact NT/NW, or Masterpact MTZ circuit breaker to a Modbus network as long as this circuit breaker is provided with a ULP port. The IFM interface enables IMUs in the ULP system to communicate by using the Modbus protocol. Once connected, the circuit breaker is considered as a slave by the Modbus master.	LV434000
IO input/output application module for one circuit breaker *(see page 115)* 	The IO module is part of a ULP system and offers built-in input/output functions to enhance the application needs. Two IO modules can be connected in the same ULP network.	LV434063

ULP module	Description	Part number
FDM121 ULP display for one circuit breaker *(see page 118)* 	The FDM121 display is a local display unit displaying measurements and operating assistance data from the IMU. **NOTE:** The FDM121 display cannot be connected to a Masterpact MTZ circuit breaker.	TRV00121
UTA maintenance module *(see page 120)* 	Use the UTA module to set up, test, and maintain the ULP modules, by using Ecoreach software *(see page 28)*. **NOTE:** The UTA module cannot be connected to a Masterpact MTZ circuit breaker.	TRV00911

RJ45 ULP Ports

NOTICE

HAZARD OF EQUIPMENT DAMAGE

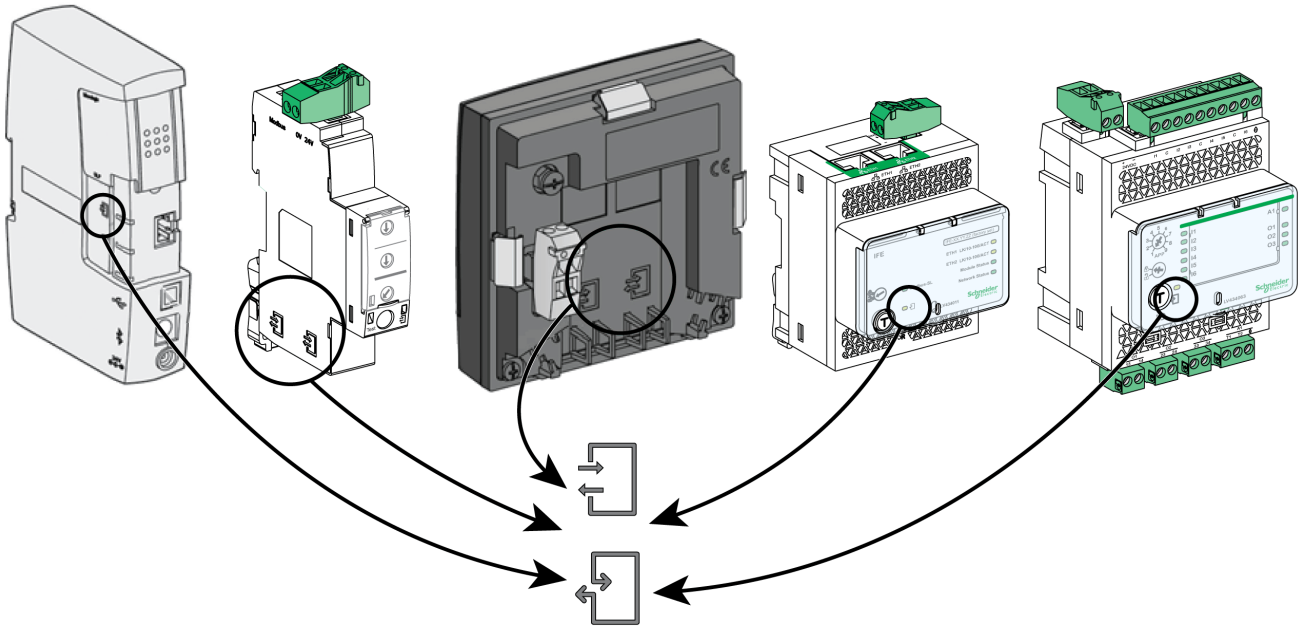
- Never connect an Ethernet device, a Modbus-SL device, or a Modbus line termination to an RJ45 ULP port.
- The RJ45 ULP ports are for ULP modules only.
- Any other use can damage the ULP module or the device connected to the ULP module.

Failure to follow these instructions can result in equipment damage.

ULP modules have RJ45 ports, identified by either one of the 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 male/male ULP cords.



RJ45 Male/Male ULP Cord

Use simple plug-and-play ULP cords to interconnect ULP modules within a single IMU. They have male RJ45 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

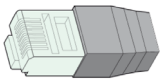
NOTICE

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 Female/Female Connector

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

Illustration	Description	Part number
	Ten RJ45 female/female connectors	TRV00870

The length of extended ULP cord is limited *(see page 44)*.

Upgrading the Firmware in ULP Modules

The user can upgrade the firmware of a ULP module (IFM interface or FDM121 display, for example) by using Ecoreach software *(see page 28)*.

The compatibility matrix embedded in Ecoreach software helps the user to perform diagnostics and correct the firmware discrepancy issues in the ULP modules by providing recommended actions and diagnostics messages relevant to the detected discrepancies *(see page 30)*.

NOTE: The firmware of the BSCM circuit breaker status control module for Compact NSX circuit breakers and the Micrologic trip units for Masterpact NT/NW or Compact NS cannot be upgraded by using Ecoreach software.

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 or 6 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 - User Guide*
- *Compact NSX DC - Circuit Breakers and Switch-Disconnectors - User Guide*

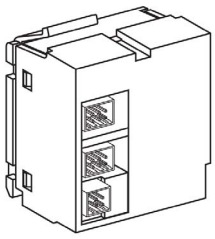
Micrologic Trip Units

Micrologic 5 or 6 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 about the Micrologic trip units, refer to the relevant *Micrologic Trip Units User Guide*.

BSCM Circuit Breaker Status Control Module

Illustration	Description	Part number
	The BSCM circuit breaker status control module provides: ● Status indication functions for the Compact NSX circuit breakers. ● Control of the communicating motor mechanism. ● Operating assistance functions.	LV434205

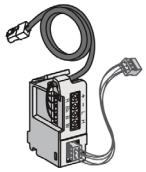
For more information about the BSCM module, refer to the following documentation:

- *Compact NSX - Circuit Breakers and Switch-Disconnectors - User Guide*
- *Compact NSX DC - Circuit Breakers and Switch-Disconnectors - User Guide*

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 or 6 trip unit to a ULP module with their RJ45 connector.

The NSX cord is suited to applications less than 480 Vac, and it is available in three cable lengths and terminated with a male RJ45 connector for direct connection to a ULP module.

Illustration	Length	Part number
	L = 0.35 m (1.15 ft)	LV434200
	L = 1.3 m (4.3 ft)	LV434201
	L = 3 m (9.8 ft)	LV434202

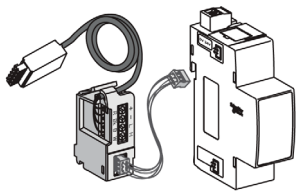
Lengths up to 5 m (16.4 ft) are possible by using RJ45 female/female connectors.

For more information about the NSX cord, refer to the following documentation:

- *Compact NSX - Circuit Breakers and Switch-Disconnectors - User Guide*
- *Compact NSX DC - Circuit Breakers and Switch-Disconnectors - User Guide*

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 female RJ45 connector. Use an RJ45 male/male ULP cord to connect the isolated electronic module of the NSX cord to a ULP module.

Illustration	Length	Part number
	L = 1.3 m (4.3 ft)	LV434204

The electronic module of the isolated NSX cord must be supplied with 24 Vdc so that the ULP system is isolated.

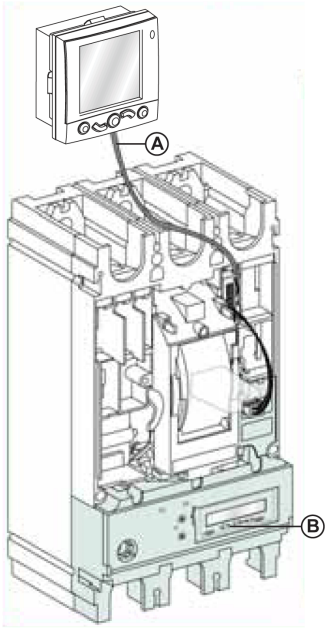
The following table summarizes the electronic module characteristics:

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 • 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

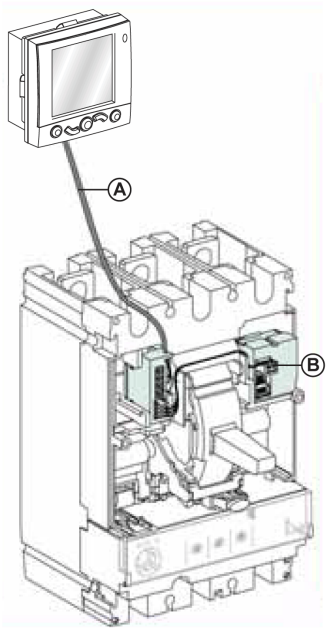
The following figures show connection of the Compact NSX circuit breaker to the IMU with the NSX cord.

Compact NSX circuit breaker with Micrologic 5 or 6 trip unit



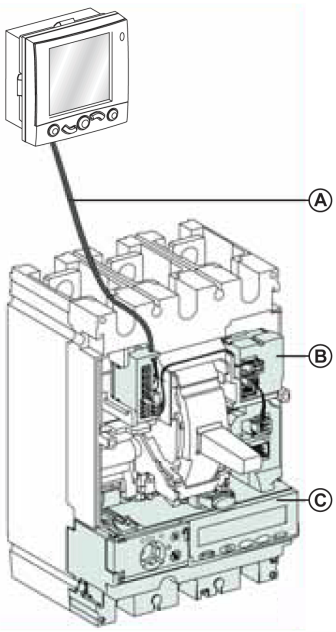
A NSX cord
B Micrologic trip unit

Compact NSX circuit breaker with BSCM module



A NSX cord
B BSCM module

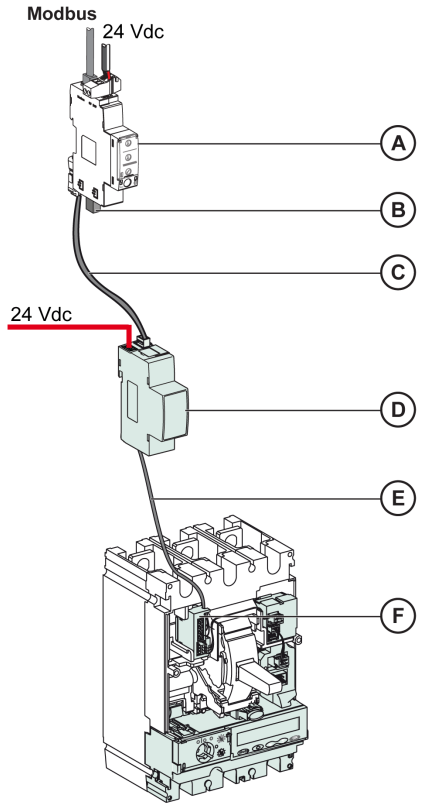
Compact NSX circuit breaker with BSCM module and Micrologic 5 or 6 trip unit



A NSX cord
B BSCM module
C Micrologic 5 or 6 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:



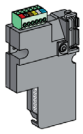
A IFM Modbus-SL interface for one circuit breaker
B ULP line termination
C ULP cord
D Insulated ULP module for system voltage greater than 480 Vac
E Circuit breaker ULP cord for system voltage greater than 480 Vac
F Connector for Compact NSX circuit breakers internal connection

Connecting Masterpact NT/NW and Compact NS Circuit Breakers to the ULP System

Introduction

Use the circuit breaker BCM ULP cord to connect the 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

Illustration	Description	Part number
	The BCM ULP circuit breaker communication module sends to and receives information from: ● The ULP system. ● The Micrologic trip unit via an infra-red link. ● The circuit breaker, via its microswitches. ● MX1 and XF communicating voltage releases.	● 33106 (spare part) ● The part number depends on the circuit breaker type. For details, refer to a selector program of Schneider Electric products.

For more information about the BCM ULP module, refer to *Masterpact NT/NW, Compact NS, PowerPact P- and R-Frame Communication Option - Installation Manual*.

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 the Micrologic trip unit to a ULP module with its RJ45 connector.

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

Illustration	Length	Part number
	L = 0.35 m (1.15 ft)	LV434195
	L = 1.3 m (4.26 ft)	LV434196
	L = 3 m (9.84 ft)	LV434197

For more information about the BCM ULP cord, refer to *Masterpact NT/NW, Compact NS, PowerPact P- and R-Frame Communication Option - Installation Manual*.

Connecting Masterpact MTZ Circuit Breakers to the ULP System

Introduction

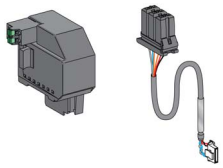
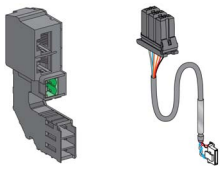
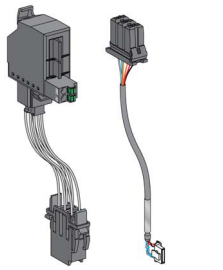
Use the RJ45 male/male ULP cord to connect the Masterpact MTZ circuit breakers to the ULP system. The circuit breaker must have a ULP port module.

ULP Port Module

Depending on the type of the circuit breaker, the ULP port module is supplied as follows:
- As standard on the Masterpact MTZ2/MTZ3 drawout circuit breakers.
- As an option on the Masterpact MTZ1/MTZ2/MTZ3 fixed circuit breakers and Masterpact MTZ1 drawout circuit breakers. It is mounted with the terminal blocks of the circuit breaker.

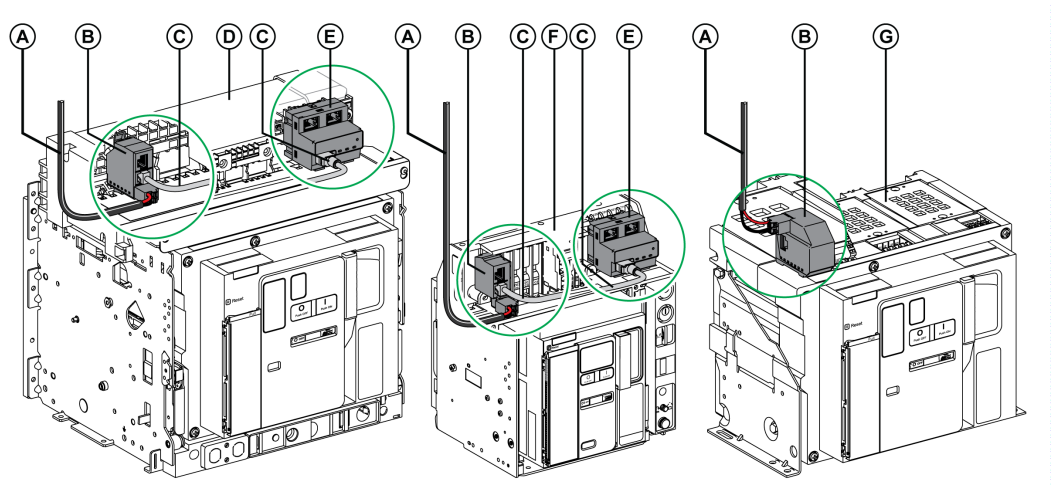
The ULP port module:
- Supplies the Micrologic X control unit.
- Integrates the ULP line termination.
- Allows the connection to external ULP modules, like the IO module or the IFE interface.

For Masterpact MTZ drawout circuit breakers with optional EIFE interface, the ULP port module:
- Supplies the EIFE interface.
- Connects the EIFE interface to the other IMU modules (for example, IO module).

Illustration	Description	Part number
	ULP port module for Masterpact MTZ1 fixed circuit breaker	LV850063SP
	ULP port module for Masterpact MTZ2/MTZ3 fixed circuit breaker	LV850061SP
	ULP port module for Masterpact MTZ1 drawout circuit breaker	LV850064SP
	ULP port module for Masterpact MTZ2/MTZ3 drawout circuit breaker	LV850062SP

Power Supply of ULP Port Module in Masterpact MTZ Circuit Breakers

The ULP port module in Masterpact MTZ circuit breakers directly supplies the Micrologic X control unit and EIFE interface.

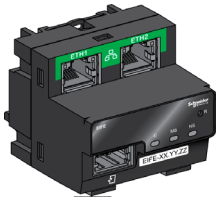


A 24 Vdc power supply
B ULP port module
C Cord between ULP port module and EIFE interface
D Drawout Masterpact MTZ2/MTZ3 circuit breaker
E EIFE embedded Ethernet interface for one Masterpact MTZ drawout circuit breaker
F Drawout Masterpact MTZ1 circuit breaker
G Fixed Masterpact MTZ circuit breaker

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 the Masterpact MTZ drawout circuit breakers.

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.

Illustration	Description	Part number
	EIFE embedded Ethernet interface for Masterpact MTZ drawout circuit breakers. The EIFE interface enables Intelligent Modular Units (IMU) containing these circuit breakers to be connected to an Ethernet network. The EIFE interface provides Ethernet access to a single Masterpact MTZ drawout circuit breaker which has a corresponding IP address.	LV851001

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

For more information about the EIFE interface, refer to *Enerlin'X EIFE - Embedded Ethernet Interface for One Masterpact MTZ Drawout Circuit Breaker - User Guide*.

Ecoreach Software

Overview

Ecoreach 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.

Ecoreach 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 and hence provides a system consistency during the operation and maintenance phase.

Ecoreach software enables the configuration of the following devices, modules, and accessories:

Device ranges	Modules	Accessories
• Masterpact MTZ1 circuit breaker • Masterpact MTZ2 circuit breaker • Masterpact MTZ3 circuit breaker	• Micrologic X control unit • Communication interface modules: IFM interface, IFE interface, and EIFE interface • ULP modules: IO module	M2C output module
• Masterpact NT/NW circuit breakers • Compact NS circuit breakers	• Micrologic trip units • Communication interface modules: BCM module, CCM module, BCM ULP module, IFM interface, IFE interface • ULP modules: IO module, FDM121 display (1)	M2C and M6C output modules
Compact NSX circuit breaker	• Micrologic trip units • Communication interface modules: BSCM module, IFM interface, IFE interface • ULP modules: IO module, FDM121 display (1)	SDTAM and SDx output modules
Acti 9 Smartlink	Acti 9 Smartlink Ethernet, Acti 9 Smartlink Modbus, Acti 9 Smartlink SI B, and Acti 9 Smartlink SI D	–
Power meters	PM5100, PM5300, PM5500 series	–
(1) For FDM121 display, only the firmware and language download are supported.		

For more information, refer to the *Ecoreach Online Help*.

Ecoreach software is available at *www.schneider-electric.com*.

Key Features

Ecoreach software performs the following actions for the supported devices and modules:

- Create projects by device discovery
- Save Ecoreach projects in Ecoreach cloud repository
- 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 the test reports
- View the communication architecture between the devices in a graphical representation
- View the measurements, logs, and maintenance information
- Export Waveform capture
- View the status of device and IO module
- Check the system firmware compatibility status
- Upgrade to the latest device firmware
- Buy, install, or remove the Digital Modules

Chapter 2
Design Rules of ULP System

What Is in This Chapter?

This chapter contains the following sections:

Section 2.1
Hardware and Firmware Compatibility of ULP Modules

What Is in This Section?

This section contains the following topics:

Hardware and Firmware Compatibility of ULP Modules

Introduction

ULP modules must be compatible regarding hardware and firmware.

The hardware and firmware compatibility of ULP modules can be checked with:
- ULP status LED *(see page 28)*
- Ecoreach software *(see page 34)*

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 ULP display for one circuit breaker	TRV00121	–	✓	✓
IO input/output application module for one circuit breaker	LV434063	✓	✓	✓
UTA maintenance module	TRV00911	–	✓	✓

Firmware Compatibility Matrix

The primary reason for upgrading the system is to obtain the latest system features. The Micrologic trip unit is the main component of the IMU. The following system compatibility tables show the firmware versions of the products that are compatible with each other.

Firmware Compatibility Matrix for Micrologic for Compact NSX

The following compatibility table shows the firmware versions of the ULP modules that are compatible with a Micrologic trip unit for Compact NSX.

ULP module	Version of Micrologic trip unit for Compact NSX		
	≥ v1.0.2 (from 12/2008)	**≥ v1.0.3 (from 12/2014)**	**≥ v1.1.0 (from 06/2016)**
BSCM	≥ v2.1.8	≥ v2.2.7	≥ v2.2.7
IFM TRV00210	≥ v1.1.1	≥ v2.2.7	≥ v2.2.7
IFM LV434000	≥ v3.0.12	≥ v3.0.12	≥ v3.0.12
IFE	–	• program file: ≥ v1.8.4 • webpage: ≥ v1.8.9	• program file: ≥ v1.8.4 • webpage: ≥ v1.8.9
IO module	–	≥ v2.1.4	≥ v2.1.4
FDM121	≥ v2.3.4	≥ v2.3.5	≥ v2.3.5
UTA module	≥ v1.0.9	≥ v1.0.9	≥ v1.0.9
FDM128	–	≥ v5.5.6	≥ v5.5.6

Example: A Micrologic trip unit for Compact NSX with a firmware version v1.0.2 manufactured from December 2008 to November 2014 is compatible with:

- BSCM module with firmware version greater than or equal to v2.1.8
- IFM interface TRV00210 with version greater than or equal to v1.1.1
  or IFM interface LV434000 with version greater than or equal to v3.0.12
- FDM121 display with version greater than or equal to v2.3.4
- UTA maintenance module with version greater than or equal to v1.0.9

Firmware Compatibility Matrix for Micrologic for Masterpact NT/NW and Compact NS

The following compatibility table shows the firmware versions of the ULP modules that are compatible with a Micrologic trip unit for Masterpact NT/NW and Compact NS.

ULP module	Version of Micrologic trip unit for Masterpact NT/NW and Compact NS		
	2010AK or 08_273 (1) (from 12/2010)	**2014AN or 08_282 (2) (from 03/2014)**	**2014AN or 08_282 (2) and hardware compatible with the ERMS function (that is, register 8709 different from 0x8000) (W152105 / 3N16035)**
BCM ULP	≥ v3.3.4	≥ v4.0.7	≥ v4.0.7
IFM TRV00210	–	≥ v2.2.7	≥ v2.2.7
IFM LV434000	–	≥ v3.0.12	≥ v3.0.12
IFE	–	• program file: ≥ v1.8.4 • webpage: ≥ v1.8.9	• program file: ≥ v1.8.4 • webpage: ≥ v1.8.9
IO module	–	≥ v2.1.4	≥ v2.1.4
FDM121	≥ v2.3.4	≥ v2.3.5	≥ v2.3.5
UTA module	≥ 1.0.9	≥ 1.0.9	≥ 1.0.9
FDM128	–	≥ v5.5.8	≥ v5.5.8
(1) Version 2010AK displays on Micrologic HMI. Version 08_273 is readable in a register through a software. (2) Version 2014AN displays on Micrologic HMI. Version 08_282 is readable through communication (IFE or IFM interface).			

Example: A Micrologic trip unit for Masterpact NT/NW with a firmware version 2010AK or 08_273 manufactured from December 2010 to February 2014 is compatible with:

- BCM ULP module with firmware version greater than or equal to v3.3.4
- FDM121 display with version greater than or equal to v2.3.4
- UTA maintenance module with version greater than or equal to v1.0.9

Firmware Compatibility Matrix for Micrologic for Masterpact MTZ

The following compatibility table shows the firmware versions of the ULP modules that are compatible with a Micrologic control unit for Masterpact MTZ.

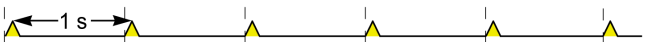
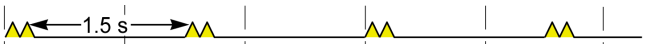
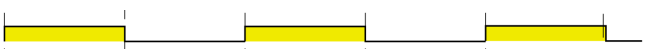
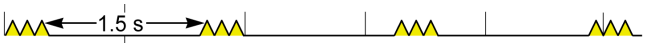
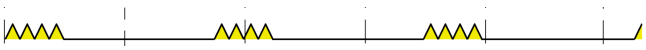
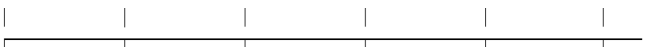
ULP module	Version of Micrologic control unit for Masterpact MTZ ≥ v1.000.200 (from 12/2016)
IFM TRV00210	–
IFM LV434000	≥ v3.0.12
IFE	≥ v3.5.3 and date code ≥ HL16485 (1)
EIFE	≥ v3.5.3
IO module	≥ v3.2.2 and date code ≥ HL16486 (2)
FDM121	–
UTA module	–
FDM128	≥ v6.3.4
(1) IFE interface hardware is compatible if manufacturing date code on the IFE interface label is greater than HL16485. IFE interface hardware with manufacturing date code lower than HL16485 operates correctly but generates a non-critical hardware discrepancy. (2) IO module hardware is compatible if manufacturing date code on the IO module label is greater than HL16486. IO module hardware with manufacturing date code lower than HL16486 operates correctly but generates a non-critical hardware discrepancy.	

Example: A Micrologic X control unit for Masterpact MTZ with a firmware version greater than v1.0.2 manufactured from December 2016 is compatible with:

- IFM interface LV434000 with version greater than or equal to v3.0.12
- IFE interface with version greater than or equal to v3.5.3 and date code greater than or equal to HL16485
- EIFE interface with version greater than or equal to v3.5.3
- IO module with version greater than or equal to v3.2.2 and date code greater than or equal to HL16486
- FDM128 display with version greater than or equal to v6.3.4

Checking Hardware and Firmware Compatibility with ULP Status LED

The yellow ULP LED describes 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	Upgrade 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 Ecoreach 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 Ecoreach Software

Ecoreach software *(see page 28)* 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 *(see page 35)*.

For more information, refer to *Ecoreach Online Help*.

Compatibility Check of Device/Firmware and Corrective Actions

Overview

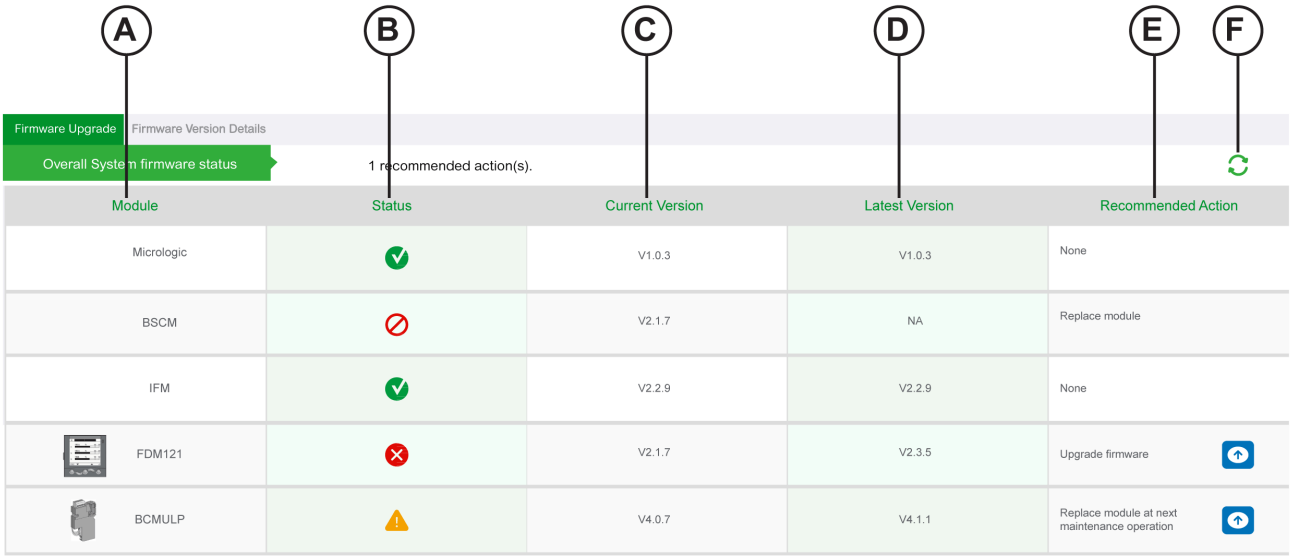
When the ULP modules are upgraded with new functionalities, you need to check the compatibility of the different modules in the IMU system. The **Overall System firmware status** table helps you to perform diagnostics and identify all discrepancy issues in the ULP modules. This table also provides the recommended actions relevant to the detected discrepancies.

NOTE: You can perform this compatibility check only when the device is connected.

Overall System Firmware Status

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

The **Overall System firmware status** displays the following compatibility table.



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

Status

Status identifies the discrepancy conditions within the ULP modules.

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

Recommended Actions

The **Recommended Action** provides solution to recover from a compatibility discrepancy situation. Each discrepancy has a generic pre-defined recommended action.

The table lists the recommended actions for discrepancy conditions of the ULP module.

Module status	Description	Recommended action to be performed
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 **Overall System firmware status**.

Section 2.2
Rules for ULP Connection and Power Supply

What Is in This Section?

This section contains the following topics:

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 male/male ULP cords, and the ULP module power supply.

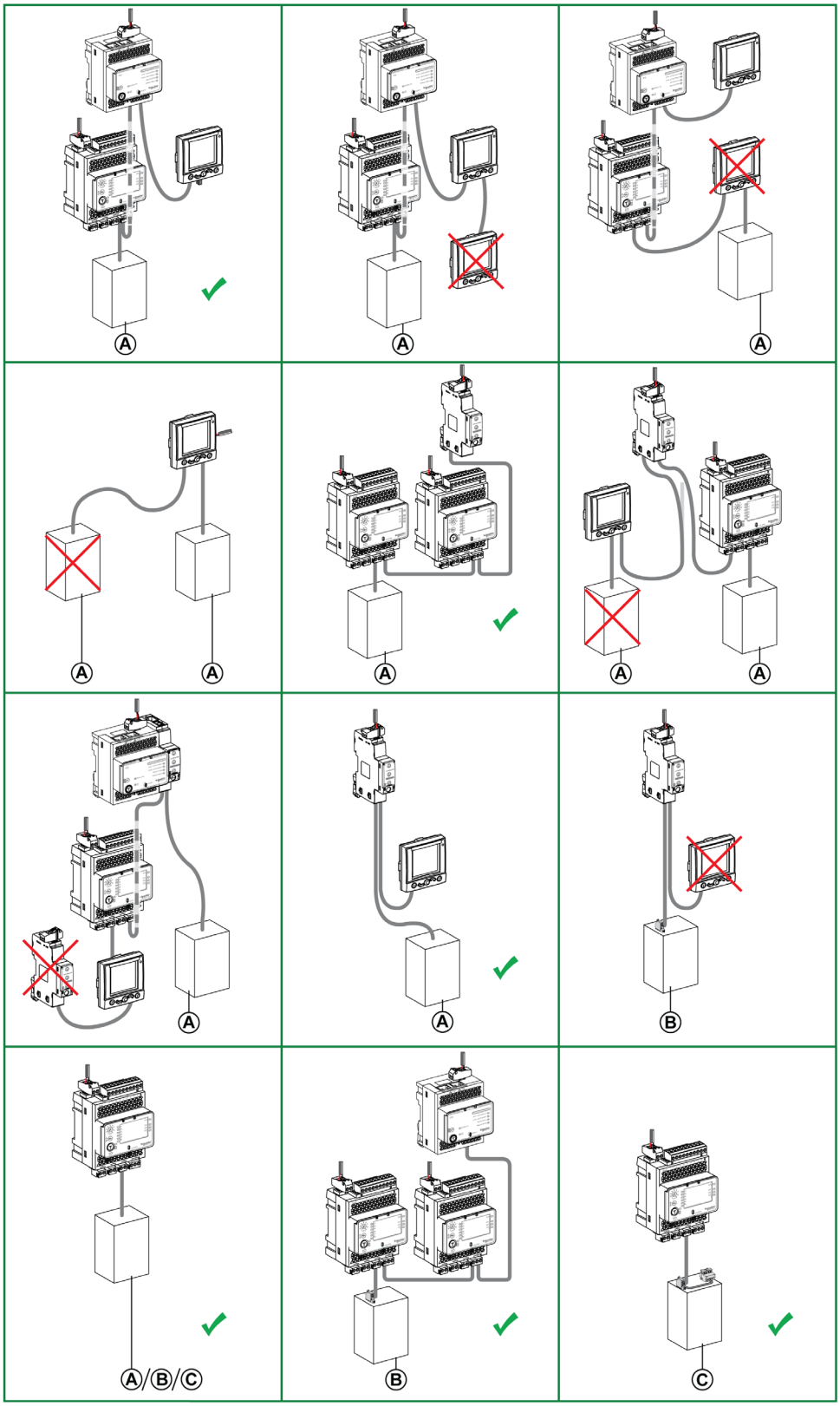
General Rule: Composition of an IMU

An IMU is composed of the following two device types:

- One circuit breaker with its Micrologic trip unit and an internal ULP communication module
- One or several external ULP modules

Circuit breaker type	ULP modules
• Compact NSX circuit breaker with BSCM circuit breaker status control module or Micrologic 5 or 6 trip unit • 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, 1, or 2 IO modules • 0 or 1 interface among: ❍ IFE interface ❍ IFE server (1) ❍ EIFE embedded Ethernet interface ❍ IFM interface
Masterpact MTZ fixed circuit breaker with ULP port module	• 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 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 rule of the composition of an IMU.



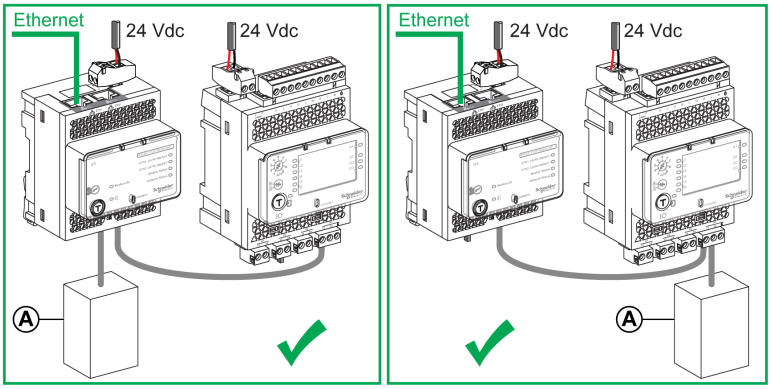
A Compact NSX, Compact NS, or Masterpact NT/NW circuit breaker

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 cable recommendations and the desired layout for the ULP modules in the electrical equipment.

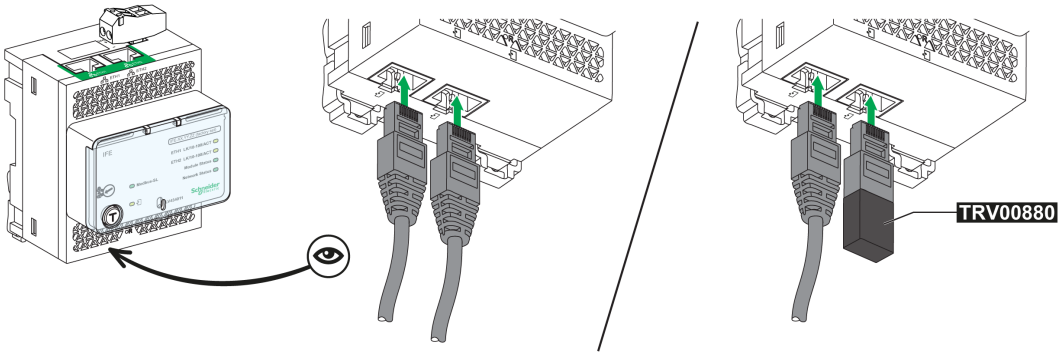


A Compact NSX, Compact NS, Masterpact NT/NW, or Masterpact MTZ circuit breaker

General Rule: ULP Line Termination

The ULP modules placed at the end of the ULP line take 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:

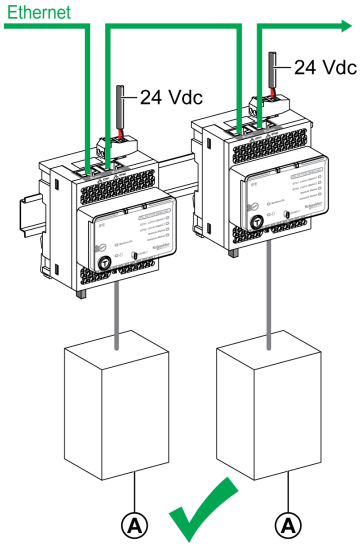
- BSCM module or Micrologic 5 or 6 trip unit for Compact NSX circuit breakers.
- BCM ULP module for Compact NS or Masterpact NT/NW circuit breakers.
- ULP port module for Masterpact MTZ circuit breakers.

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

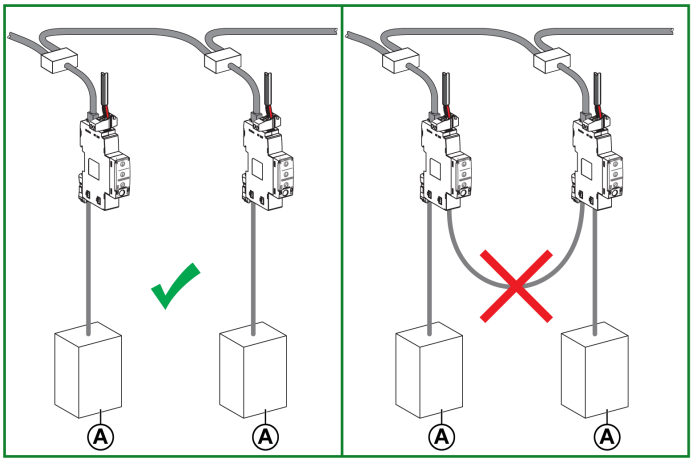
Do not connect the IMUs to one another by ULP cords.

- 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 without IFM interface 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:

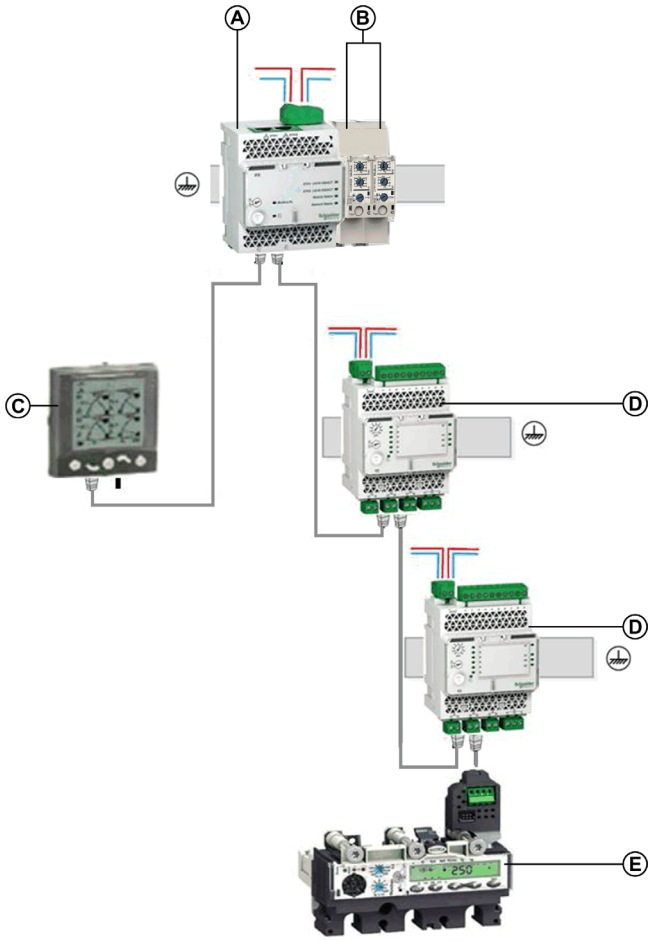
Ue (V L-N / U L-L) (Vac)	Maximum number of Micrologic X control units without VPS power supply (Masterpact MTZ circuit breakers)	Maximum number of Micrologic X control units with VPS power supply (Masterpact MTZ circuit breakers)	Maximum number of Micrologic trip units (Compact NSX circuit breakers)
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.
- BCM ULP module for Masterpact NT/NW and Compact NS circuit breakers.

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



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 the power supply.

Length of ULP Cords

ULP cord length rules 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 *(see page 45)*.
- 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

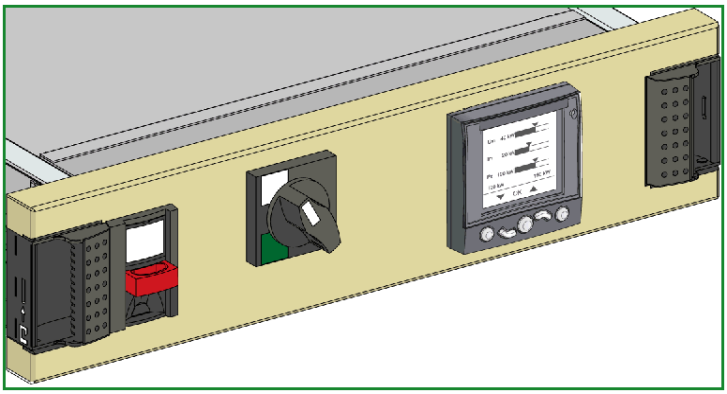
Characteristic	Value
Connection	Daisy-chaining of ULP cords and ULP line termination at the end of the ULP line.
Maximum length	• 20 m (65.6 ft) in total for the IMU. • 10 m (32.8 ft) between two ULP modules if both ULP modules have an external power supply. • 5 m (16.4 ft) between two ULP modules if 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 *(see page 44)*.
Voltage range supported	24 Vdc -10%/+10% (21.6–26.4 Vdc)
Current limitation on each ULP RJ45 port	300 mA *(see page 47)*

Intelligent Modular Unit (IMU) with Withdrawable Drawer

Installation in a Withdrawable Drawer

In equipment with withdrawable drawers, the circuit breaker and possibly the FDM121 ULP display for one circuit breaker, are found in the withdrawable drawer. The IFE or IFM interface and IO modules must always be in the fixed part.

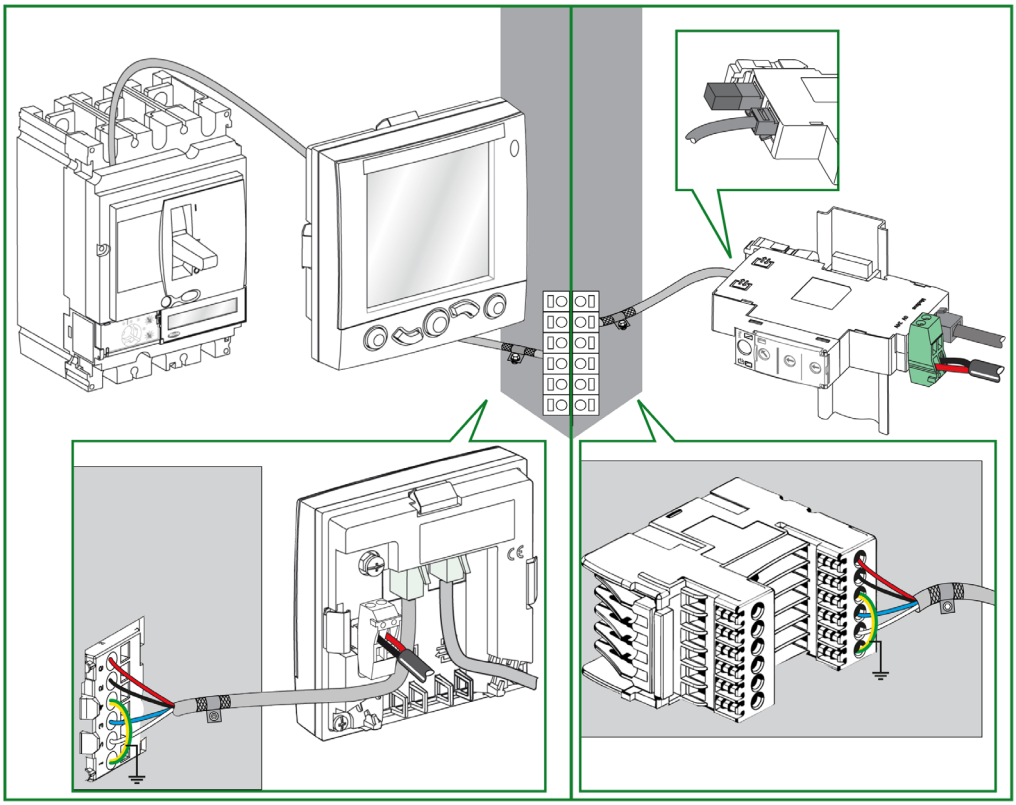
The FDM121 display can be placed on the front of the drawer:



Connection of the Withdrawable Drawer

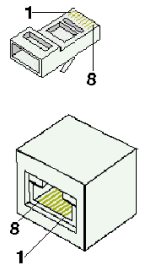
The ULP connection between the fixed part and the part built into the withdrawable drawer is made with the pluggable control terminal blocks on the unit.

Withdrawable part **Fixed part**



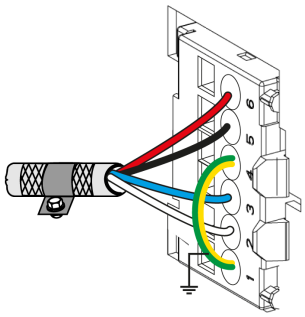
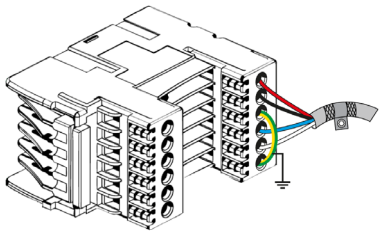
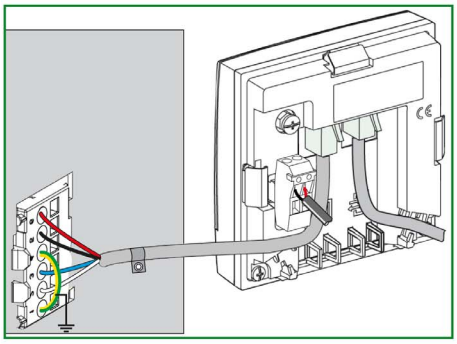
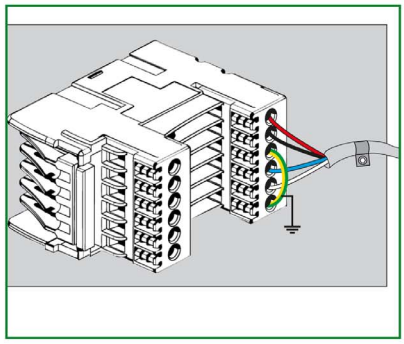
RJ45 Pin Connection of ULP Cord

The RJ45 male/male ULP cord uses an RJ45 connector whose pin connection is described in the following table:

RJ45 connector	Pin number	Pair number	Wire color	Assignment
	Cover	Shielding	Braid	Shielding
	1	Pair 1	White	Data (L)
	2	Pair 1	Blue	Data (H)
	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:

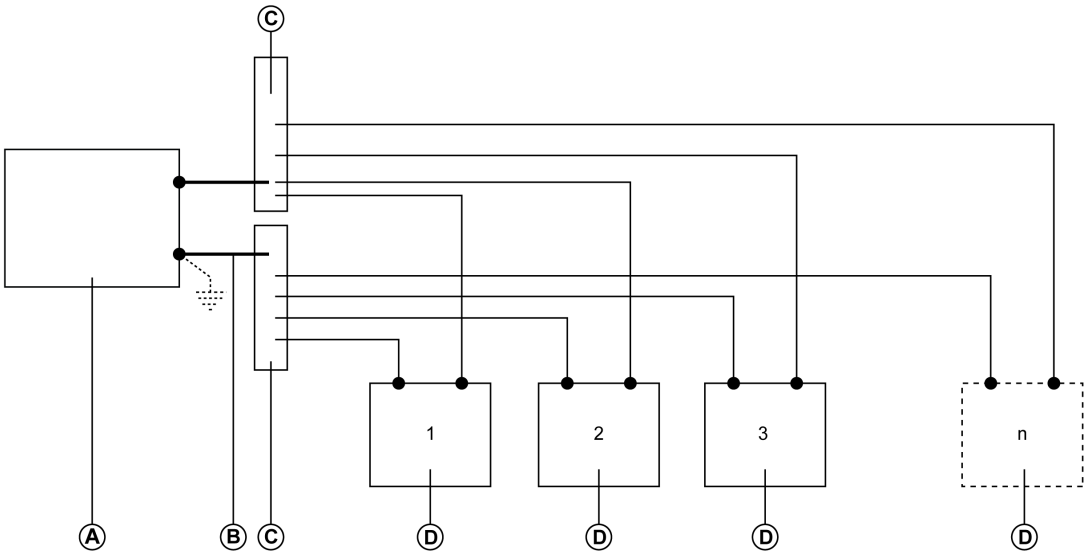
Step	Action	
1	Plug the four conductors into the terminal block (removable side): ● Terminal 1: Connected to terminal 4 and to ground ● Terminal 2: White wire (L data) ● Terminal 3: Blue wire (H data) ● Terminal 5: Black wire (0 V) ● Terminal 6: Red wire (24 Vdc)	
2	Plug the four ULP cord conductors into the terminal block on the fixed part in the same order.	
3	Unstrip 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.	
4	Insert the wire braid into a grounding clamp at both ends of the unstripped ULP cord.	
5	Screw the grounding clamps on the fixed part and withdrawable part of the drawer.  	

ULP System Power Supply

Power Supply Distribution Systems

Power supply distribution systems can be one of the following:

- **Star connection:**
  This power supply distribution system is recommended to minimize EMC disturbances due to common impedance.
  The following diagram shows how to design a power distribution (DC or AC). In this configuration, the common impedance is minimized. Only the link between the main power supply and the terminal distribution is common impedance. If this length is very short, the common impedance is low. The wiring of each device must be done with twisted-pair cables to avoid loops and radiated emissions. It is possible to supply power to three or four devices by line if the current consumption is low (less than 500 mA) and the total length is less than 5 m (16.4 ft).



A Power supply
B Very short cable
C Terminal distribution
D Circuit breaker

- **Daisy chain:**
  The power connectors between each device in the system can be distributed in a daisy chain with a loop and the last device must be connected directly to the power supply. This way a device can be disconnected without impact on the others and the voltage drop on the devices is limited.
  Cables between the daisy chain and the loop for reconnecting the power supply must be close together to avoid current loop and to avoid generation of EMC disturbances.

NOTE: When the IMUs are divided between a number of pieces of electrical equipment, each electrical equipment must have its dedicated 24 Vdc power supply.

ULP Module Consumption

It is possible to power ULP modules by a 24 Vdc voltage distributed through the RJ45 male/male ULP cords.

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

The following table lists the 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 ULP display for one circuit breaker	21 mA	30 mA
Micrologic 5 or 6 trip unit for Compact NSX circuit breakers	30 mA	55 mA
Micrologic X control unit for Masterpact MTZ circuit breaker (supplied 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
UTA maintenance module	0 mA (the UTA module has its own power supply)	0 mA (the UTA module has its own power supply)

Power Supply Characteristics

NOTICE

LOSS OF DOUBLE INSULATION

- Supply the ULP modules with a 24 Vdc SELV (Safety Extra Low Voltage) power supply only. 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 a ULP module. 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 or equipment damage.

The 24 Vdc power supplies of the ULP system must be SELV (Safety Extra Low Voltage) to provide insulation coordination (IEC 60664) 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.
  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. Therefore, a minimum of one circuit isolation transformer is 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.
  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 products on condition that they have double insulation or reinforced insulation to retain the SELV nature of the power supply. These products 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 products are supplied with the same power supply. • The power supply is installed in the same electrical equipment as the products. • Only one connection of 0 V to ground: 0 V of products is not connected to ground in the installation comprising the power supply and the products.	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 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

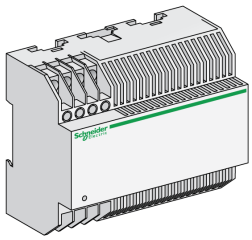
Power supply rating rules are as follows:

- To design the power supply dedicated to communication modules, check the maximum short-circuit current (Icc). It must not exceed 20 A, that 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 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

Available 24 Vdc power supplies include the range of Phaseo ABL8 modules and the AD modules:

- ABL8 power supplies (3 to 10 A, overvoltage category II) are recommended for large installations.
- AD power supplies (1 A, overvoltage category IV) are recommended for:
  - Installation limited to a few IMUs.
  - Power supply of Micrologic trip units in Masterpact NT/NW or Compact NS circuit breakers.

Characteristic	Phaseo ABL8 module	AD module
Illustration		
Overvoltage category defined by IEC 60947-1	Category II	Category IV
Input supply voltage AC	• 110–120 Vac • 200–500 Vac	• 110–130 Vac • 200–240 Vac • 380–415 Vac
Input supply voltage DC	–	• 24–30 Vdc • 48–60 Vdc • 100–125 Vdc
Dielectric withstand	• 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: • 3.5 kV RMS for 1 minute (380 Vac model) • 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)
Temperature	• 50 °C (122 °F) • 60 °C (140 °F) with 80% nominal load maximum	70 °C (158 °F)
Output Current	3 A or 5 A	1 A
Ripple	200 mV peak-peak	240 mV peak-peak
Output voltage setting for line loss compensation	24–28.8 Vdc	–

NOTE: For applications requiring an overvoltage category higher than II, install a surge arrester when using a 24 Vdc ABL8 module.

Power Supply Part Numbers

Power supply	Rating	Input-Output voltage	Part number
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	54440
		48/60 Vdc - 24 Vdc	54441
		100/125 Vdc - 24 Vdc	54442
		110/130 Vac - 24 Vdc	54443
		200/240 Vac - 24 Vdc	54444
		380/415 Vac - 24 Vdc	54445
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

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 24 Vdc wires (output of the 24 Vdc power supply) must be twisted together.
- The 24 Vdc wires (output of the 24 Vdc power supply) must cross the power cables perpendicularly.
- Power supply conductors must be cut to length. Do not loop excess conductor.

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 intelligent modular unit (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	Supply mode
IFE Ethernet interface for one circuit breaker	Must be connected to a 24 Vdc power supply and cannot be supplied through its ULP port.
IFE Ethernet switchboard server	Must be connected to a 24 Vdc power supply and cannot be supplied through its ULP port.
IFM Modbus-SL interface for one circuit breaker	Must be connected to a 24 Vdc power supply and cannot be supplied 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 supplied through its ULP port.
ULP port module for Masterpact MTZ circuit breakers	Must be connected to a 24 Vdc power supply and cannot be supplied through its ULP port.
Micrologic X control unit for Masterpact MTZ circuit breakers	Supplied by the ULP port module.
EIFE embedded Ethernet interface for one Masterpact MTZ drawout circuit breaker	Supplied by the ULP port module.
FDM121 ULP display for one circuit breaker	• Must be connected to a power supply if alone or not located at the end of the ULP line. • Supplied by the other ULP modules through the ULP cord if located at the end of the ULP line.
Micrologic 5 or 6 trip unit for Compact NSX circuit breakers	Supplied by the other ULP modules through the ULP cord.
BSCM circuit breaker status control module for Compact NSX circuit breakers	Supplied by the other ULP modules through the ULP cord.
Micrologic trip unit for Masterpact NT/NW and Compact NS circuit breakers	Must be supplied by a dedicated AD power supply.
BCM ULP circuit breaker communication module for Masterpact NT/NW and Compact NS circuit breakers	Supplied by the other ULP modules through the ULP cord.

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.

Section 2.3
Rules for Connection to the Communication Network

What Is in This Section?

This section contains the following topics:

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 *(see page 112)*.

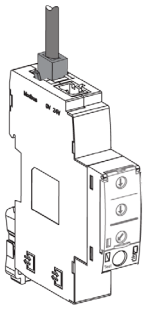
The 24 Vdc power supply terminal block delivered with the IFM interface is used to supply the IFM interface with power either in a daisy-chain or in a star connection.

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.

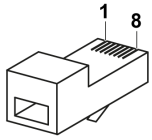
Connection of RJ45 Modbus Cable to the IFM Interface

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

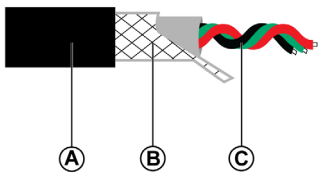


Pin Connection of the RJ45 Male/Male Modbus Cable

The RJ45 male/male Modbus cable (VW318306R••) uses an RJ45 connector whose pin 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 Male/Male Modbus Cable



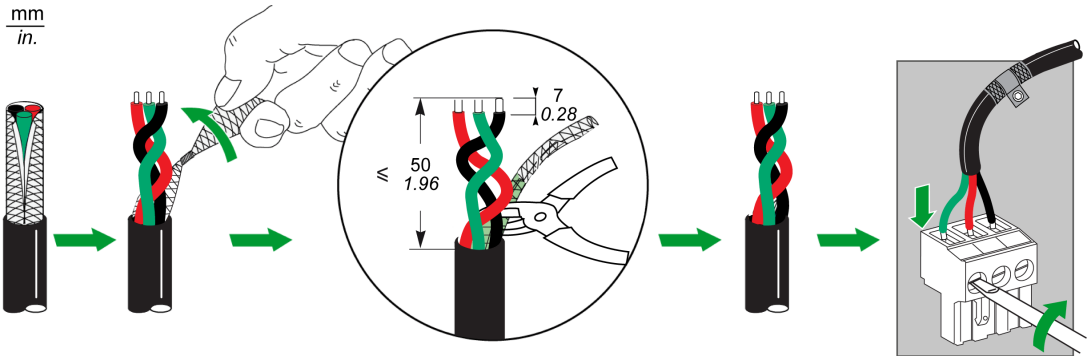
A Outer sheath
B Shielding braid
C Twisted communication wires (red/black/green)

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

Connection of the IFM Interface to an Open-Style Connector

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

- With an RJ45 male/male Modbus cable (VW318306R••):
  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.



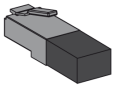
- With a Modbus serial link cable (VW3A8306D30) with one RJ45 male connector and free wires at other end:
  1. Identify the three wires to be connected to a connector:
     Pin number 4 (D1): blue wire
     Pin number 5 (D0): white-blue wire
     Pin number 8 (0 VL): brown wire
  2. Cut off the five 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 lug to the ground.
  5. Connect the Phoenix Contact RJ45 connector to the Modbus port of the IFM interface.
  6. At the other cable end, connect the wires to terminals (for example, screw terminals or tap junctions).

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 master 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 to the Modbus RJ45 connector on the last IFM interface.

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

Connection to the Modbus Master

Introduction

Connection to the Modbus master does not vary when the Modbus-SL network is or is not contained within the electrical equipment.

IFM interfaces with part number LV434000 and TRV00210 can be installed on the same Modbus-SL network *(see page 60)*.

Connection of IFM Interfaces to Modbus-SL master

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

- To connect a single IFM interface, use the RJ45 Modbus T-junction.
- To connect several stacked IFM interfaces, use the RJ45 Modbus cable.
- To interconnect several isolated IFM interfaces, 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 Modbus-SL interfaces for one circuit breaker is connected to the Modbus master (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 master or the IFE server can be connected directly to the Modbus-SL network of the IFM interfaces in the electrical equipment.

An example of a Modbus-SL network contained within the electrical equipment is provided in Ethernet Connection Linking Two Pieces of Electrical Equipment *(see page 58)*.

Modbus-SL Network Not Contained in Electrical Equipment

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

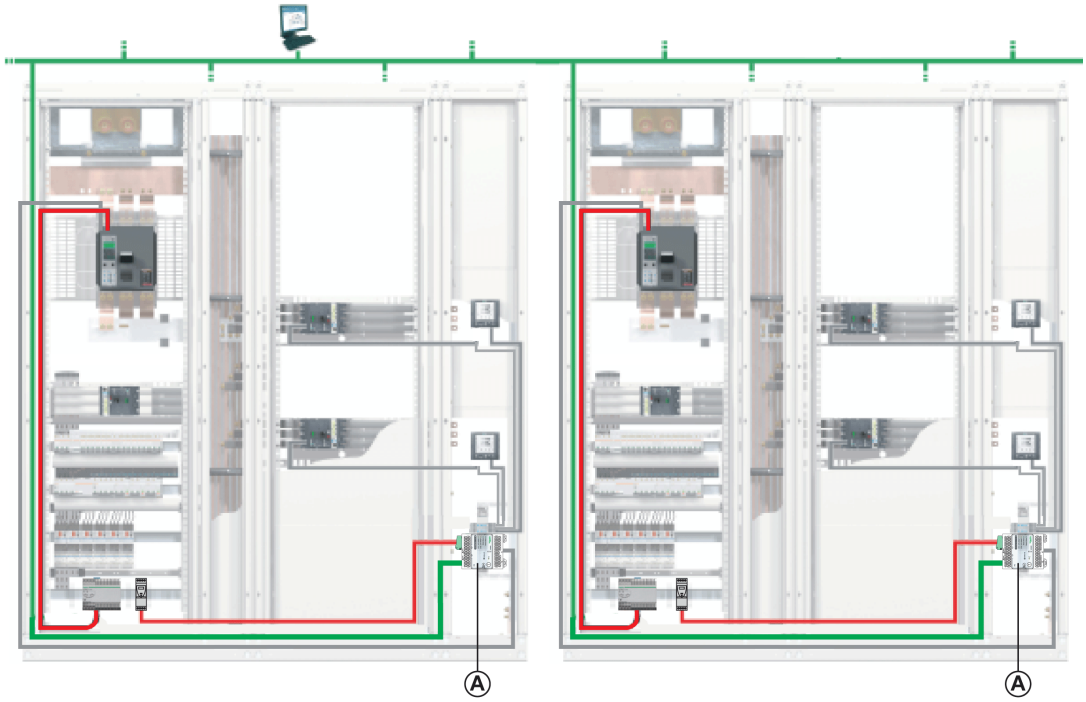
- The Modbus-SL network between the IFM interfaces is connected to a Modbus master outside the electrical equipment.
- The Modbus-SL network between the IFM interfaces exits the electrical equipment to extend to another electrical equipment.

An example of a Modbus-SL network not contained within the electrical equipment is provided in Modbus Connection Linking Several Pieces of Electrical Equipment *(see page 59)*.

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.



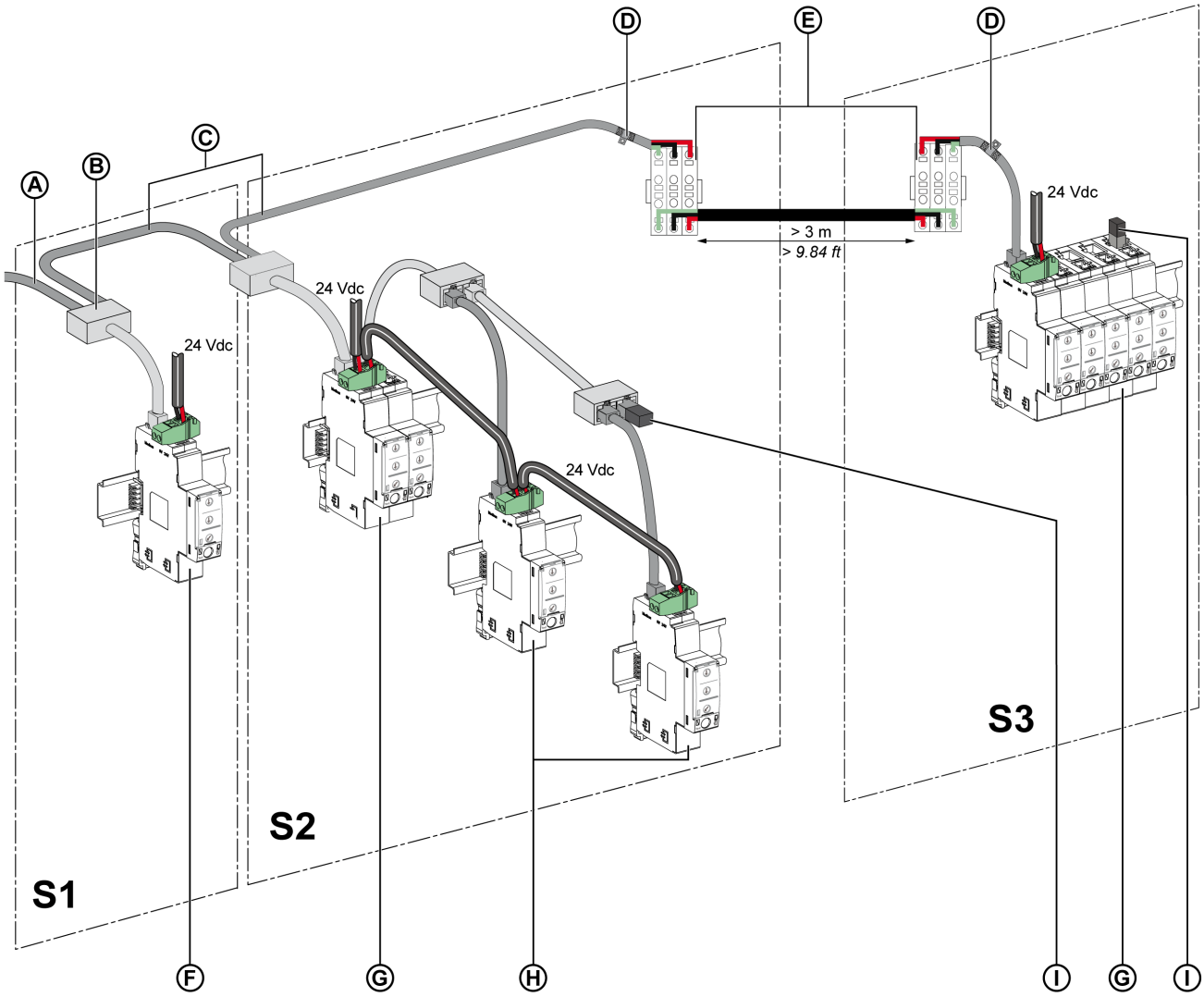
A IFE server

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 *(see page 71)*.

Modbus Connection Linking Several Pieces of Electrical Equipment

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



A Modbus cable coming from Modbus master
B RJ45 Modbus T-junction
C Modbus cable
D Grounding clamp
E Shunt terminal block
F Single IFM interface
G IFM interfaces grouped in islands with the stacking accessory
H IFM interfaces daisy-chained with the Modbus cable
I Modbus line termination

The rules below must be followed:

- Each Modbus segments in electrical equipment **S2** and **S3** 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 master, and a Modbus line termination must be connected at the other end, that is, on the last IFM interface (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 IFM interface.
    A Modbus line termination must be connected at the other end, that is, on the last IFM interface or other Modbus slave (on the last IFM interface in electrical equipment **S2** in this case).
- Maximum Length L 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

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:

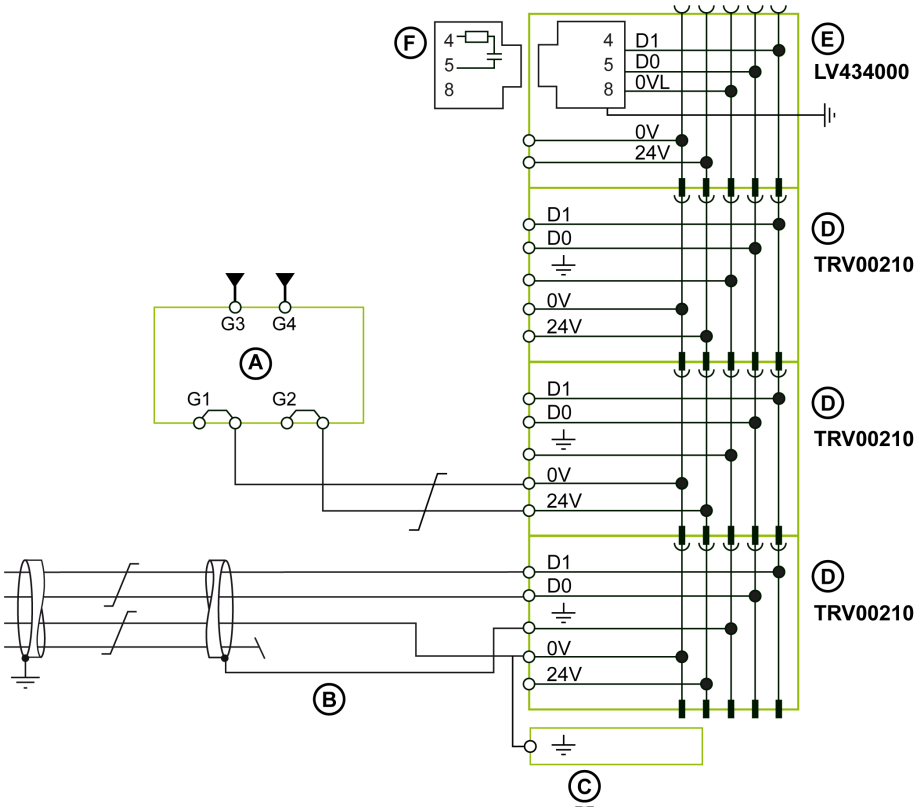
- Any IFM interface with part number TRV00210 present in a ULP system architecture can be replaced by an IFM Interface with part number LV434000.
- IFM interfaces with part number TRV00210 or LV434000 can be connected or stacked together.

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 *(see page 147)*.

Examples of Wiring Diagrams Including IFM Interfaces with Part Number LV434000 and TRV00210

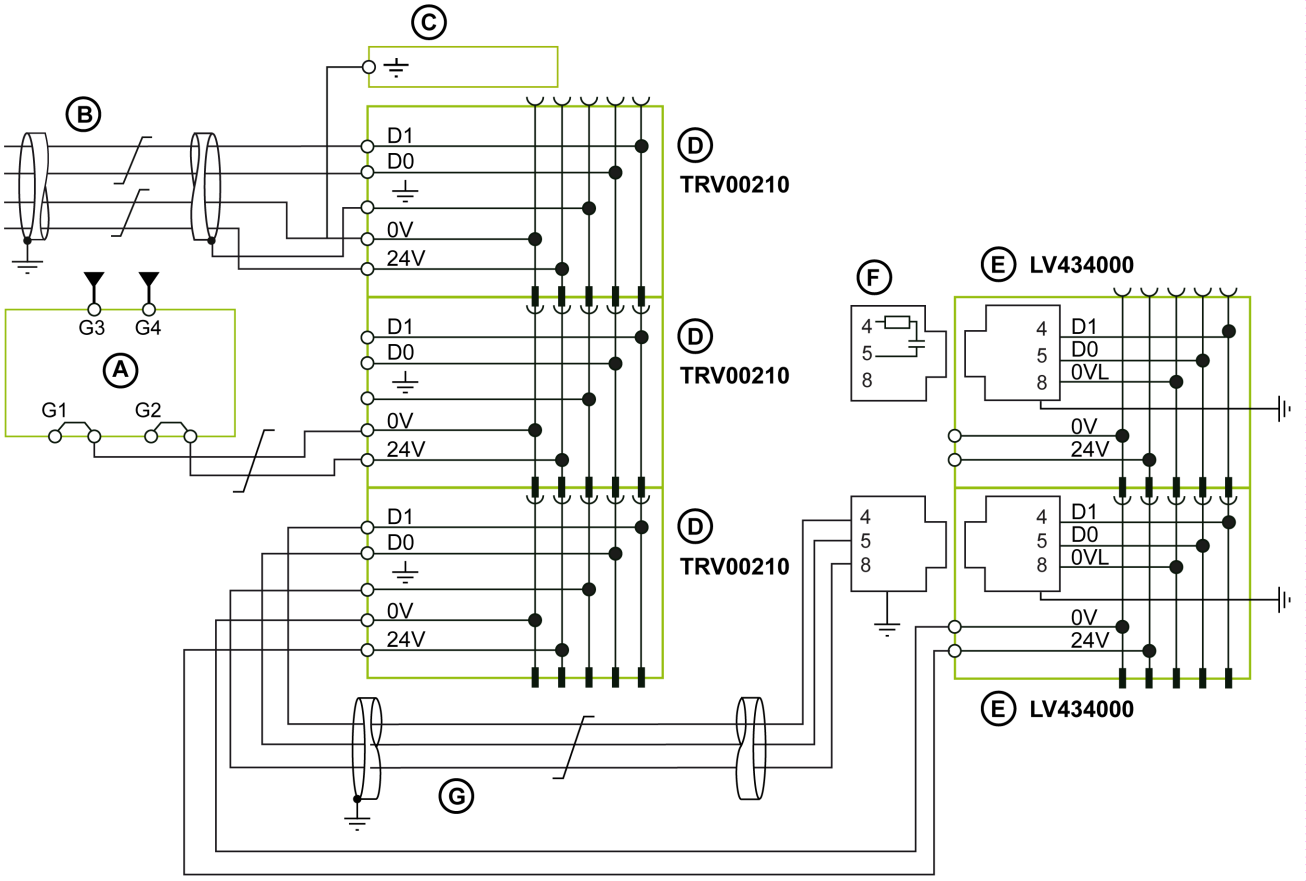
The following wiring diagrams show the connections for the Modbus cable and the 24 Vdc power supply.

Example 1: IFM interfaces with part number LV434000 and TRV00210 grouped in islands.



A 24 Vdc power supply
B Modbus cable coming from Modbus master
C Protective ground terminal block
D IFM interface with part number TRV00210
E IFM interface with part number LV434000
F Modbus line termination

Example 2: IFM interfaces with part number LV434000 and TRV00210 in a daisy-chain or in a star connection.



A 24 Vdc power supply
B Modbus cable coming from Modbus master
C Protective ground terminal block
D IFM interface with part number TRV00210
E IFM interface with part number LV434000
F Modbus line termination
G Modbus cable connecting IFM interfaces with part number TRV00210 and LV434000

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

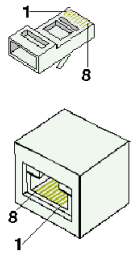
General Rules for Ethernet Cable

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		

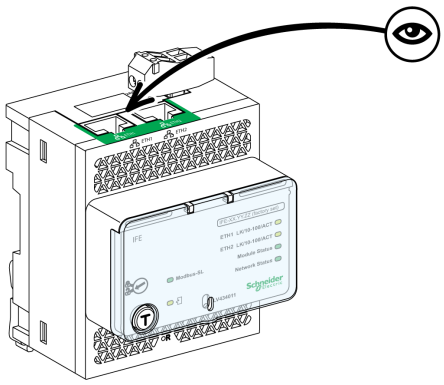
Ethernet Connection on IFE Interface or IFE Server

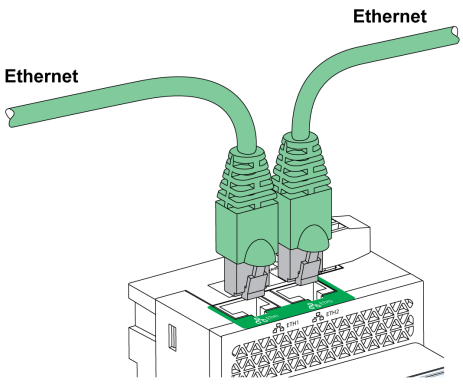
NOTICE

HAZARD OF EQUIPMENT DAMAGE

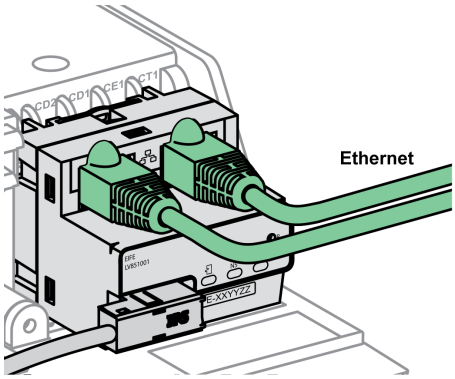
- Never connect an Ethernet device to an RJ45 ULP port.
- The RJ45 ULP ports of the IFE interface are for ULP modules only.
- Any other use can damage the IFE interface or the device connected to the IFE interface.

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.
- The connection of the cable shield must be as short as possible.
- Several shields can be connected together.
- Identify the logical name and the logical address of each device.

Section 2.4
ULP System Architectures

What Is in This Section?

This section contains the following topics:

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 four architectures.

- Standalone architecture: the IMUs are not communicating to communication interfaces (IFE, EIFE, or IFM interfaces).
- Centralized Modbus architecture: 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
  - Tap-linked distributed Modbus architecture

  Both these distributed architectures can be combined to form a mixed architecture.
- Daisy-chained Ethernet architecture: 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: 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 standards IEC 61439-1 and IEC 61439-2.

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 products 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. • 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.	• Additional wiring needed for daisy-chaining the Modbus cable between the IFM interfaces. • 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 failure.
Star Ethernet	• Dependability in case of device 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 male/male ULP cords.

Standalone Architecture

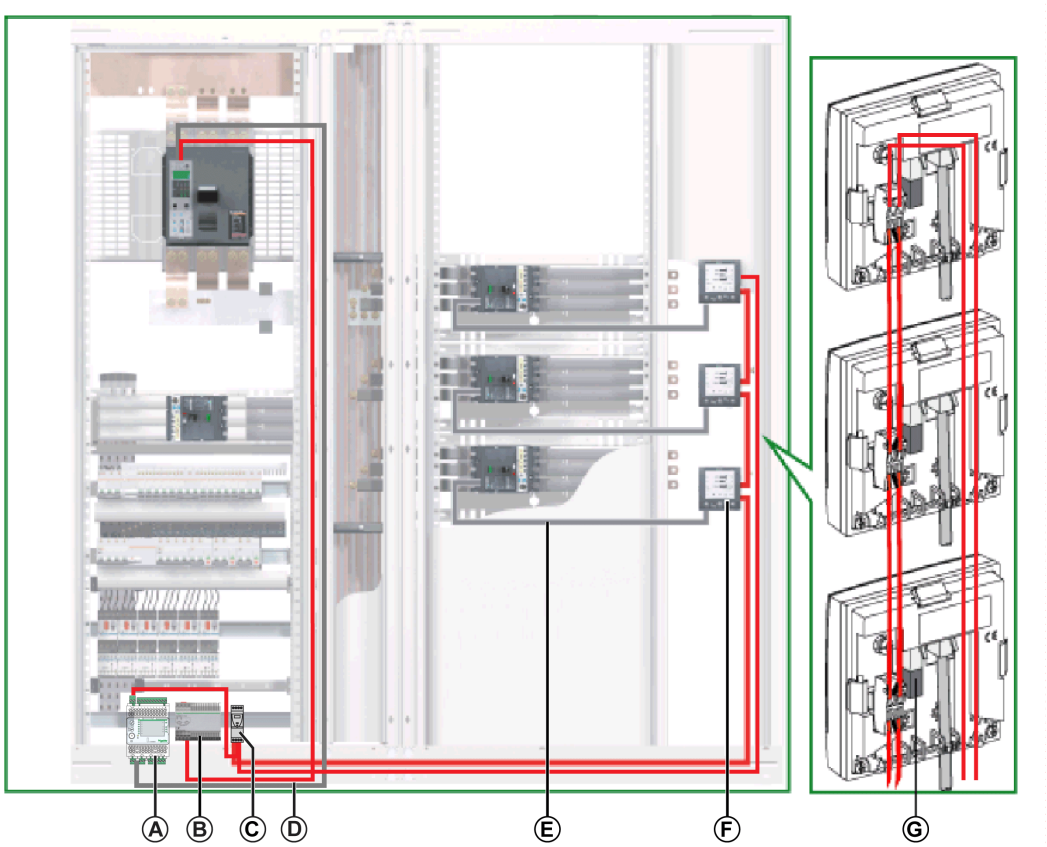
Introduction

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 ULP display for one circuit breaker or an IO input/output application module for one circuit breaker and a compatible circuit breaker (Compact NSX, Compact NS, or Masterpact NT/NW) 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 *FDM121 ULP Display for One Circuit Breaker - Instruction Sheet*.

The 24 Vdc power supply is selected from the list supplied in the examples of 24 Vdc power supplies *(see page 50)*. The power supply rating must be selected according to IMU consumption.

Centralized Modbus Architecture

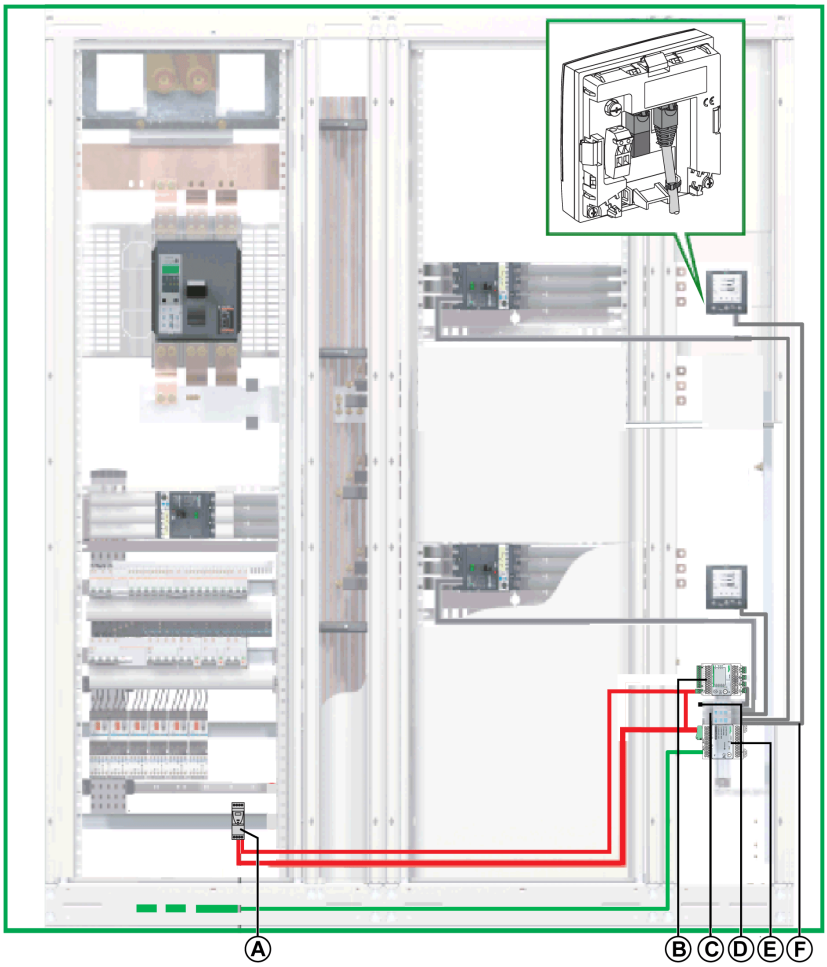
Introduction

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 *(see page 159)*.

Centralized Modbus Architecture

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

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

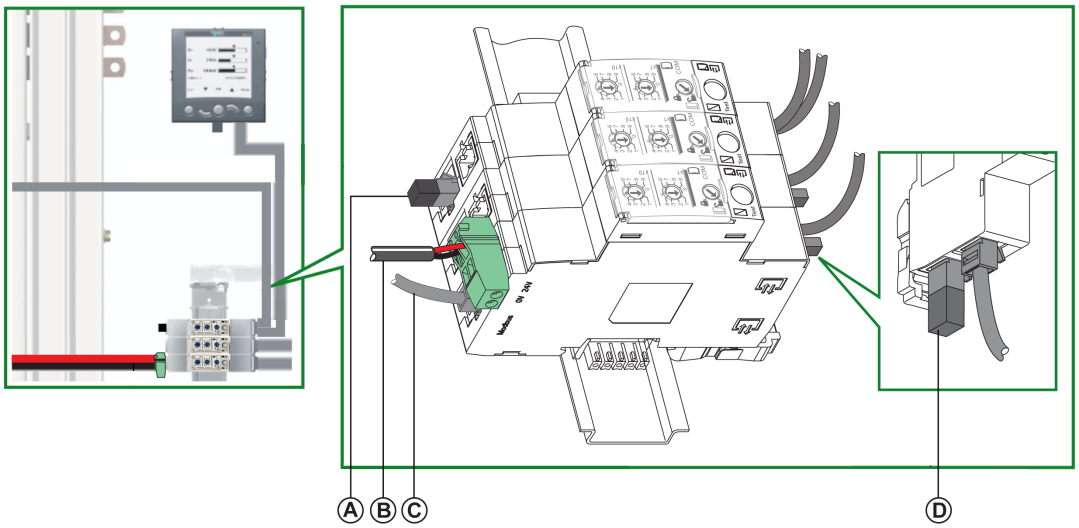


A ABL8 power supply
B IO module
C IFM interfaces grouped with stacking accessories
D Modbus line termination
E IFE server
F RJ45 male/male ULP cord

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.



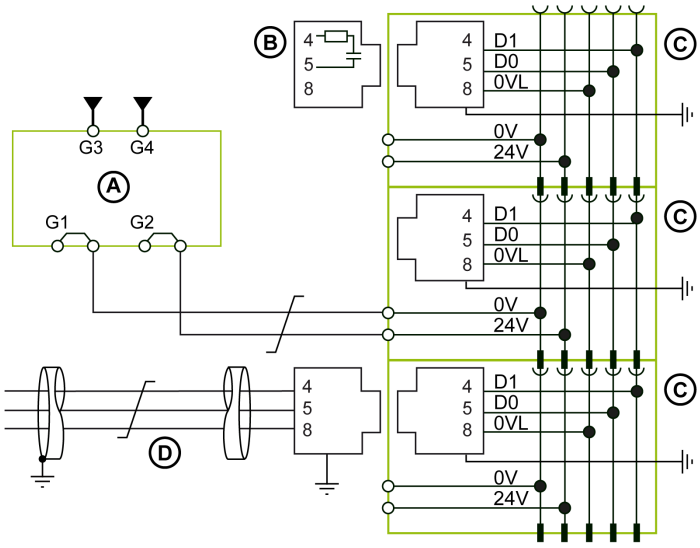
A Modbus line termination
B 24 Vdc power supply
C Modbus cable coming from Modbus master
D ULP line termination

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

The Modbus cable coming from the Modbus master 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 with diameter adapted to cable type and fixation adapted to the installation (for example, screw or DIN rail).

Wiring Diagram

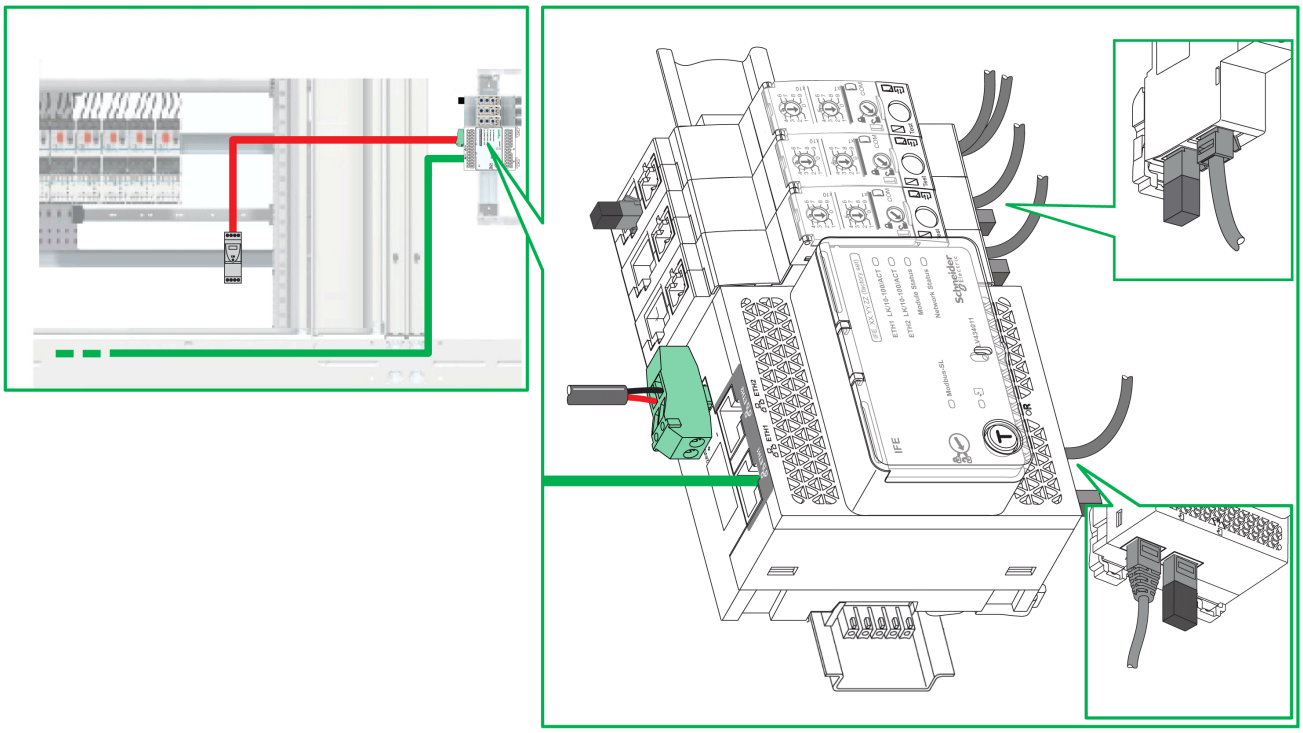
The following wiring diagram shows the connections for the Modbus cable and the 24 Vdc power supply:



A 24 Vdc power supply
B Modbus line termination 120 Ω
C IFM interface
D Modbus cable coming from Modbus master

IFE Ethernet Switchboard Server Power Supply

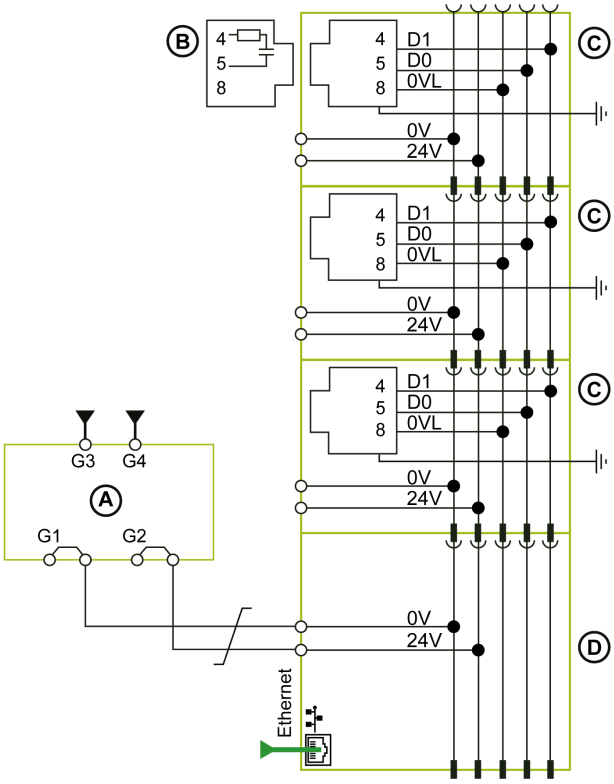
When the IFE server is stacked to the IFM interfaces, the 24 Vdc power supply of the IFE server and the serial line Modbus communication are distributed to the IFM interfaces.



Cable	Description
	Ethernet network
	ULP network
	24 Vdc power supply

Wiring Diagram for IFE Ethernet Switchboard Server

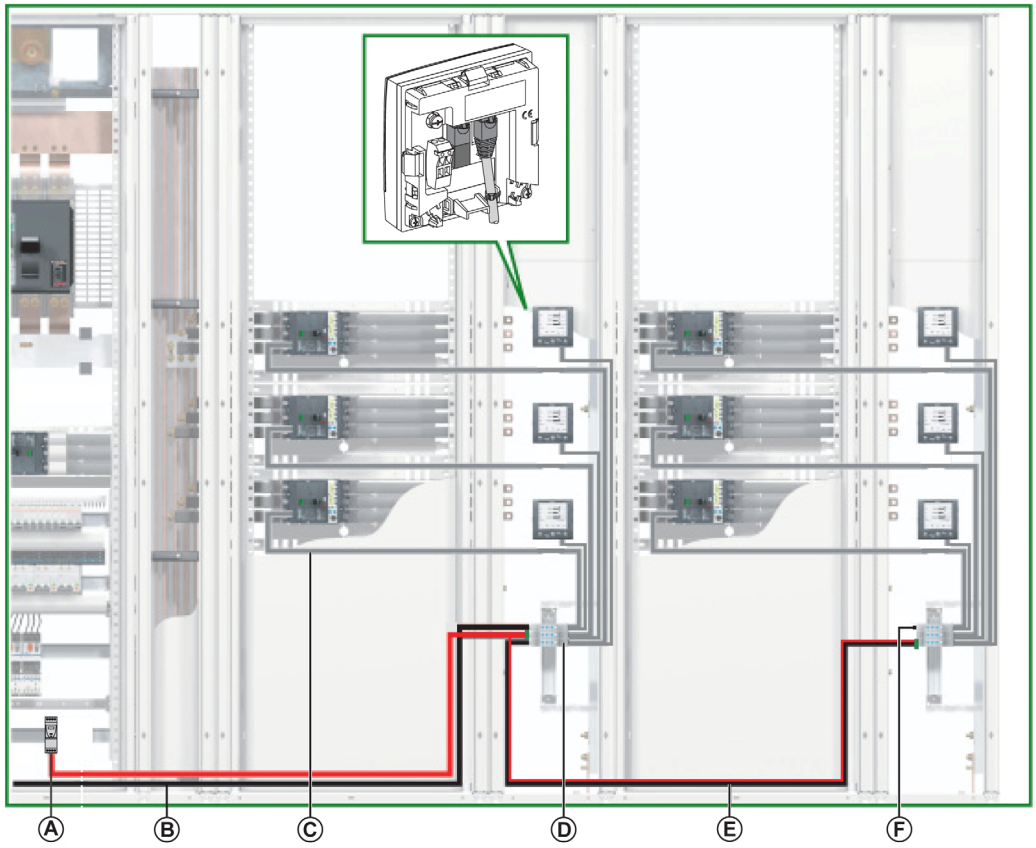
The following wiring diagram shows the connections for the IFE server and the 24 Vdc power supply in detail:



A 24 Vdc power supply
B Modbus line termination 120 Ω
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 ABL8 power supply
B Modbus cable coming from Modbus master
C NSX cord
D IFM interface
E Modbus cable running to second cubicle
F Modbus line termination

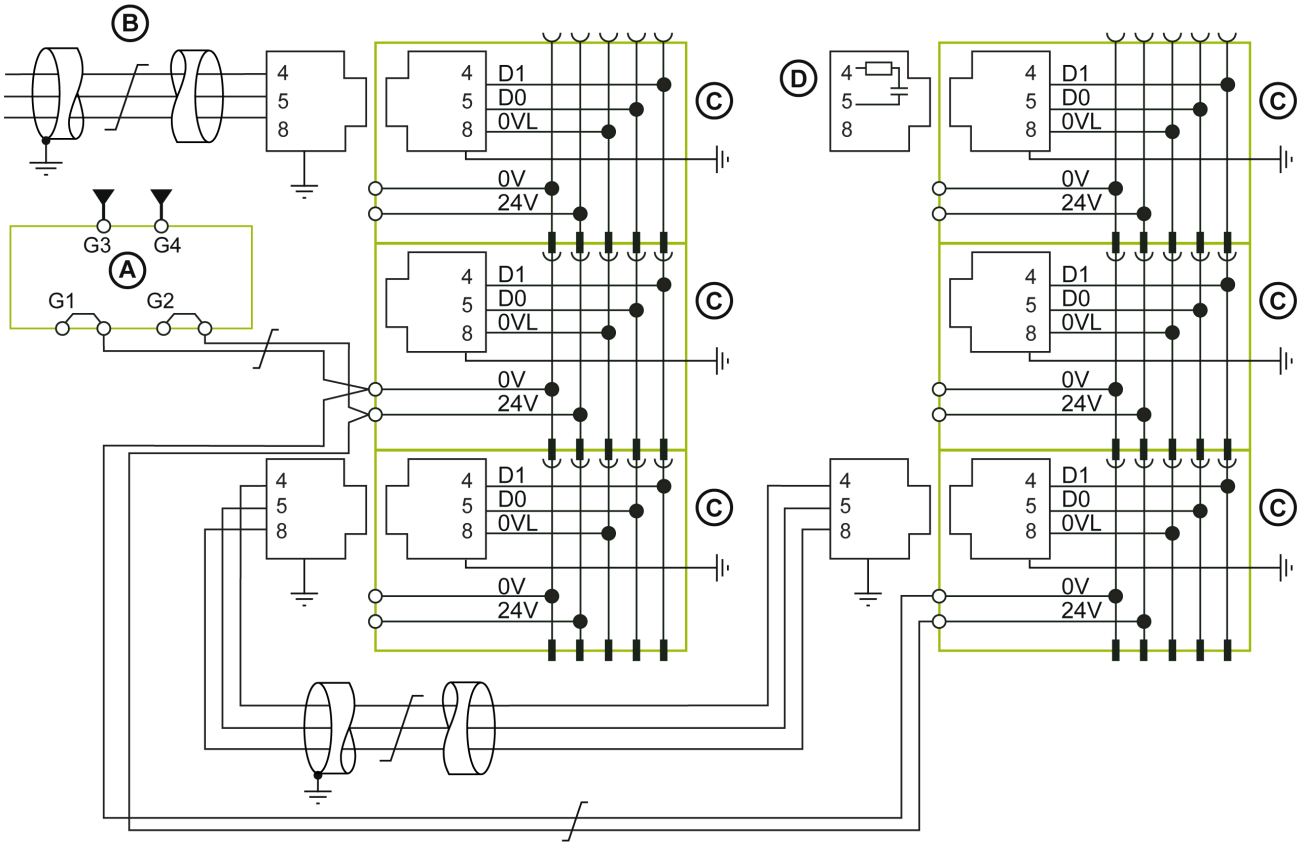
Cable	Description
▬▬▬	Modbus network
▬▬▬	ULP network
▬▬▬	24 Vdc power supply

Modbus Cable Connection with a Single Power Supply Segment

- The Modbus cable coming from the Modbus master 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 with diameter adapted to cable type and fixation adapted to 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 with diameter adapted to cable type and fixation adapted to 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

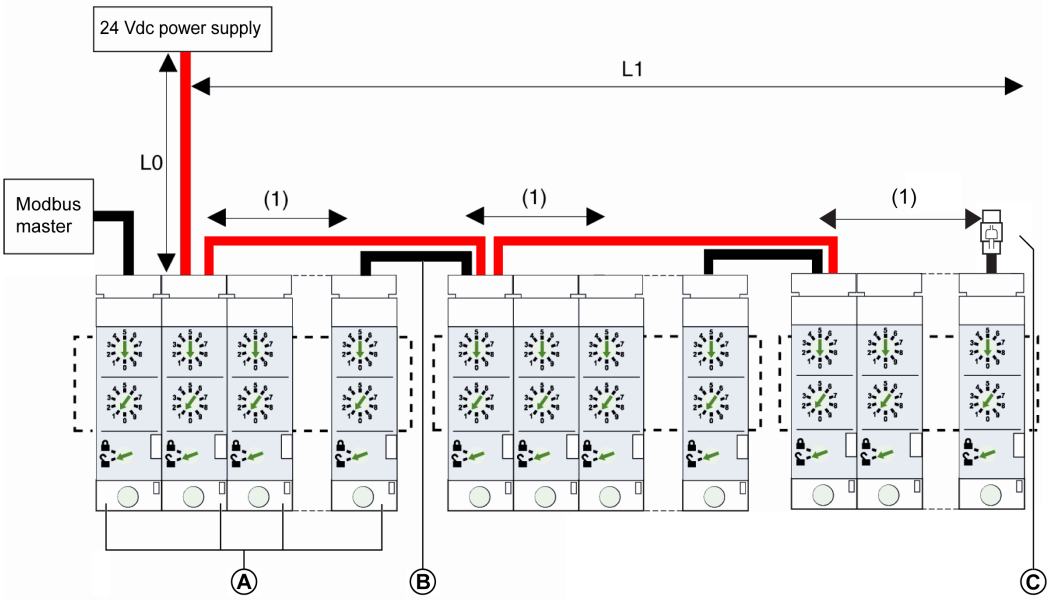
The following wiring diagram shows the connections for the Modbus cables and the 24 Vdc power supply in the case of a single power supply segment:



A 24 Vdc power supply
B Modbus cable coming from Modbus master
C IFM interface
D Modbus line termination 120 Ω

Modbus Cable Lengths for a Single Power Supply Segment

The following figure shows the Modbus cable lengths in detail, in the case of a centralized Modbus architecture with a single power supply segment:



A IFM interfaces grouped with stacking accessories
B Modbus cable ensuring continuity of the Modbus signal
C Modbus line termination

(1) Count the contact resistance between two RJ45 connectors in the group of IFM interfaces as 1 m (3.28 ft) of Modbus cable when both Modbus cables are connected to two of the first seven IFM interfaces, and as 2 m (6.56 ft) of Modbus cable thereafter.

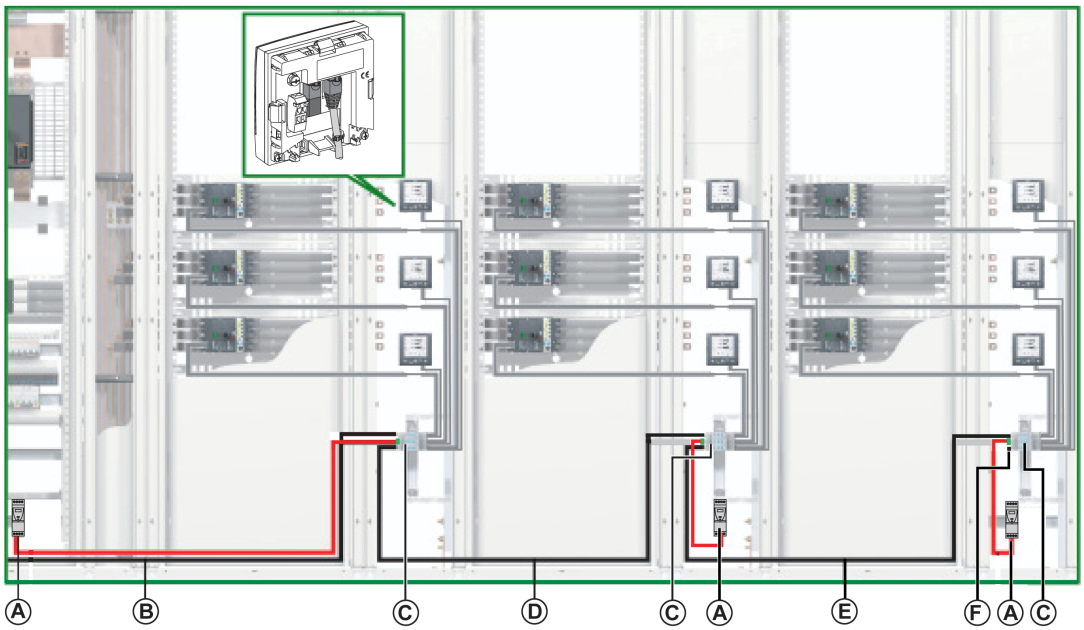
The following table summarizes the maximum lengths of Modbus cable for the centralized Modbus architecture with a single power supply segment. The Modbus cable under consideration is described in the connection of IFM interface *(see page 54)*.

24 Vdc rating	L0 (in 0.75 mm^2 (18 AWG) wires)	L1 (in 0.5 mm^2 (20 AWG) wires)
1 A	5 m (16.4 ft)	45 m (147.6 ft)
3 A	3 m (9.84 ft)	15 m (49.2 ft)

Case of Several Power Supply Segments

When more than one 24 Vdc power supply is needed *(see page 47)*, 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 ABL8 power supply
B Modbus cable coming from Modbus master
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

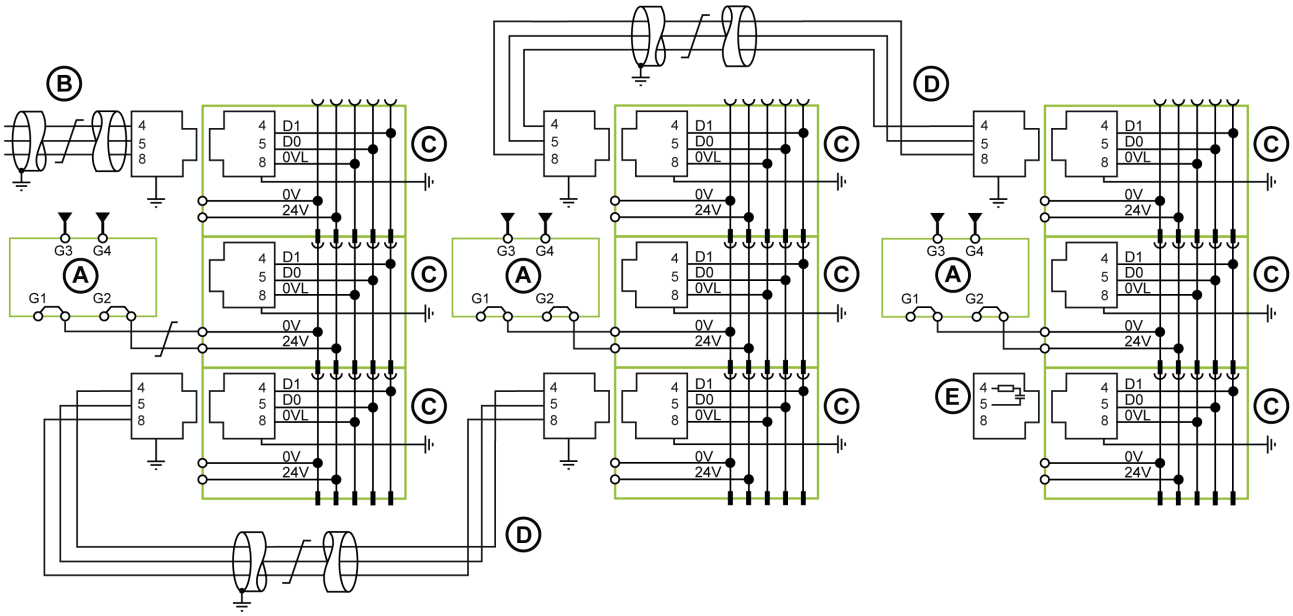
Cable	Description
▬▬▬	Modbus network
▬▬▬	ULP network
▬▬▬	24 Vdc power supply

Connection of Modbus Cable with Several Power Supply Segments

- The Modbus cable coming from the Modbus master ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps with diameter adapted to cable type and fixation adapted to 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 with diameter adapted to cable type and fixation adapted to 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 with diameter adapted to cable type and fixation adapted to 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

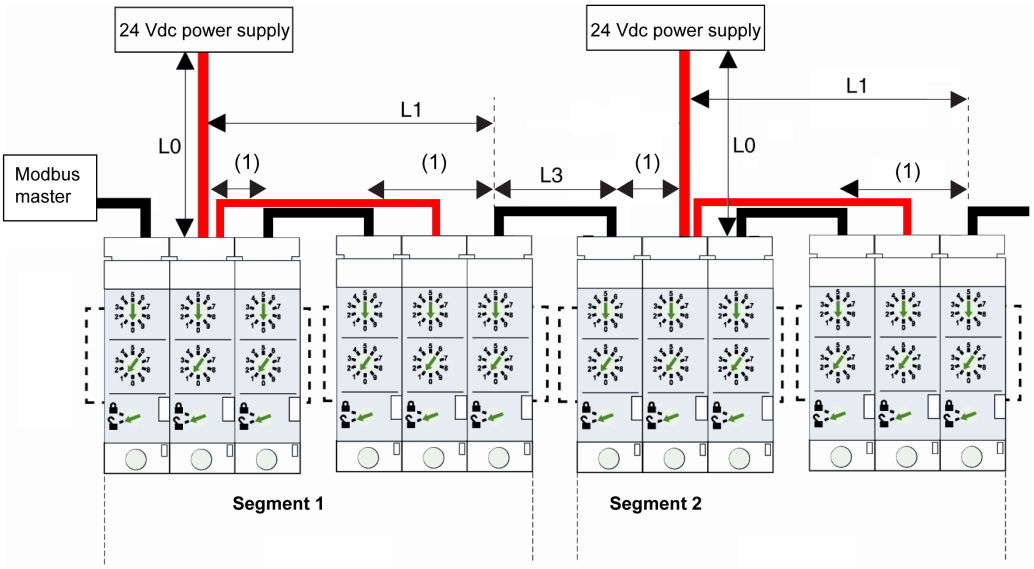
The following wiring diagram shows the connections for the Modbus cables and the 24 Vdc power supply in the case of several power supply segments:



A 24 Vdc power supply
B Modbus cable coming from Modbus master
C IFM interface
D Modbus cable between pieces of electrical equipment
E Modbus line termination 120 Ω

Modbus Cable Lengths for Several Power Supply Segments

The following figure shows the Modbus cable lengths in detail, in the case of a centralized Modbus architecture with several power supply segments:



(1) Count the contact resistance between two RJ45 connectors in the group of IFM interfaces as 1 m (3.28 ft) of Modbus cable when both Modbus cables are connected to two of the first seven IFM interfaces, and as 2 m (6.56 ft) of Modbus cable thereafter.

Modbus cable L3 ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps with diameter adapted to cable type and fixation adapted to the installation (for example, screw or DIN rail).

The following table summarizes the maximum lengths of Modbus cable for the centralized architecture with several power supply segments. The Modbus cable under consideration is described in the connection of IFM interface *(see page 54)*.

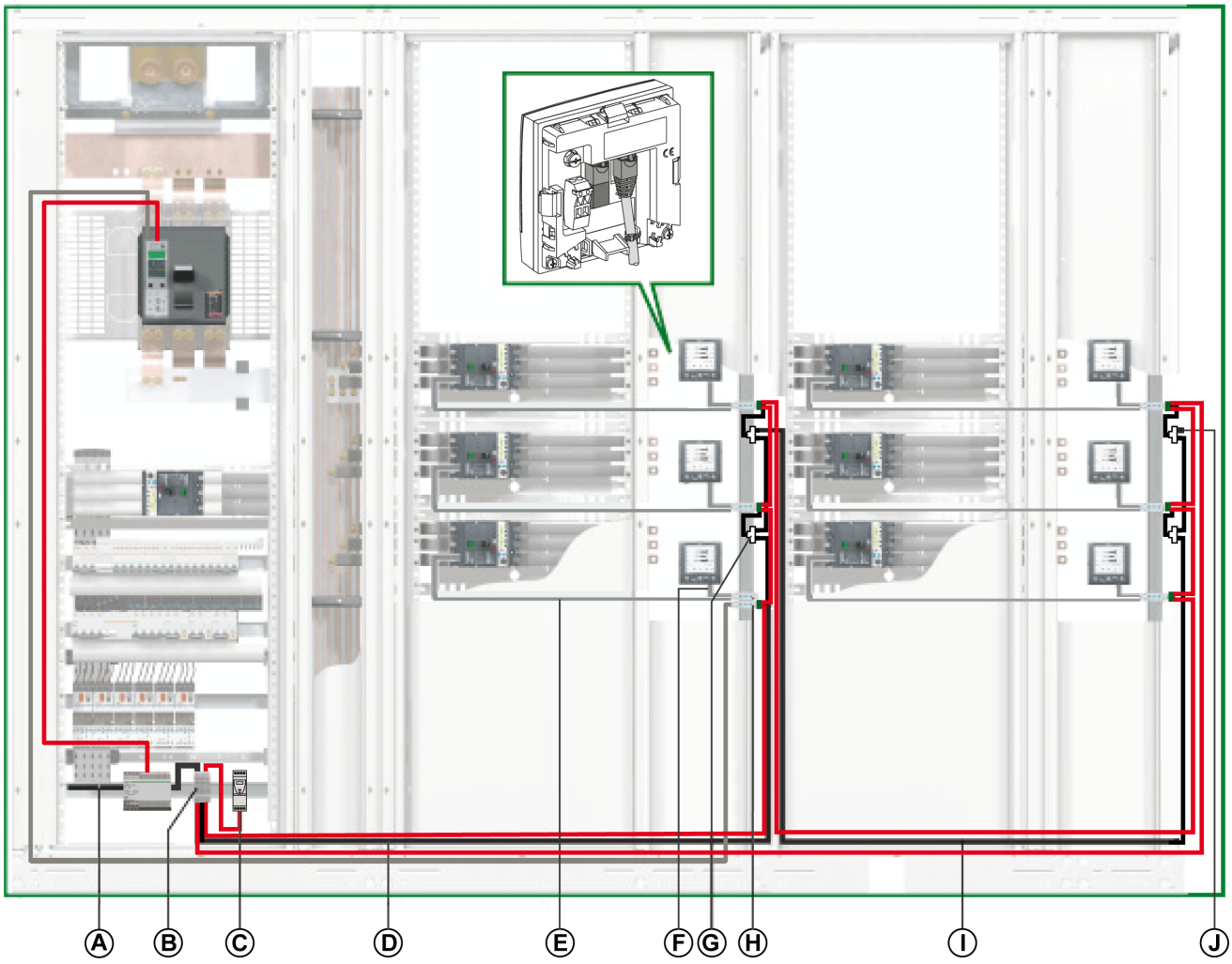
24 Vdc rating	L0 (in 0.75 mm^2 (18 AWG) wires)	L1	Sum of the L1s (for all power supply segments)	Sum of the L1s and L3s (total length)
1 A	5 m (16.4 ft)	45 m (147.6 ft)	105 m (344.5 ft)	500 m (1,640 ft)
3 A	3 m (9.84 ft)	15 m (49.2 ft)	35 m (114.8 ft)	500 m (1,640 ft)

NOTE: The maximum number of power supply segments is three segments for a single Modbus network *(see page 47)*.

Daisy-Chained Distributed Modbus Architecture

Daisy-Chained Distributed Modbus Architecture

The following figure shows an example of a daisy-chained distributed Modbus architecture with IMUs: an IMU consisting of a Compact NS circuit breaker and an IFM interface, and six IMUs consisting of a Compact NSX circuit breaker, an IFM interface, and an FDM121 display each.



A Modbus cable coming from Modbus master
B Shunt terminal block on the incoming supply
C ABL8 power supply
D Modbus cable running to first cubicle
E NSX cord
F RJ45 male/male ULP cord
G RJ45 Modbus T-junction
H IFM interface
I Modbus cable running to second cubicle
J Modbus line termination

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

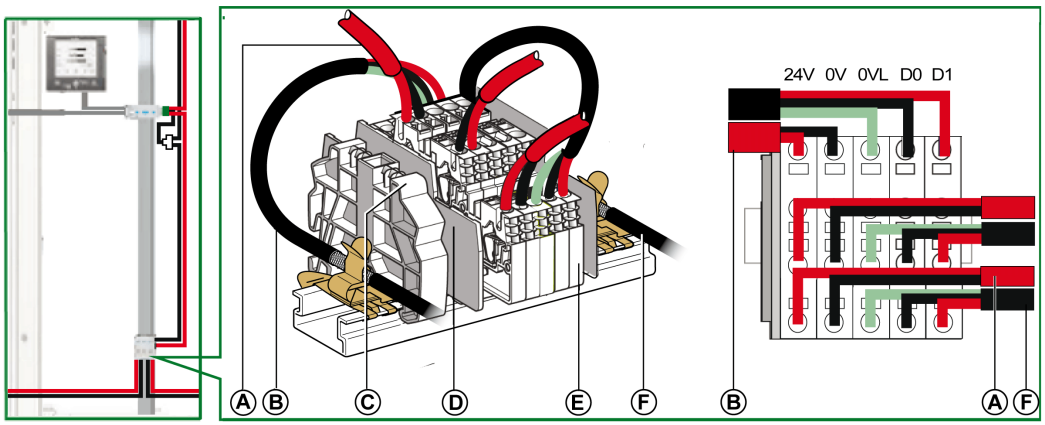
For a distributed Modbus architecture, an RJ45 Modbus T-junction can be used to connect the upstream Modbus cable and the downstream Modbus cable.

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 master
C Clip-on plastic end stop
D End plate
E Spring terminal block
F Modbus cable running to first cubicle

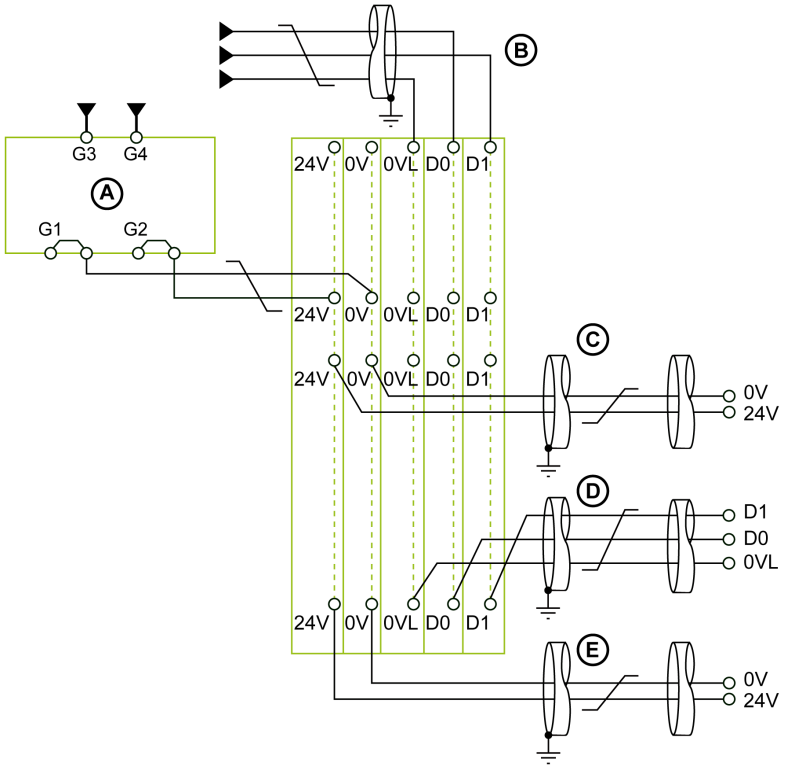
The following table lists the part numbers for the shunt terminal block:

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 master ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps with diameter adapted to cable type and fixation adapted to 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 with diameter adapted to cable type and fixation adapted to 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 slave in the electrical equipment (a PM800 communicating power meter, for example).

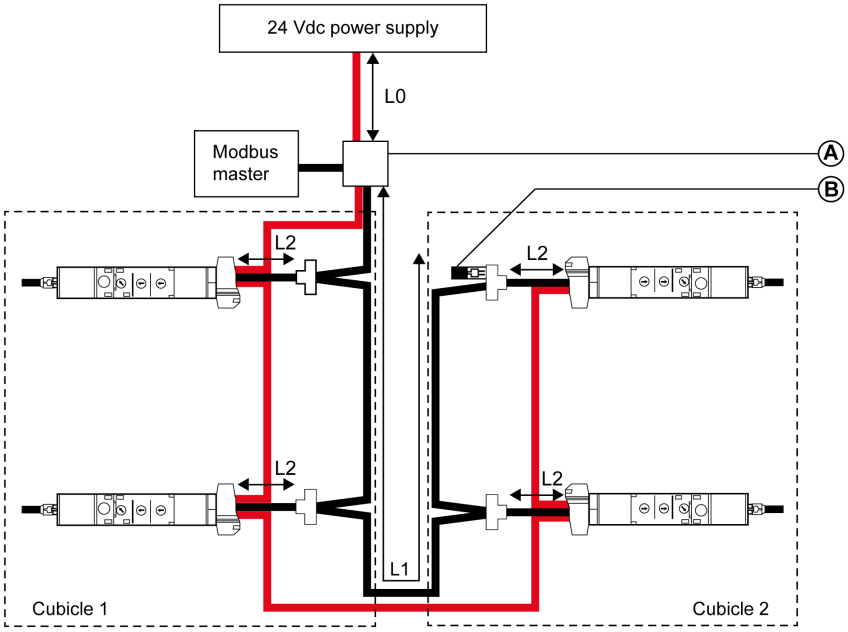
Wiring Diagram of Shunt Terminal Block on the Incoming Supply



A 24 Vdc power supply
B Modbus cable coming from Modbus master
C 24 Vdc power supply cable running from Modbus slaves
D Modbus cable running to Modbus slaves
E 24 Vdc power supply cable running to Modbus slaves

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 following table summarizes the maximum Modbus cable lengths for the daisy-chained distributed Modbus architecture with a single power supply segment. The Modbus cable under consideration is described in the connection of IFM interface *(see page 54)*.

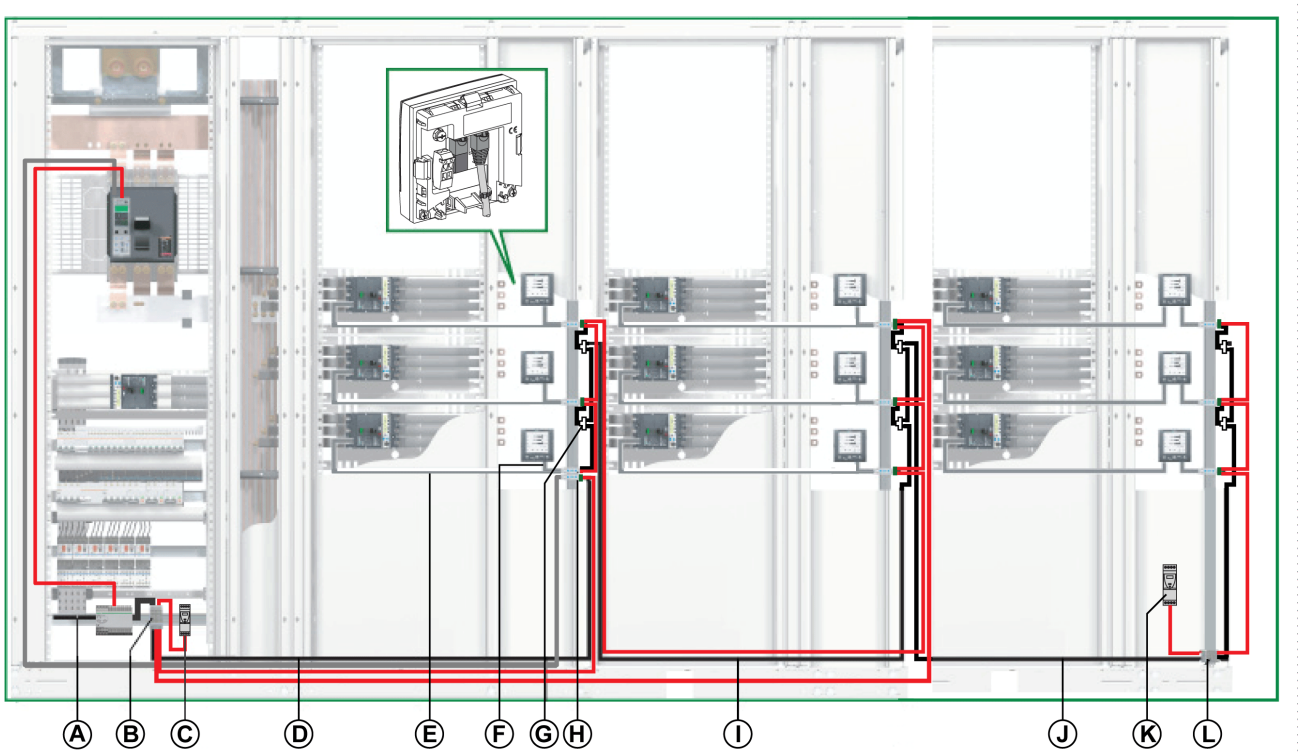
24 Vdc rating	L0 (in 0.75 mm^2 (18 AWG) wires)	L1
1 A	5 m (16.4 ft)	45 m (147.6 ft)
3 A	3 m (9.8 ft)	15 m (49.2 ft)

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 *(see page 47)*, 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 master
B Shunt terminal block on the incoming supply
C ABL8 power supply
D Modbus cable running to first cubicle
E NSX cord
F RJ45 male/male ULP cord
G RJ45 Modbus T-junction
H IFM interface
I Modbus cable running to second cubicle
J Modbus cable running to third cubicle
K Insertion of an ABL8 power supply
L Shunt terminal block on the cubicle incomer
M Modbus line termination

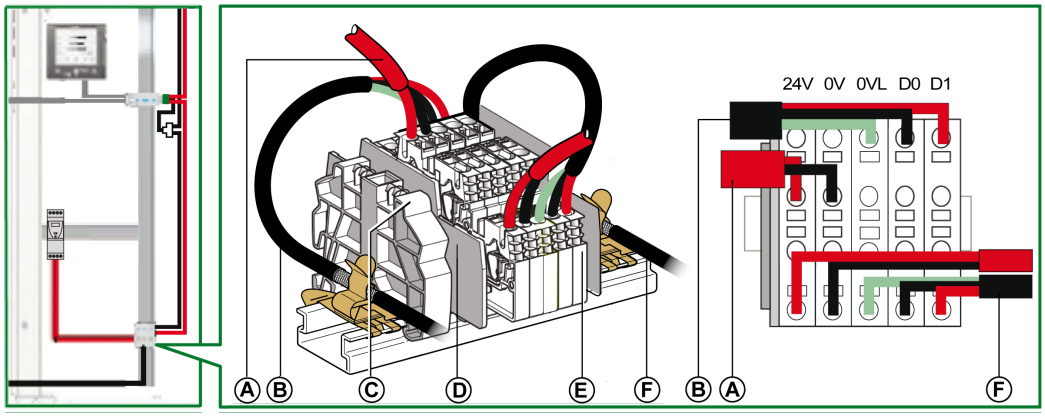
Cable	Description
———	Modbus network
———	ULP network
———	24 Vdc power supply

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:

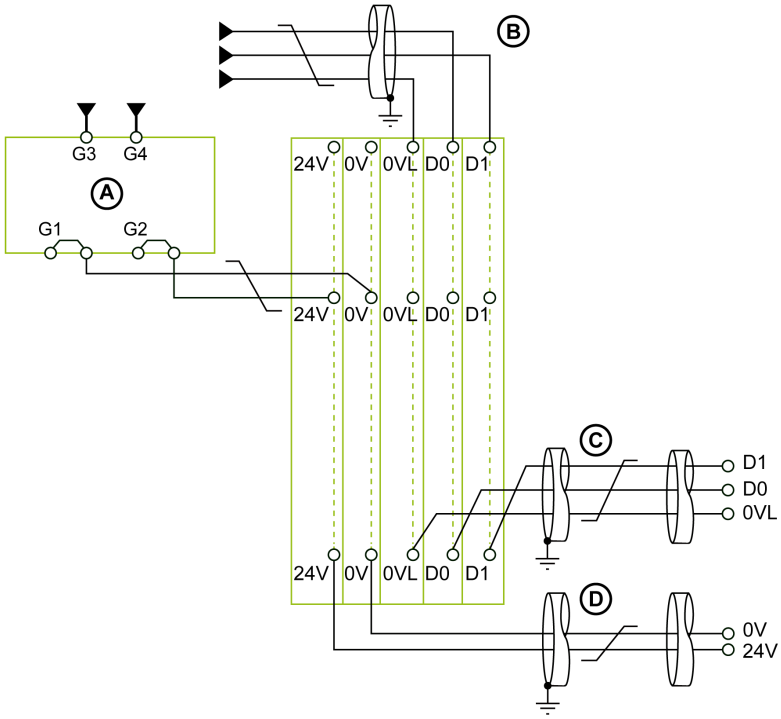


A 24 Vdc power supply
B Modbus cable coming from second cubicle
C Clip-on plastic end stop
D End plate
E Spring terminal block
F Modbus cable rising up the third cubicle

Modbus Cable Connection

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

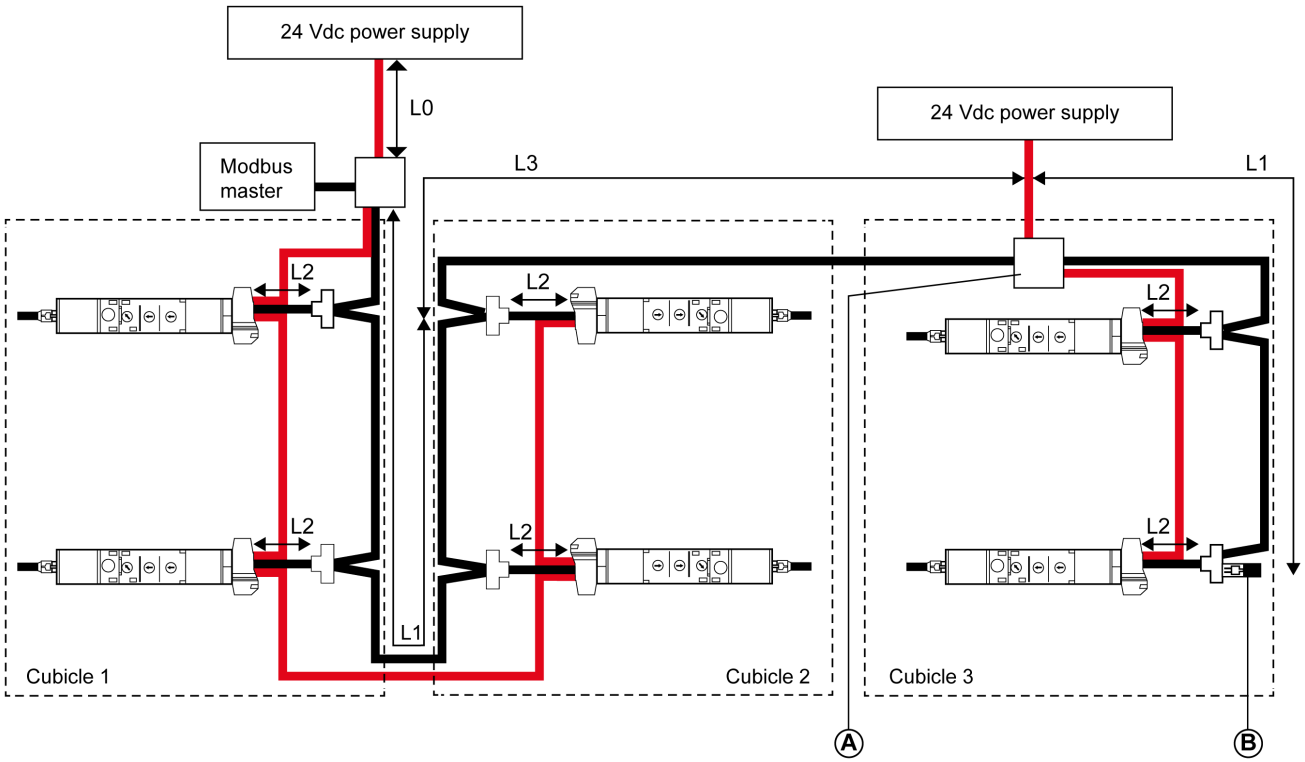
Wiring Diagram of Shunt Terminal Block on the Incomer of the Third Cubicle



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

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 with diameter adapted to cable type and fixation adapted to the installation (for example, screw or DIN rail).

The following table summarizes the maximum Modbus cable lengths for the daisy-chained distributed Modbus architecture with several power supply segments. The Modbus cable under consideration is described in the connection of IFM interface *(see page 54)*.

24 Vdc rating	L0 (in 0.75 mm^2 (18 AWG) wires)	L1	Sum of the L1s (for all power supply segments)	Sum of the L1s and L3s (total length)
1 A	5 m (16.4 ft)	45 m (147.6 ft)	105 m (344.5 ft)	500 m (1,640 ft)
3 A	3 m (9.8 ft)	15 m (49.2 ft)	35 m (114.8 ft)	500 m (1,640 ft)

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

NOTE: The maximum number of power supply segments is three segments for a single Modbus network *(see page 47)*.

Tap-Linked Distributed Modbus Architecture

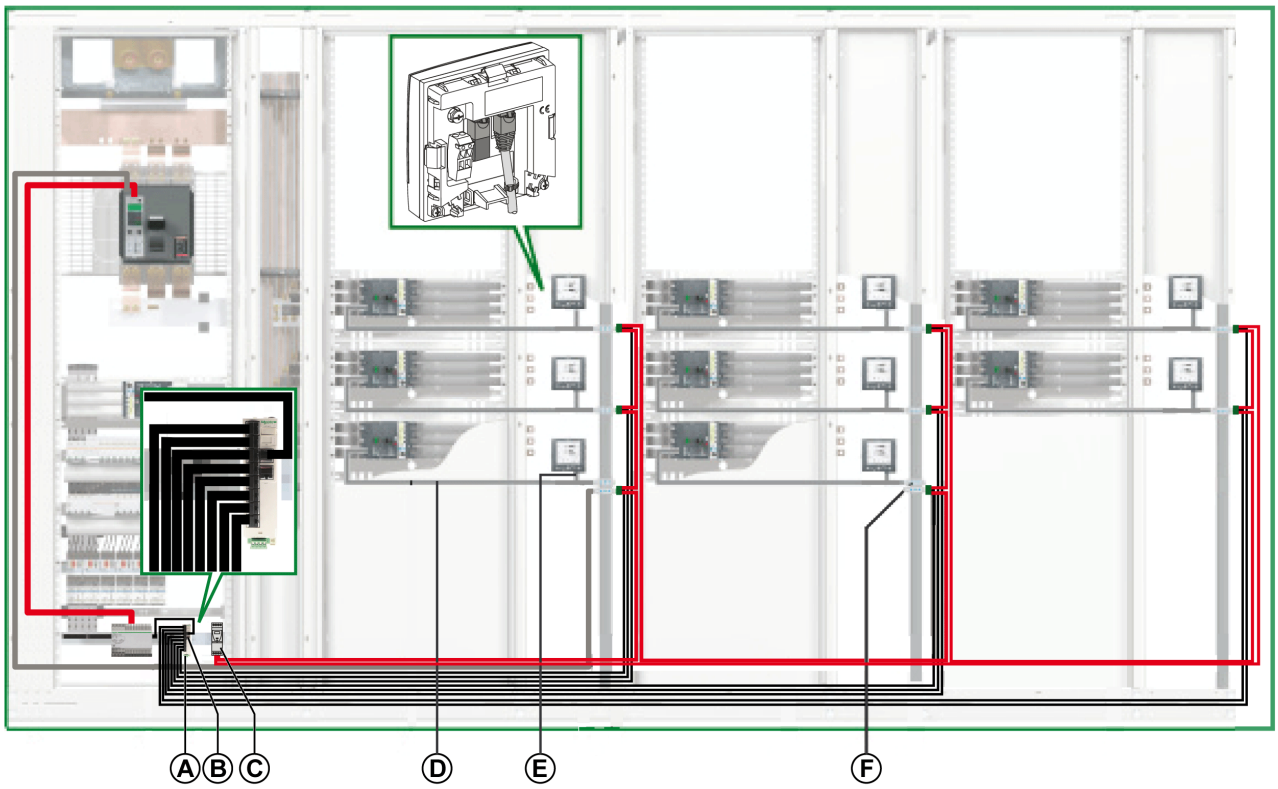
Introduction

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

- A Modbus splitter block distributes Modbus cable up to eight IFM interfaces *(see page 86)*.
- 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 *(see page 87)*.

Tap-Linked Distributed Modbus Architecture With Modbus Splitter Block

The following figure shows an example of a derivated distributed Modbus architecture with IMUs: an IMU consisting of a Compact NS circuit breaker and an IFM interface, and eight IMUs consisting of a Compact NSX circuit breaker, an IFM interface, and an FDM121 display each.

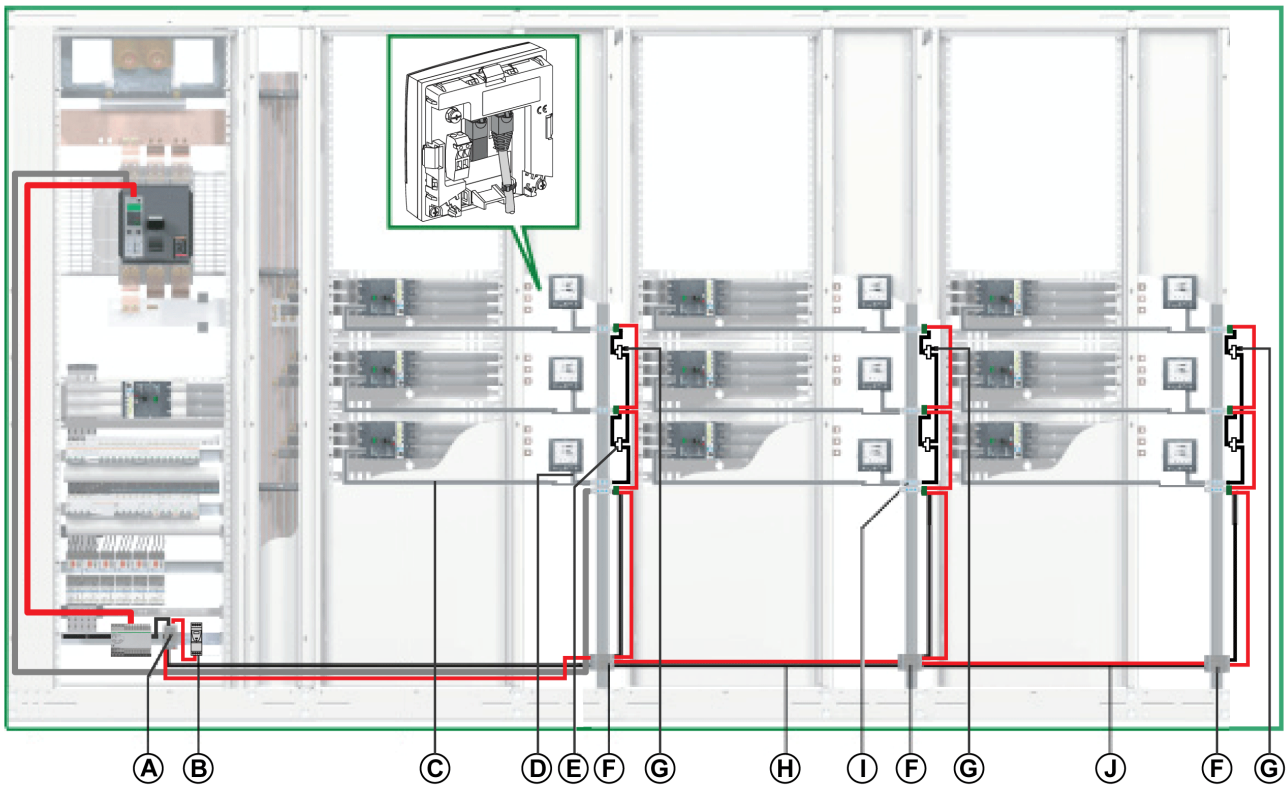


A Modbus splitter box
B Modbus line termination
C ABL8 power supply
D NSX cord
E RJ45 male/male ULP cord
F IFM interface

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 derivated distributed Modbus architecture with IMUs: an IMU consisting of a Compact NS circuit breaker and an IFM interface, and nine IMUs consisting of a Compact NSX circuit breaker, an IFM interface, and an FDM121 display each.



A Shunt terminal block on the incoming supply
B ABL8 power supply
C NSX cord
D RJ45 male/male ULP cord
E RJ45 Modbus T-junction
F Shunt terminal block on the cubicle incomer
G Modbus line termination
H Modbus cable running to the second cubicle
I IFM interface
J Modbus cable running to the third cubicle

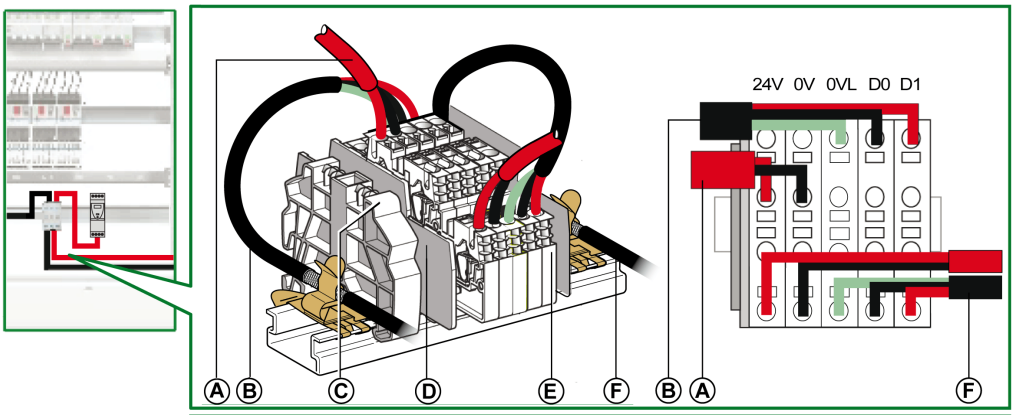
Cable	Description
▬▬▬	Modbus network
▬▬▬	ULP network
▬▬▬	24 Vdc power supply

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 protective 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 master
C Clip-on plastic end stop
D End plate
E Spring terminal block
F Modbus cable running to first cubicle

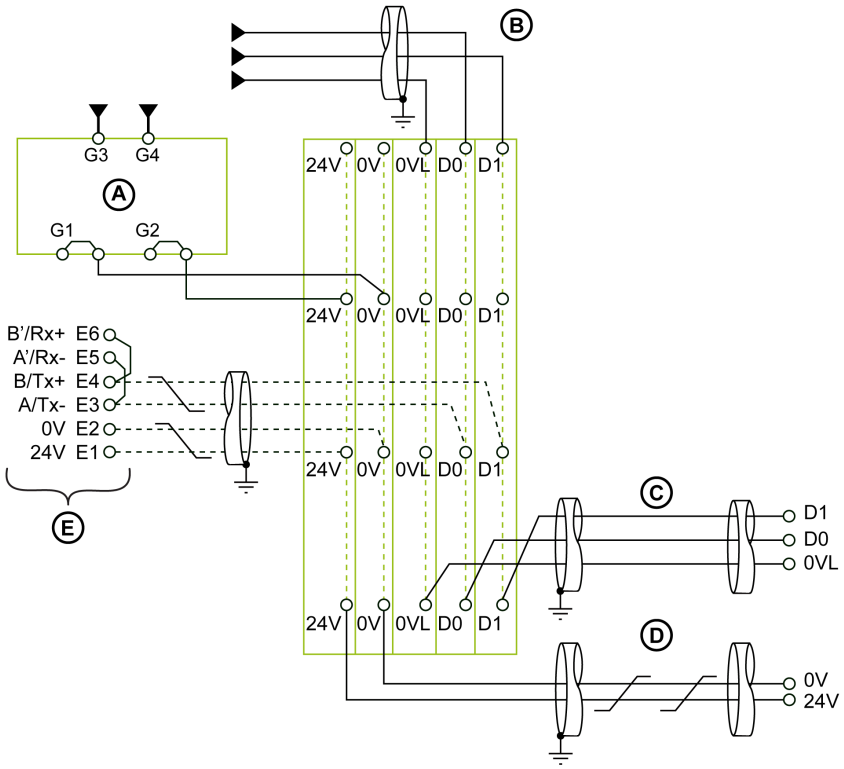
The following table lists the part numbers for the shunt terminal block:

Component	Nominal cross-section	Part number
4-channel spring terminal block	2.5 mm^2 (14 AWG)	NSYTRR24D+NSYTRALV24 (gray)
Protective ground terminal block	2.5 mm^2 (14 AWG)	AB1 RRNETP235U4 (green/yellow)
End plate	–	AB1 RRNACE244
Clip-on plastic end stop	–	AB1 AB8R35

Modbus Cable Connection

- The Modbus cable coming from the Modbus master ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps with diameter adapted to cable type and fixation adapted to 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 with diameter adapted to cable type and fixation adapted to 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 slave in the electrical equipment (a PM800 communicating power meter, for example).

Wiring Diagram of Shunt Terminal Block on the Incoming Supply



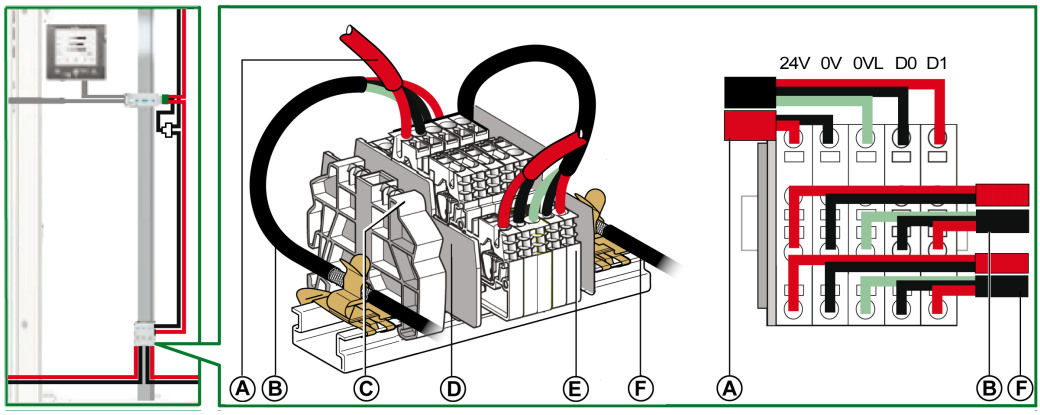
A 24 Vdc power supply
B Modbus cable coming from Modbus master
C Modbus cable running to first cubicle
D 24 Vdc power supply cable running to first cubicle
E Modbus slave (for example, Masterpact NT/NW circuit breaker)

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.

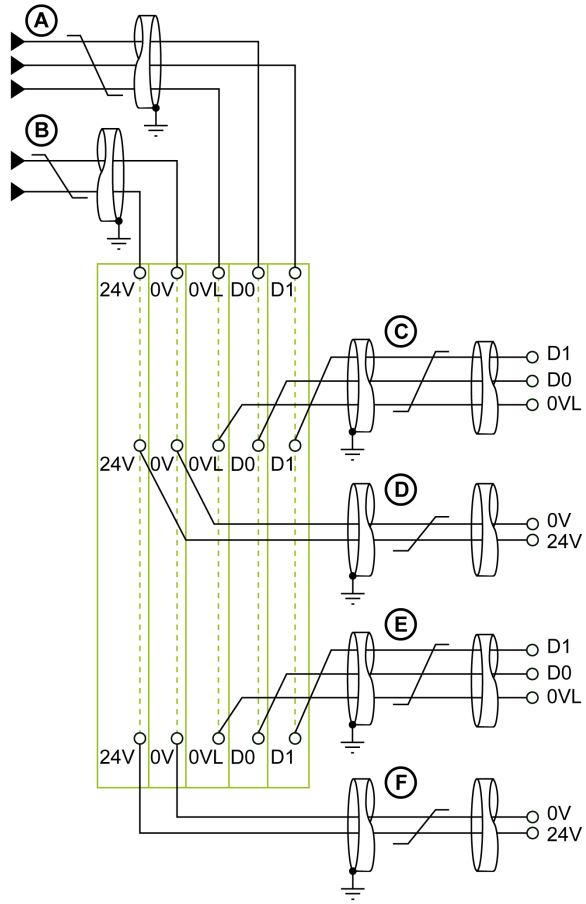
The shunt terminal block is created using four 5-channel spring terminal blocks.

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

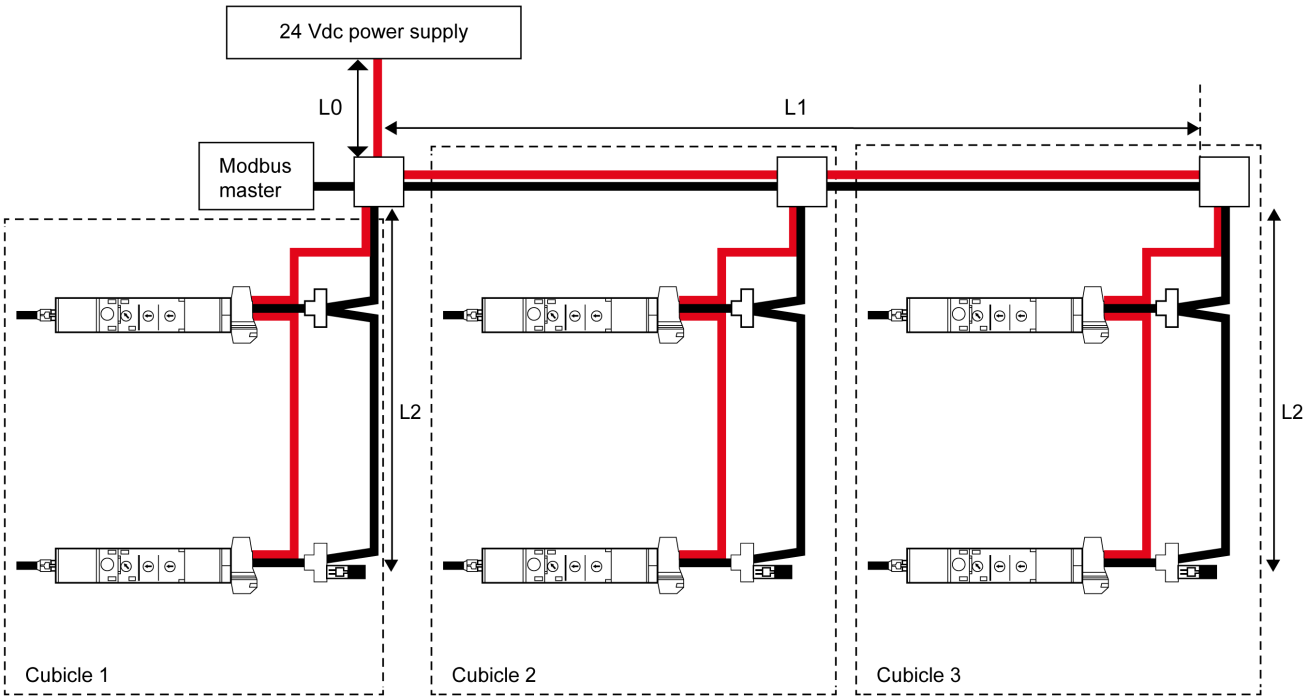
Wiring Diagram of Shunt Terminal Block on the Cubicle Incomer



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

Modbus Cable Lengths for a Single Power Supply Segment

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



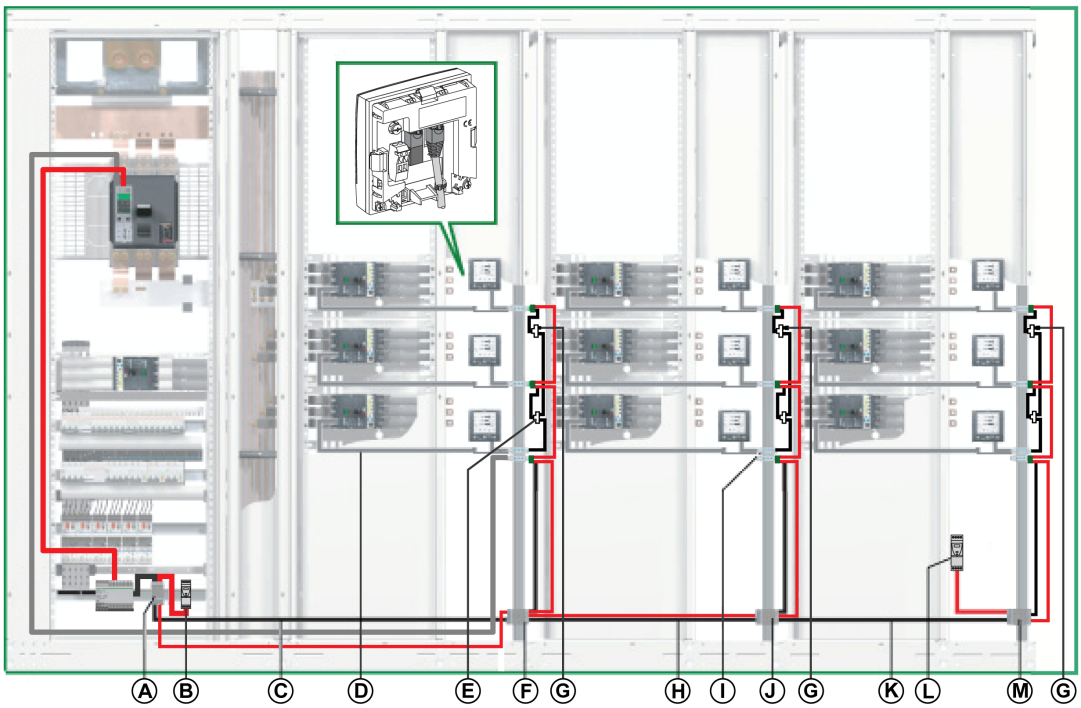
The following table summarizes the maximum Modbus cable lengths for the tap-linked distributed Modbus architecture with a single power supply segment. The Modbus cable under consideration is described in the connection of IFM interface *(see page 112)*.

24 Vdc rating	L0 (in 0.75 mm^2 (18 AWG) wires)	L1	L2	Sum of the L2s (for all tap links)
1 A	5 m (16.4 ft)	45 m (147.6 ft)	10 m (32.8 ft)	40 m (131.2 ft)
3 A	3 m (9.84 ft)	15 m (49.2 ft)	5 m (16.4 ft)	40 m (131.2 ft)

Case of Several Power Supply Segments

When more than one 24 Vdc power supply is needed (see segmented power supply *(see page 47)*), 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 Shunt terminal block on the incoming supply
B 24 Vdc power supply
C Modbus cable running to the first cubicle
D NSX cord
E RJ45 Modbus T-junction
F Shunt terminal block on the incomer of the first cubicle
G Modbus line termination
H Modbus cable running to the second cubicle
I IFM interface
J Shunt terminal block on the incomer of the second cubicle
K Modbus cable running to the third cubicle
L Insertion of an ABL8 power supply
M Shunt terminal block on the incomer of the third cubicle

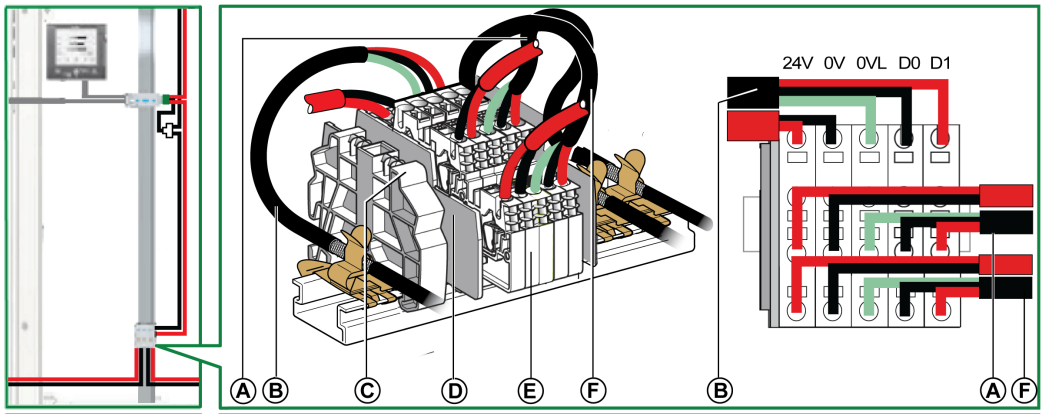
Cable	Description
▬▬	Modbus network
▬▬	ULP network
▬▬	24 Vdc power supply

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 protective ground terminal block offering grounding of the Modbus cable shielding by connection to the DIN rail.

For the shunt terminal block part numbers, see the appropriate component *(see page 88)*.

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

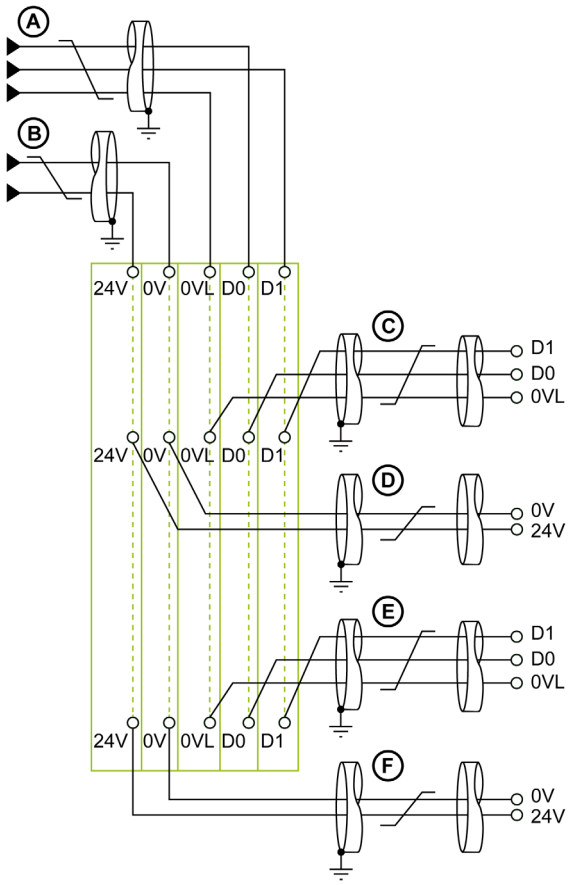


A Modbus cable rising up the second cubicle
B Modbus cable coming from the first cubicle
C Clip-on plastic end stop
D End plate
E Spring terminal block
F Modbus cable running to the third cubicle

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 with diameter adapted to cable type and fixation adapted to 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 with diameter adapted to cable type and fixation adapted to 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



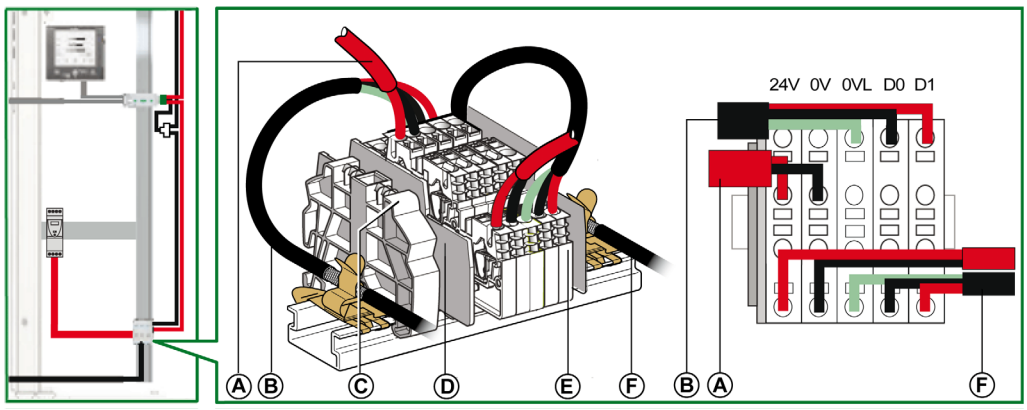
A Modbus cable coming from first cubicle
B 24 Vdc power supply cable coming from first cubicle
C Modbus cable rising up second cubicle
D 24 Vdc power supply cable rising up second cubicle
E Modbus cable running to third cubicle
F 24 Vdc power supply cable running to third cubicle

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 protective 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.

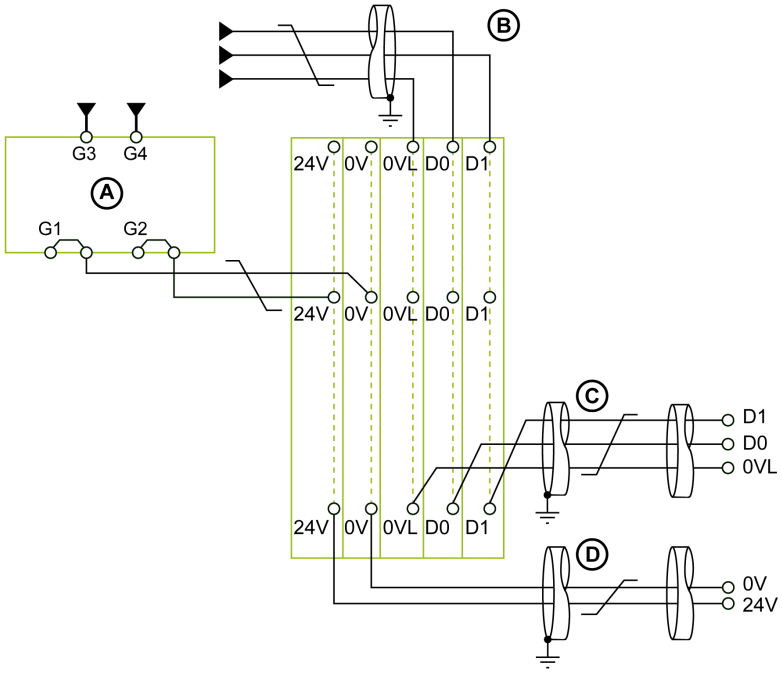


A 24 Vdc power supply
B Modbus cable coming from the shunt terminal block on the incomer of the second cubicle
C Clip-on plastic end stop
D End plate
E Spring terminal block
F Modbus cable rising up the third cubicle

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 with diameter adapted to cable type and fixation adapted to 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 with diameter adapted to cable type and fixation adapted to 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.

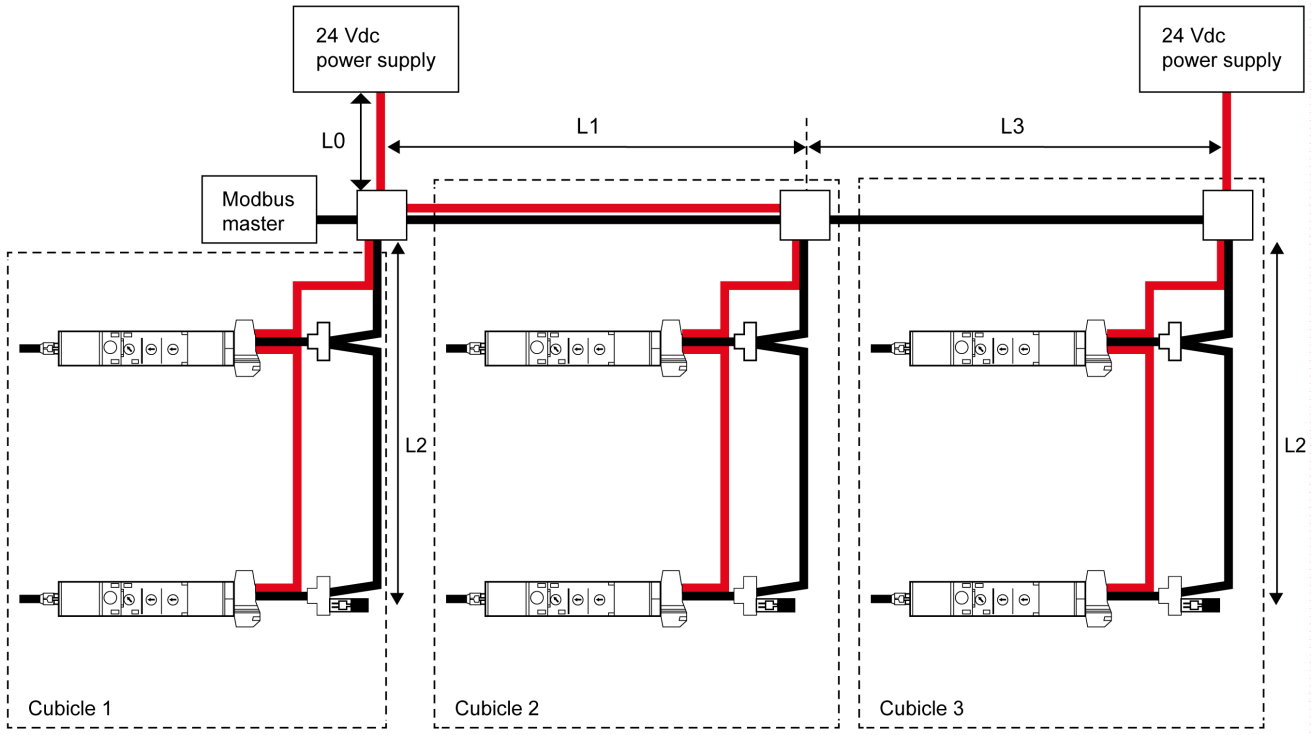
Wiring Diagram of Shunt Terminal Block on the Incomer of the Third Cubicle



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

Modbus Cable Lengths for Several Power Supply Segments

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



Modbus cable L3 ensures continuity of the Modbus signal (D0, D1, and 0 VL) and shield continuity by using brass clamps with diameter adapted to cable type and fixation adapted to the installation (for example, screw or DIN rail).

The power supply is connected to a separate 24 Vdc power supply on the shunt terminal block on the incomer of the third cubicle.

The following table summarizes the maximum Modbus cable lengths for the tap-linked distributed Modbus architecture with several power supply segments. The Modbus cable under consideration is described in the connection of IFM interface *(see page 54)*.

24 Vdc rating	L0 (in 0.75 mm^2 (18 AWG) wires)	L1	L2	Sum of the L2s (for all tap links)	Sum of the L1s, L2s, and L3s (total length)
1 A	5 m (16.4 ft)	35 m (114.8 ft)	10 m (32.8 ft)	40 m (131.2 ft)	500 m (1,640 ft)
3 A	3 m (9.8 ft)	10 m (32.8 ft)	5 m (16.4 ft)	40 m (131.2 ft)	500 m (1,640 ft)

NOTE: The maximum number of power supply segments is 3 segments for a single Modbus network *(see page 47)*.

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

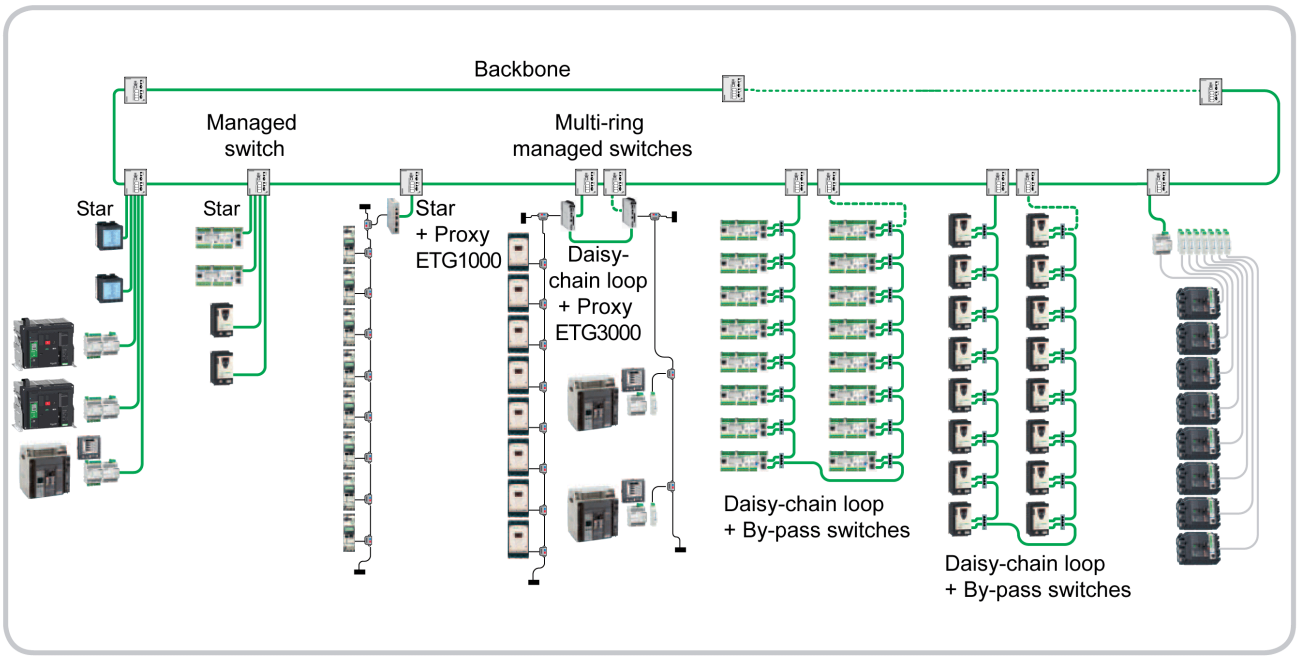
In the case of Ethernet high dependability, the architecture is fault tolerant.

A high dependability Ethernet architecture is based around a fault 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 faults 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 failure 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.

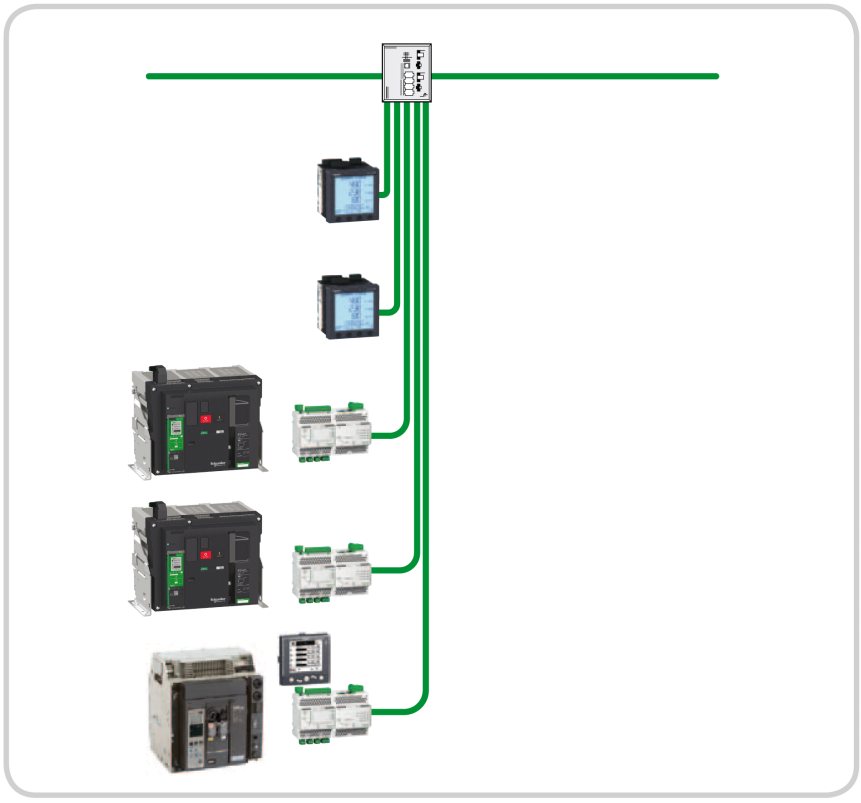
If any device is inoperative, none of the other devices are affected. But if the switch is inoperative, the entire network suffers degraded performance or complete failure.

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 failure. If this occurs, a failure 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:



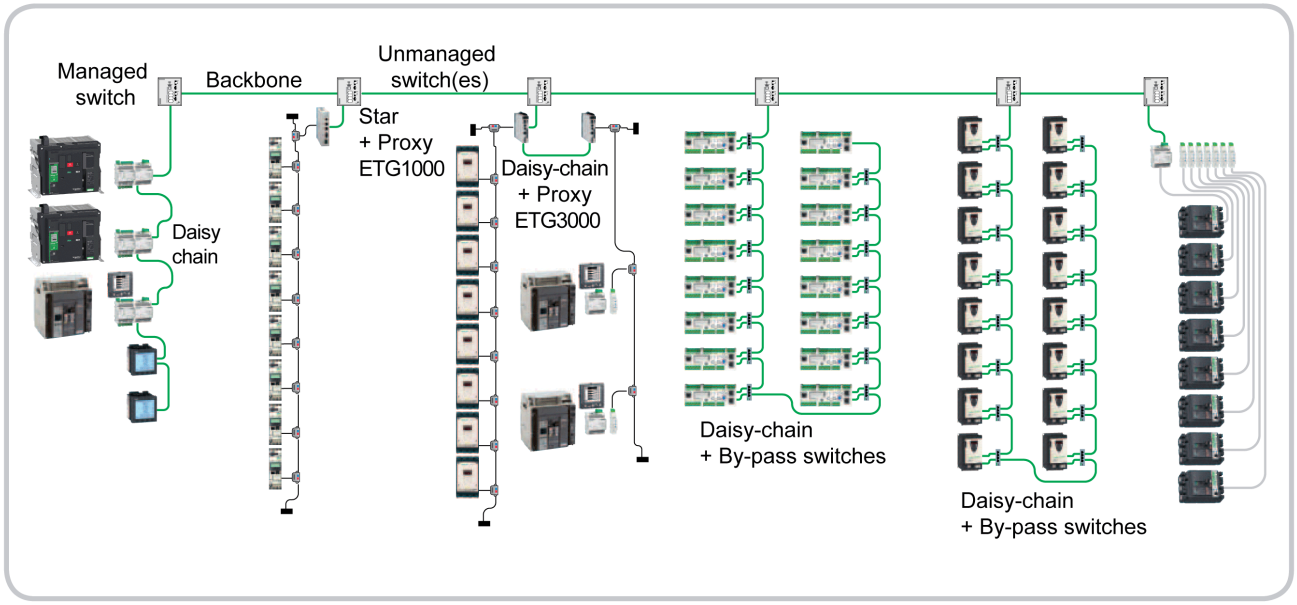
The following table presents the benefits of a star architecture for the user:

User values	Characteristics	Validity in the architecture	Benefit for the user
Dependability	Tolerant to first switch failure	–	✓
	Tolerant to first node failure	✓	
	Tolerant to second node failure	✓	
	Tolerant to several nodes failures	✓	
	One or more common modes	–	
	Additional failure 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.

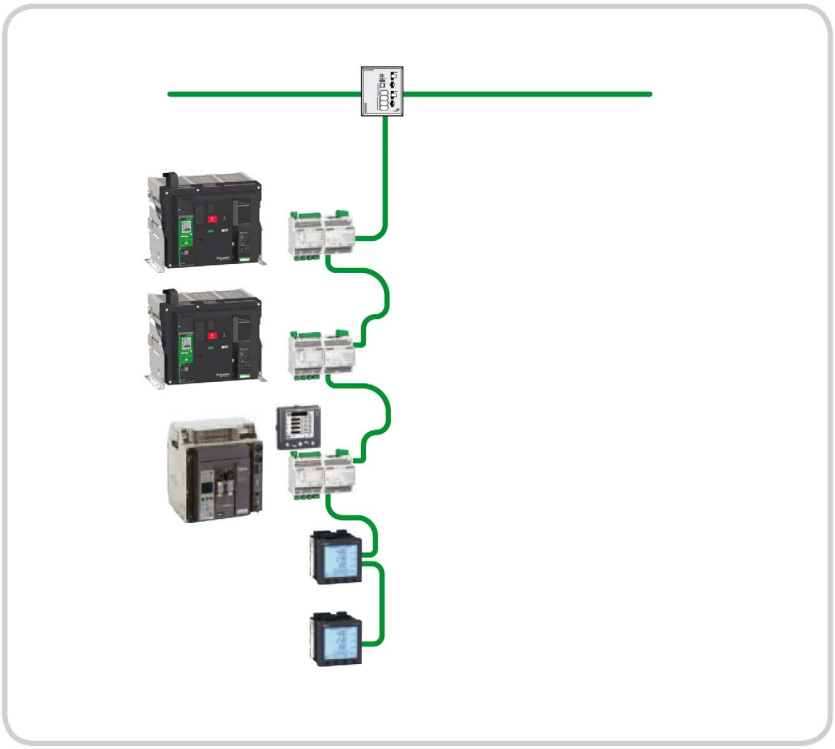
If any device becomes inoperative, or if a cable failure occurs, it will isolate devices that are connected after the failure. The remaining devices (between the switch and the cable failure) continue to operate normally, but they are not able to communicate with the isolated devices.

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

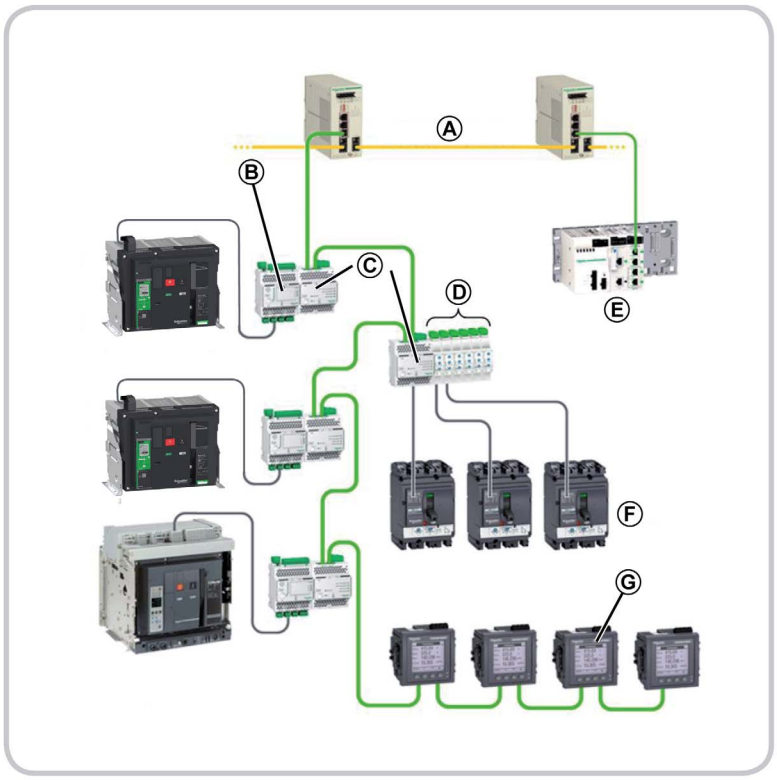
This type of architecture for connecting devices is recommended in the case of competitive global architecture.

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:



The following diagram shows a daisy-chain architecture built using the following devices:
- Three Masterpact circuit breakers connected to an IO module and an IFE interface.
- Seven Compact NSX circuit breakers with one directly connected to the IFE interface and the six others connected to the IFM interface.
- Four power meters PM5560.
- Two unmanaged switches connected to each other via an optical fiber bus backbone.
- One PLC.



A BUS backbone
B IO module
C IFE interface
D IFM interface
E PLC
E Seven Compact NSX circuit breakers
G PowerLogic PM5560 power meter

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 failure	–	–
	Tolerant to first node failure	–	
	Tolerant to second node failure	–	
	Tolerant to several nodes failures	–	
	One or more common modes	–	
	Additional failure modes	–	
Operability	Withdrawability of one functional unit	✓	✓
	Withdrawability of two functional units	✓	
	Withdrawability of several functional units	✓	

Chapter 3
ULP Modules

What Is in This Chapter?

This chapter contains the following sections:

Section 3.1
IFE Ethernet Interfaces for Circuit Breaker

IFE Ethernet Interfaces

Introduction

The IFE interface enables an intelligent modular unit (IMU), for example a fixed Masterpact MTZ, a Masterpact NT/NW, a Compact NS, or a Compact NSX circuit breaker to be connected to an Ethernet network. Each circuit breaker has its own IFE interface and a corresponding IP address.

For installation information, consult the instruction sheet available on the Schneider Electric website: *QGH13473*

For detailed information, refer to *Enerlin'X IFE - Ethernet Interface for One Circuit Breaker - User Guide*.

Types of IFE Interface

There are two part numbers of the IFE interface:

- LV434001 - IFE Ethernet interface for one circuit breaker
  This type of IFE interface is an Ethernet interface for Compact, PowerPact, and Masterpact circuit breakers.
  NOTE: The IFE interface with part number LV434001 completely replaces the IFE interface with part number LV434010. The LV434001 interface comes with the real time clock (RTC) feature and allows ULP connections up to 20 m with the Masterpact MTZ circuit breakers (LV434010 had a theoretical limitation of 5 m over the life of the IFE interface).
- LV434002 - IFE Ethernet switchboard server
  This type of IFE interface is an Ethernet interface for Compact, PowerPact, and Masterpact circuit breakers and a server for Modbus-SL (serial line) connected devices.
  NOTE: The IFE server with part number LV434002 completely replaces the IFE server with part number LV434011. The LV434002 server comes with the real time clock (RTC) feature and allows ULP connections up to 20 m with the Masterpact MTZ circuit breakers (LV434011 server had a theoretical limitation of 5 m over the life of the IFE interface).

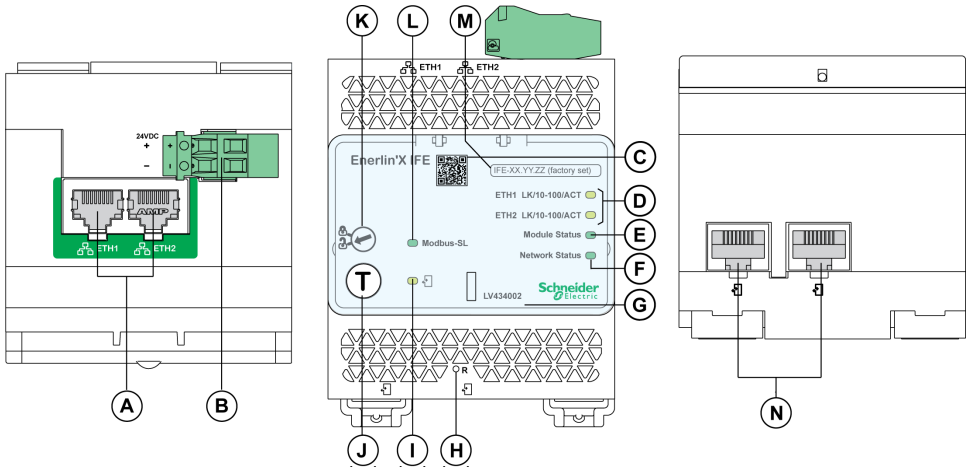
IFE Interface Features

The main features of IFE interface are:

- Dual Ethernet port for simple daisy chain connection
- Device profile web service for discovery of the IFE interface on the local area network (LAN)
- ULP compliant for location of the IFE interface in the electrical equipment
- Ethernet interface for Compact, PowerPact, and Masterpact circuit breakers
- Server for Modbus-SL connected devices (only for the IFE server with the part number LV434002)
- Embedded setup webpages
- Embedded monitoring webpages
- Embedded control webpages
- Built-in email alarm notification for circuit breaker connected to IFE interface

NOTE: The built-in switch of IFE interface does not support the ring topology as it does not have the feature of the loop back protection.

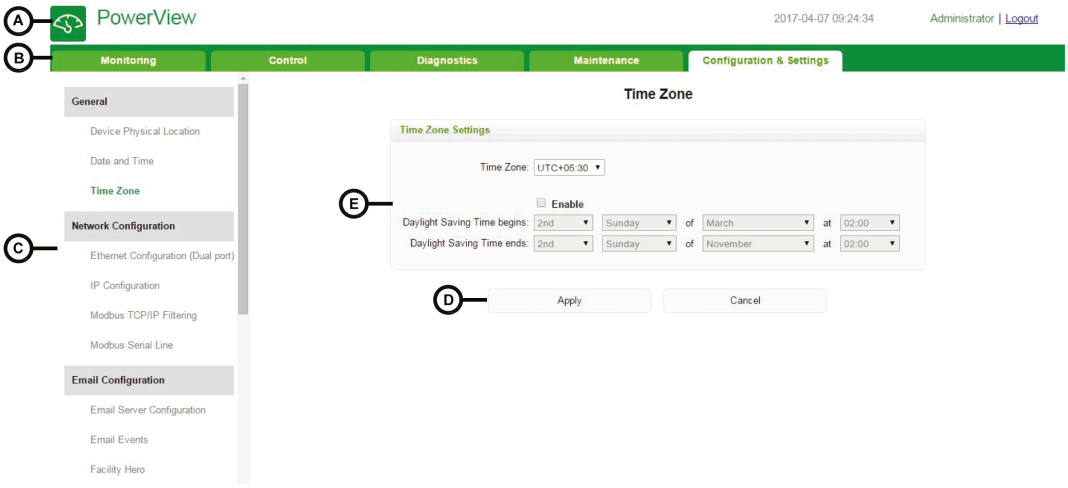
Hardware Description



A Ethernet 1 and Ethernet 2 RJ45 communication ports
B 24 Vdc power supply terminal block
C QR code to product information
D Ethernet communication LEDs
E Module status LED
F Network status LED
G Sealable transparent cover
H Reset button
I ULP status LED
J Test button (accessible even with cover closed)
K Locking pad
L Modbus traffic status LED (IFE server only)
M Device name label
N Two RJ45 ULP ports

IFE Interface Web Server Interface Layout

This graphic shows the user interface layout of the IFE interface.



A Banner
B Menu tabs
C Subtabs
D Action button
E Display zone

Monitoring Webpage

Monitoring submenu	Webpage	Description
Real Time Data	**Single Device Pages**	The single device pages provide basic readings of the selected devices.
	Summary Device Pages	The summary device pages provide summaries of one or more selected devices.
	Trending	The trending page view provides real-time graphic and table trending of common topics across multiple devices.
Device Logging	**Single Device Pages**	The single device pages provide the graphic and table trending logs of user-selectable quantities for selected devices.
	Summary Device Pages	The summary device pages provide graphic trending logs of multiple devices with a common topic.

Control Webpage

Control submenu	Webpage	Description
Device Control	**Device Control**	Resets and controls the connected slave devices.
Set Device Time	**Set Device Time**	Sets the slave device time to synchronize with the IFE time and displays the slave device time of the selected device.

Diagnostics Webpage

Diagnostics submenu	Webpage	Description
General	**Statistics**	Displays diagnostic data used to troubleshoot the network-related problems.
Product Information	**Device Identification**	• Displays the IFE basic information to set the IFE device name and helps in the device physical location. • Contains information about the product name, serial number, model number, firmware version, unique identifier, MAC address, IPv4 address, and IPv6 link local address.
	IMU Information	Displays the list of the IMU devices connected to the ULP port.
Device Health Check	**Read Device Registers**	Displays register data connected locally to the IFE interface.
	Communication Check	Verifies the communications health of all the slave devices connected to IFE interface.
IO Readings	**IO Readings**	Displays the status of ULP IO module of the selected device. Displays **No IO modules connected** if the selected device is not connected to a IO module. NOTE: **ULP IO Module** refers to the slave device name defined in the **Device List** page.

Maintenance Webpage

Maintenance submenu	Webpage	Description
Indicators	**Indicators**	Displays the maintenance counters of the connected ULP devices.

Configuration & Settings Webpage

Configuration & settings submenu	Webpage	Description
General	**Device Physical Location**	• Locate the device IFE-XXYYZZ • Click **Blink ON**. • The ULP LED of the selected device IFE-XXYYZZ blinks and is active for 15 s (Test mode: 1 s ON, 1 s OFF).
	Date and Time	Sets the date and time manually or sets the IFE time automatically using an SNTP source or configures the slave device connected to IFE interface to synchronize their time with the IFE time automatically.
	Time Zone	Configures the time zone for the region and sets the daylight saving time.
Network Configuration	**Ethernet Configuration (Dual port)**	Configures the Ethernet.
	IP Configuration	Configures the IP parameters.
	Modbus TCP/IP Filtering	Configures the maximum number of Modbus TCP/IP server connections. Configures the IP addresses that can access the IFE interface through Modbus TCP/IP.
	Modbus Serial Line	Configures serial communication parameters.
Email Configuration	**Email Server Configuration**	Configures the alarms to be emailed. Configures the SMTP parameter for mailing purpose.
	Email Events	Configures the alarms to be sent through email.
	Facility Expert	Configures the SMTP server automatically when you enable the Facility Expert and sends alarms to the Facility Expert notification center.
Device Configuration	**Device List**	Configures local serial devices on the Modbus serial daisy chain and IMU core product connected to the ULP port of the IFE interface.
	Device Logging	Configures device logging parameters.
	Device Log Export	Configures device logging export options.
Other Configuration	**SNMP Parameters**	Configures Simple Network Management Protocol (SNMP).
	Preferences	Configures IFE preferences.
	Advanced Services Control	Configures the advanced service control parameters.
	User Account	Creates and edits groups and users. Configures email accounts.
	Webpage Access	Configures webpage access rights for each user group.

Section 3.2
EIFE Embedded Ethernet Interface for One Masterpact MTZ Drawout Circuit Breaker

EIFE Embedded Ethernet Interface for One Masterpact MTZ Drawout Circuit Breaker

Introduction

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 of the Masterpact MTZ circuit breaker. It provides information about the intelligent modular unit (IMU) system. In addition, it monitors the three positions of the circuit breaker when inserted in its cradle:

- Cradle connected
- Cradle disconnected
- Cradle in test position

For installation information, consult the instruction sheet available on the Schneider Electric website: *NVE23550*

For detailed information, refer to *Enerlin'X EIFE - Embedded Ethernet Interface for One Masterpact MTZ Drawout Circuit Breaker - User Guide*.

Type of EIFE

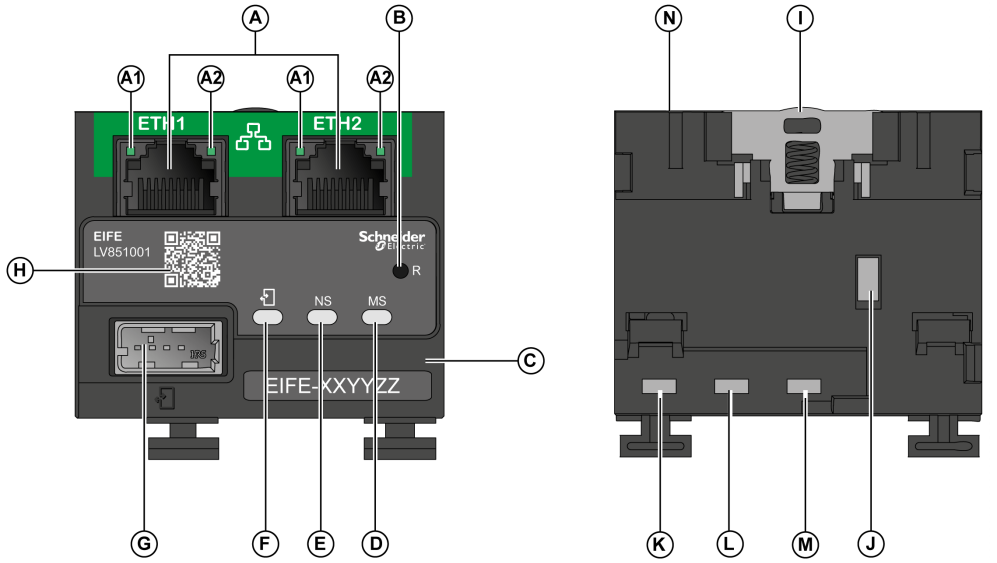
The part number of the EIFE interface is LV851001.

EIFE Interface Features

The main features of EIFE interface are:

- Dual 10/100 Mbps Ethernet port for simple daisy chain connection.
- Device profile Web service for discovery of the EIFE interface on the local area network (LAN).
- Ethernet interface for Masterpact MTZ drawout circuit breakers.
- Embedded setup webpages.
- Embedded monitoring webpages.
- Embedded control webpages.
- Cradle status management (CE, CD, and CT).
- Built-in email alarm notification.
- Network time management (SNTP).

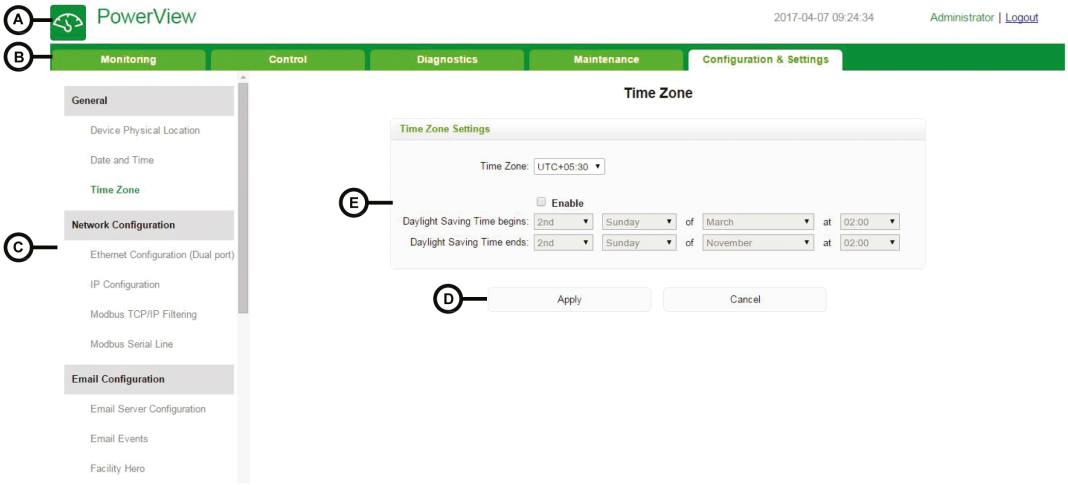
Hardware Description



A Two RJ45 Ethernet ports
A1 OFF: 10 Mbps
Steady green: 100 Mbps
A2 Steady green: link
Blinking green: activity
B IP reset button
C Device identification label
D Module status LED
E Network status LED
F ULP status LED
G USB mode ULP port
H QR code to product information
I DIN clip
J Grounding connection
K CT limit switch
L CE limit switch
M CD limit switch
N MAC ID

EIFE Interface Web Server Interface Layout

This graphic shows the user interface layout of the EIFE interface.



A Banner
B Menu tabs
C Subtabs
D Action button
E Display zone

Monitoring Webpage

Monitoring submenu	Webpage	Description
Real Time Data	**Single Device Pages**	The single device pages provide basic readings of the Masterpact MTZ drawout circuit breaker.
	Summary Device Pages	The summary device pages provide summaries of the Masterpact MTZ drawout circuit breaker.
	Trending	The trending page view provides real-time graphic and table trending of common topics across multiple devices.
Device Logging	**Single Device Pages**	The single device pages provide the graphic and table trending logs of user-selectable quantities for the Masterpact MTZ drawout circuit breaker.
	Summary Device Pages	The summary device pages provide graphic trending logs of Masterpact MTZ drawout circuit breaker with a common topic.

Control Webpage

Control submenu	Webpage	Description
Device Control	**Device Control**	Resets and controls the Masterpact MTZ drawout circuit breaker.
Set Device Time	**Set Device Time**	Sets the Masterpact MTZ drawout circuit breaker time to synchronize with the EIFE time and displays the Masterpact MTZ drawout circuit breaker time.

Diagnostics Webpage

Diagnostics submenu	Webpage	Description
General	**Statistics**	Displays diagnostic data used to troubleshoot the network-related problems.
Product Information	**Device Identification**	• Displays the EIFE basic information to set the EIFE device name and helps in the device physical location. • Contains information about the product name, serial number, model number, firmware version, unique identifier, MAC address, IPv4 address, and IPv6 link local address.
	IMU Information	Displays the list of the IMU devices connected to the ULP port.
Device Health Check	**Read Device Registers**	Displays register data connected locally to the EIFE interface.
	Communication Check	Verifies the communications health of the Masterpact MTZ drawout circuit breaker connected to EIFE interface.
IO Readings	**IO Readings**	Displays the status of ULP IO module of the Masterpact MTZ drawout circuit breaker. Displays **No IO modules connected** if the Masterpact MTZ drawout circuit breaker is not connected to a IO module. **NOTE: ULP IO Module** refers to the Masterpact MTZ drawout circuit breaker name defined in the **Device List** page.

Maintenance Webpage

Maintenance submenu	Webpage	Description
Indicators	**Indicators**	Displays the maintenance counters of the Masterpact MTZ drawout circuit breaker.

Configuration & Settings Webpage

Configuration & settings submenu	Webpage	Description
General	**Device Physical Location**	• Locate the device EIFE-XXYYZZ • Click **Blink ON**. • The ULP LED of the selected device EIFE-XXYYZZ blinks and is active for 15 s (Test mode: 1 s ON, 1 s OFF).
	Date and Time	Sets the date and time manually or sets the EIFE time automatically using an SNTP source or configures the ULP devices connected to EIFE interface to synchronize their time with the EIFE time automatically.
	Time Zone	Configures the time zone for the region and sets the daylight saving time.
Network Configuration	**Ethernet Configuration (Dual port)**	Configures the Ethernet.
	IP Configuration	Configures the IP parameters.
	Modbus TCP/IP Filtering	Configures the maximum number of Modbus TCP/IP server connections. Configures the IP addresses that can access the EIFE interface through Modbus TCP/IP.
Email Configuration	**Email Server Configuration**	Configures the alarms to be emailed. Configures the SMTP parameter for mailing purpose.
	Email Events	Configures the alarms to be sent through email.
	Facility Hero	Configures the SMTP server automatically when you enable the Facility Hero and sends alarms to the Facility Hero notification center.
Device Configuration	**Device List**	Configures Masterpact MTZ drawout circuit breaker connected to the ULP port of the EIFE interface.
	Device Logging	Configures device logging parameters.
	Device Log Export	Configures device logging export options.
Other Configuration	**SNMP Parameters**	Configures Simple Network Management Protocol (SNMP).
	Preferences	Configures EIFE preferences.
	Advanced Services Control	Configures the advanced service control parameters.
	User Account	Creates and edits groups and users. Configures email accounts.
	Webpage Access	Configures webpage access rights for each user group.

Section 3.3
IFM Modbus-SL Interface for One Circuit Breaker

IFM Modbus-SL Interface for One Circuit Breaker

Introduction

The IFM Modbus-SL interface for one circuit breaker enables an intelligent modular unit with a Compact NSX, Compact NS, Masterpact NT/NW, or Masterpact MTZ circuit breaker, to be connected to a 2-wire Modbus-SL network. Each IMU has its own IFM interface and a corresponding Modbus address.

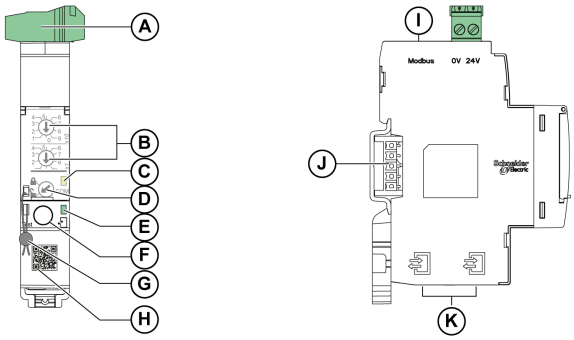
For installation information, consult the instruction sheet available on the Schneider Electric website: *NVE85393*

Type of IFM Interface

The IFM interface with Modbus-SL RJ45 port (part number LV434000) replaces the IFM Modbus-SL interface with 5-pin connector (part number TRV00210).

The recommendations for installation and wiring of the IFM interface with part number TRV00210 are described in the appendix *(see page 147)*.

Hardware Description



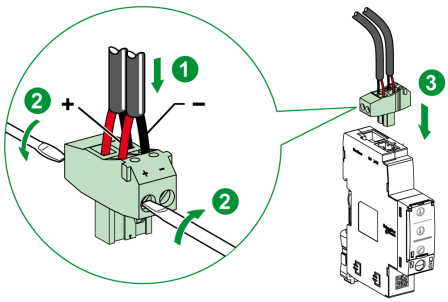
A 24 Vdc power supply terminal block
B Modbus address rotary switches
C Modbus traffic status LED
- yellow: transmission and reception of the Modbus messages in progress
- off: no Modbus traffic

D Modbus locking pad
E ULP status LED
F Test button
G Mechanical lock
H QR code to product information
I Modbus-SL RJ45 port
J Stacking accessory connection (TRV00217, optional)
K Two RJ45 ULP ports

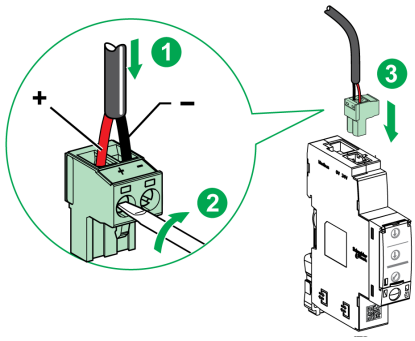
24 Vdc Power Supply

Use one of the two following 24 Vdc power supply terminal block to supply the IFM interface with power:

- The standard terminal block delivered with the IFM interface allows its supply either in daisy-chain or in star connection.



- The compact terminal block (MSTB 2,5/ 2-ST-5,08 from Phoenix Contact or equivalent) can be used to supply the IFM interface in star connection only.



Modbus Address Rotary Switches

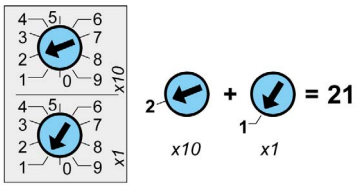
The IFM interface bears the Modbus address of the intelligent modular unit to which it is connected.

The user defines the Modbus address by using the two address rotary switches on the front panel of the IFM interface.

The address range is 1 to 99. Value 0 is forbidden because it is reserved for broadcasting commands.

The IFM interface is initially configured with address 99.

Example of the configuration of the address rotary switches for address 21:



NOTE: When the IFM interface is connected to a BCM ULP circuit breaker communication module, the Modbus address range is limited from 1 to 47.
Furthermore, do not use the addresses x+50, x+100, x+200 for any other Modbus slaves connected on the same Modbus network. For example, if the IFM interface is set at the Modbus address 22, therefore do not set any other Modbus slaves at the address 72 or 122 or 222.

Modbus Traffic Status LED

The Modbus traffic status LED informs the user about the traffic transmitted or received by the IMU over the Modbus network.

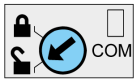
- When the Modbus address rotary switches are on value 0, the yellow LED is steady ON.
- When the Modbus address rotary switches are on value anywhere between 1 and 99, the yellow LED is ON during the transmission and reception of messages, OFF otherwise.

NOTE: When the IFM interface is connected to a BCM ULP module, the LED is steady ON if the Modbus address rotary switches are on value above 47.

Modbus Locking Pad

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

- If the arrow points to the open padlock (factory setting), remote control commands are enabled.



- If the arrow points to the closed padlock, remote control commands are disabled.

The only remote control commands that are enabled even if the arrow points to the closed padlock are the Set Absolute Time and Get Current Time commands.
For more information about these commands, refer to *Masterpact NT/NW, Compact NS - Modbus Communication Guide*.

NOTE: For IFM interface slaves connected to an IFE Ethernet switchboard server, the locking pad of the IFE interface does not disable the remote control commands in IFM interface.

Test Button

The test button tests the connection between all the ULP modules connected to the IFM interface.

Pressing the test button launches the connection test for 15 seconds.

During the test, all the ULP modules keep working normally.

Configuration

Configure the IFM interface in one of two ways:

- Automatic configuration (**Auto-Speed sensing** On): When a Modbus master is communicating on the Modbus communication network, the IFM interface automatically detects the speed and parity of the Modbus connection (default configuration).
- Custom configuration: By deactivating the IFM interface **Auto-Speed sensing** option with Ecoreach software *(see page 28)*, the user can customize the speed and parity of the Modbus connection.

Automatic Configuration

The user defines the Modbus address for the IFM interface with the two address switches. When the IFM interface is connected to the Modbus network, it automatically detects the connection parameters. The **Auto-Speed sensing** algorithm automatically tests the possible speeds and parities and detects the speed and parity of the connection.

The transmission format is related to the parity:

- The transmission format is binary with one start bit, eight data bits, one stop bit in the case of even or odd parity.
- The transmission format is two stop bits if there is no parity.

Custom Configuration

Use the two address switches to define the Modbus address for the IFM interface.

The user can customize the communication parameters with Ecoreach software.

- The supported speeds are 4800, 9600, 19,200, and 38,400 Baud.
- The supported parities are even, odd, and no parity.

NOTE: The Modbus address and locking pad status cannot be modified with Ecoreach software.

Section 3.4
IO Input/Output Application Module for One Circuit Breaker

IO Input/Output Application Module for One Circuit Breaker

Introduction

The IO module is part of an ULP system with built-in functionalities and applications.

The IO module is a component of the ULP system and is compliant with the ULP system specifications.

The ranges of circuit breakers compatible with the IO module are:
- Masterpact MTZ1 circuit breaker
- Masterpact MTZ2 circuit breaker
- Masterpact MTZ3 circuit breaker
- Masterpact NW circuit breaker
- Masterpact NT circuit breaker
- Compact NS 1600b-3200 circuit breaker
- Compact NS 630b-1600 circuit breaker
- Compact NSX circuit breaker

For installation information, consult the instruction sheet available on the Schneider Electric website: *HRB49217*

For detailed information, refer to *Enerlin'X IO - Input/Output Application Module for One Circuit Breaker - User Guide*.

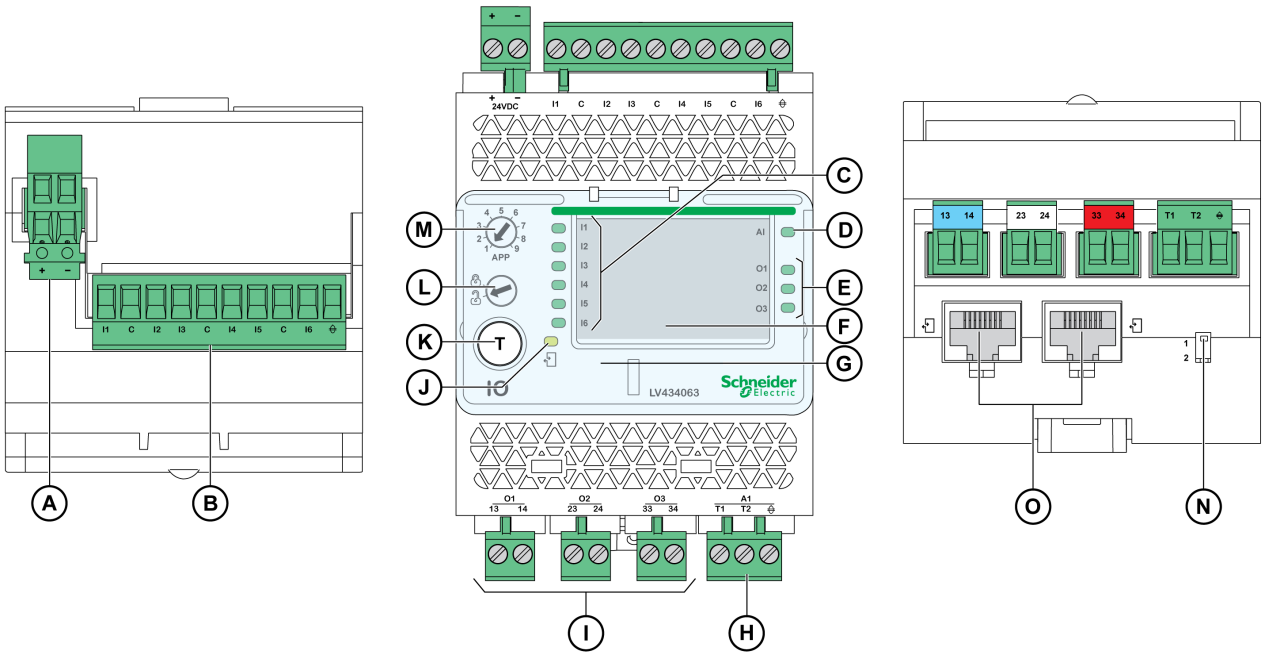
Type of IO Module

The IO module part number is LV434063.

IO Module Resources

The IO module resources are:
- Six digital inputs that are self-powered for either NO or NC dry contact or pulse counter.
- Three digital outputs that are bistable relays (5 A maximum).
- One analog input for Pt100 temperature sensor.

Hardware Description



A 24 Vdc power supply terminal block
B Digital input terminal block: six inputs, three commons, and one shield
C Six input status LEDs
D Analog input status LED
E Three output status LEDs
F I/O identification labels
G Sealable transparent cover
H Analog input terminal block
I Digital output terminal block
J ULP status LED
K Test/reset button (accessible with cover closed)
L Setting locking pad
M Application rotary switch: 1 to 9
N Switch for IO module addressing (IO module 1 or IO module 2)
O Two RJ45 ULP ports

Predefined Applications

Predefined applications add new functions to the intelligent modular unit (IMU):

- Selection by the application rotary switch on the IO module, defining the application with a predefined input/output assignment and wiring diagram.
- No additional setting by the customer is required.

The resources not assigned to the predefined application are available for additional user-defined applications.

List of Predefined Applications

Application rotary switch position	Predefined application	Description
1	Cradle management	Monitors the position of the circuit breaker in the cradle.
2	Circuit breaker operation	Controls the opening and closing of the circuit breaker by using the control mode (local or remote) and the inhibit close order.
3	Cradle management and Energy Reduction Maintenance Setting (ERMS)	Monitors the position of the circuit breaker in the cradle and monitors the position of inputs and controls the ERMS mode of the circuit breaker.
4	Light and load control	Controls the light and load application.
5–8	Spare	–
9	Custom	Performs the user-defined applications with the IO module.

User-Defined Applications

User-defined applications are processed by the IO module in addition to the predefined applications selected.

The user-defined applications are available depending on:
- the predefined applications selected.
- the IO module resources (inputs and outputs) not used by the application.

The resources required by user-defined applications are assigned using Ecoreach software *(see page 28)*.

List of User-Defined Applications

The following table provides the list of user-defined applications available according to the predefined applications selected with the application rotary switch on the IO module.

Function	User-defined applications	Predefined application selected									
		1	2	3	4	5	6	7	8	9 (IO1)	9 (IO2)
Protection	Energy Reduction Maintenance Settings (ERMS)	✓	–	–	✓	–	–	–	–	✓	✓
	Dual Settings	✓	–	✓	✓	–	–	–	–	✓	✓
Control	Enable/inhibit close order	✓	–	✓	✓	–	–	–	–	✓	✓
	User-defined output	✓	✓	✓	✓	–	–	–	–	✓	✓
Energy Management	Energy counter reset	✓	–	✓	✓	–	–	–	–	✓	✓
	User-defined pulse counters	✓	–	✓	✓	–	–	–	–	✓	✓
Monitoring	Cradle management	✓	–	✓	–	–	–	–	–	–	✓
	Drawer management	–	–	–	–	–	–	–	–	✓	✓
	Cooling system	✓	–	✓	✓	–	–	–	–	✓	✓
	Predefined input acquisition	✓	–	✓	✓	–	–	–	–	✓	✓
	User-defined input acquisition	✓	–	✓	✓	–	–	–	–	✓	✓
	Input indicator	✓	✓	✓	✓	–	–	–	–	✓	✓
	Threshold overrun of input counter indicator	✓	✓	✓	✓	–	–	–	–	✓	✓
	Breaker status indicator	✓	✓	✓	✓	–	–	–	–	✓	✓
	Maintenance indicator	✓	✓	✓	✓	–	–	–	–	✓	✓
	Trip indicator	✓	✓	✓	✓	–	–	–	–	✓	✓
	Pre-alarm indicator	✓	✓	✓	✓	–	–	–	–	✓	✓
	User-defined alarm indicator	✓	✓	✓	✓	–	–	–	–	✓	✓
	Multi-event group indicator	✓	✓	–	✓	–	–	–	–	✓	✓

✓ = user-defined application available
– = user-defined application not available

Section 3.5
FDM121 ULP Display for One Circuit Breaker

FDM121 ULP Display for One Circuit Breaker

Introduction

The FDM121 ULP display for one circuit breaker unit displays the measurements, alarms, and operating assistance data from the intelligent modular unit. The FDM121 display can control:

- the circuit breaker equipped with a motor mechanism, or
- pre-defined applications performed by an IO module.

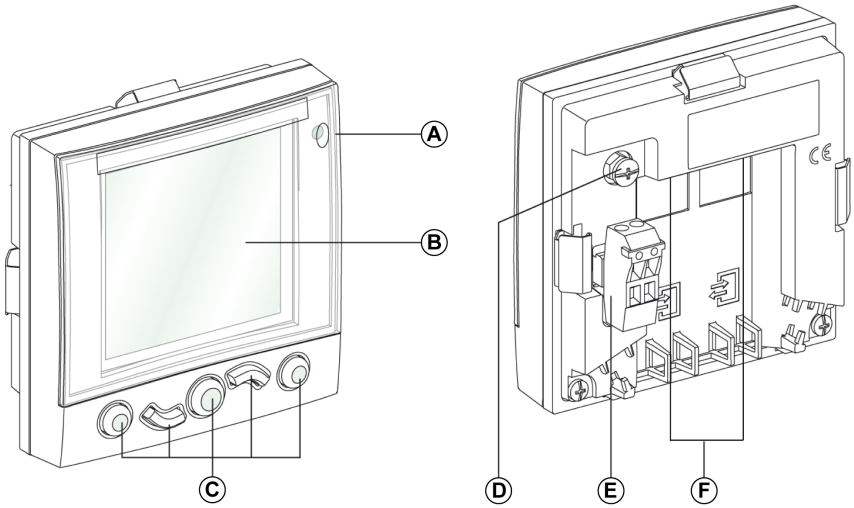
For installation information, consult the instruction sheet available on the Schneider Electric website: *GHD16275AA*

For detailed information, refer to the *FDM121 ULP Display for One Circuit Breaker User Guide*.

Hardware Compatibility

The FDM121 display is not compatible with Masterpact MTZ circuit breakers.

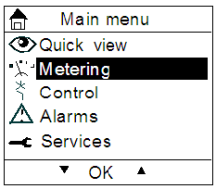
Hardware Description



A Alarm Indicator LED
B LCD screen
C Navigation keys
D Functional ground
E 24 Vdc power supply terminal block
F Two RJ45 ULP ports

Main Menu

The **Main menu** offers five menus for monitoring and using the ULP system IMUs.



The description and content of the menus depend on the IMU. For more information, refer to the documentation for the device connected to the FDM121 display.

For example, if you have an FDM121 display connected to a Compact NSX, refer to the *Micrologic 5 and 6 Trip Units User Guide*.

The menus available in the **Main menu** are as follows:

Menu	Description
Quick view	**Quick view** menu The **Quick view** menu provides quick access to the information essential for operation.
Metering	**Metering** menu The **Metering** menu displays the data made available by the Micrologic trip unit: ● Current, voltage, power, energy, and harmonic distortion measurements ● Minimum and maximum metering values
Control	**Control** menu The **Control** menu is used to control a circuit breaker equipped with a communicating motor mechanism from the FDM121 display. The proposed commands are: ● Circuit breaker opening ● Circuit breaker closing with or without self-timer ● Circuit breaker reset after trip ● IO module lighting control ● IO module load control
Alarms	**Alarms** menu The **Alarms** menu is used to display: ● The event log file for the last 40 events and alarms detected by the devices connected to the FDM121 display since the last power-up of the FDM121 display. ● The alarm history (for example, alarms, trips, maintenance, and control status) for the device connected to the FDM121 display.
Services	**Services** menu The **Services** menu contains all the FDM121 display setup functions and the operating assistance information: ● Reset (peak demand values, energy meters) ● Setup (display module date and time, parameters) ● Maintenance (operation counters, load profile) ● Product version (identification of the IMUs) ● Language (choice of language display) ● Monitoring and controlling the IO modules (IO status, forcing command, and counters) ● Setup of the IP address of the IFE Ethernet interface for one circuit breaker

Section 3.6
UTA Maintenance Module

What Is in This Section?

This section contains the following topics:

Presentation of the UTA Maintenance Module

Introduction

The UTA maintenance module is used to test and maintain the ULP modules and their accessories.

The UTA maintenance module is connected to the IMU by:

- Connection to the test port on the Micrologic trip unit in Compact NSX circuit breakers, which allows connection on the front of the electrical equipment.
- ULP connection, where the UTA module connects to a ULP port on one of the ULP modules of the IMU.

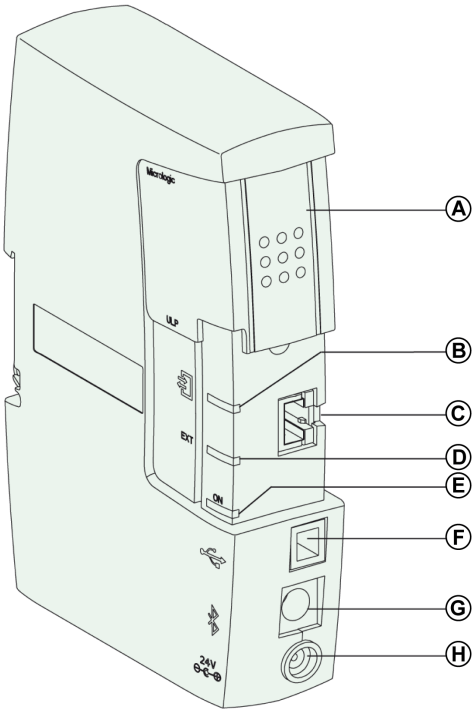
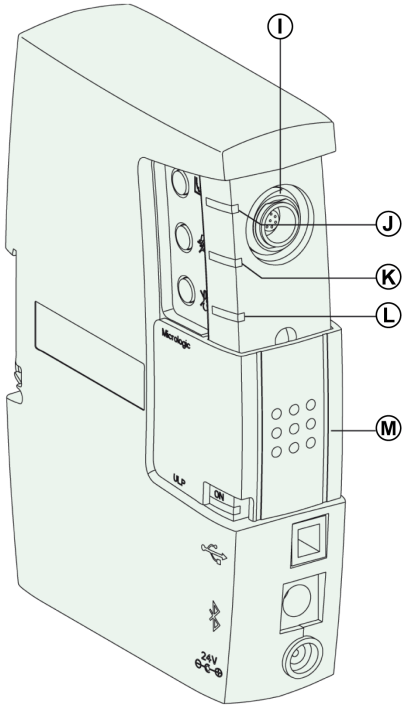
For installation information, consult the instruction sheet available on the Schneider Electric website: *GHD16349AA*

Hardware Compatibility

The UTA maintenance module is not compatible with Masterpact MTZ circuit breakers.

Hardware Description

The following table describes the two types of connection for the UTA module, depending on the position of the sliding mechanical cap.

ULP connection	Connection to the test port on the Micrologic trip unit
	
A Sliding mechanical cap in ULP position **B** ULP communication LED **C** RJ45 ULP port **D** LED indicating that the 24 Vdc external power supply is not connected **E** **ON** LED **F** USB connector **G** Bluetooth adapter connector **H** 24 Vdc external power supply unit input	**I** Connection socket for special cable connecting UTA module to test port on Micrologic trip unit **J** Electrical push-to-trip **Test** button and LED indicator **K** Inhibit ground fault protection button and LED indicator **L** Inhibit thermal memory button and LED indicator **M** Sliding mechanical cap in test position

Operating Modes

The UTA module operates in either of two modes:

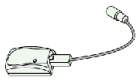
- In offline mode (not connected to a computer), the UTA module connects to the test port on the Micrologic trip unit and as such can be used to perform:
  - Tripping tests
  - The inhibit functions required for tripping tests by primary current injection
- In online mode (connected to a computer with USB or Bluetooth) with LTU (Local Test Utility) and RSU (Remote Setting Utility) software, the UTA module can be used to perform the following actions:
  - Set the protection parameters (RSU)
  - Display the protection parameters (RSU and LTU)
  - Set the alarm parameters (RSU)
  - Display the alarm parameters (RSU and LTU)
  - Display the settings curves (RSU and LTU)
  - Simulate alarms and tripping on the Compact NSX circuit breaker (LTU)
  - Check discrimination and the ZSI (Zone Selective Interlocking) function (LTU)
  - Store all the operating data and maintenance tests in a dedicated file for each Compact NSX circuit breaker (LTU)
  - Set the IFM Modbus-SL interface for one circuit breaker parameters (RSU)
  - Upgrade the firmware in the ULP modules (RSU)
  - Reset passwords associated with the IMU (RSU)

NOTE: The LTU software only works with a connection to the test port on the Micrologic trip unit. The RSU software works with both types of connection.
For more information about the RSU and LTU software, refer to the *RSU and LTU Online Helps*.

Bluetooth Option

If desired, the user can order the optional Bluetooth connection.

The Bluetooth option consists of a Bluetooth module which connects to the UTA module. The Bluetooth key for the computer is not supplied.



Part Numbers

The following table lists the part numbers for the components in the maintenance kit:

Product	Description	Part number
Maintenance kit	Case, UTA module, external power supply unit, and associated cables	TRV00910
UTA module	–	TRV00911
24 Vdc power supply for UTA module	–	TRV00915
Micrologic test cable	Cable for connecting the UTA module to the test port on the Micrologic trip unit	TRV00917
Bluetooth option	Bluetooth module for connection to the UTA module	VW3A8114

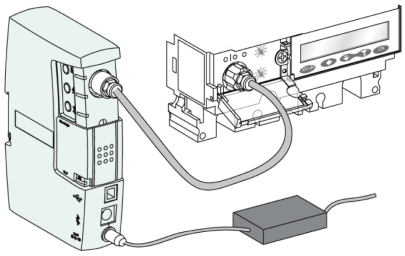
Connection to the Test Port on the Micrologic Trip Unit in Compact NSX Circuit Breakers

Introduction

Connect the UTA maintenance module to the test port on the Compact NSX Micrologic trip unit by using the test cable supplied in the maintenance kit. Place the sliding mechanical cap of the UTA module in the Micrologic position.

Connection in Offline Mode

In offline mode, the UTA module is not connected to a computer. The UTA module is connected to the test port on the Compact NSX Micrologic trip unit and must be powered by the 24 Vdc external power supply unit provided in the maintenance kit.



In offline mode, the UTA module can be used to perform the Compact NSX circuit breaker tripping tests and the inhibit ground fault protection and thermal memory tests. For more information on these three functions, see the test functions *(see page 125)*.

Connection to a Computer

The UTA module connected to a computer can carry out the complete range of checks, tests, and adjustments on the IMUs by using Ecoreach software *(see page 28)*.

There are two possible configurations for connecting the UTA module to a computer:

- By using the USB port
- By using the Bluetooth option

Connection to the ULP System

Introduction

⚠ WARNING

RISK OF ELECTROCUTION, ELECTRIC ARC OR BURNS

Do not connect the internal Modbus network of the electrical equipment to an external Modbus network without inserting an isolation barrier.

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

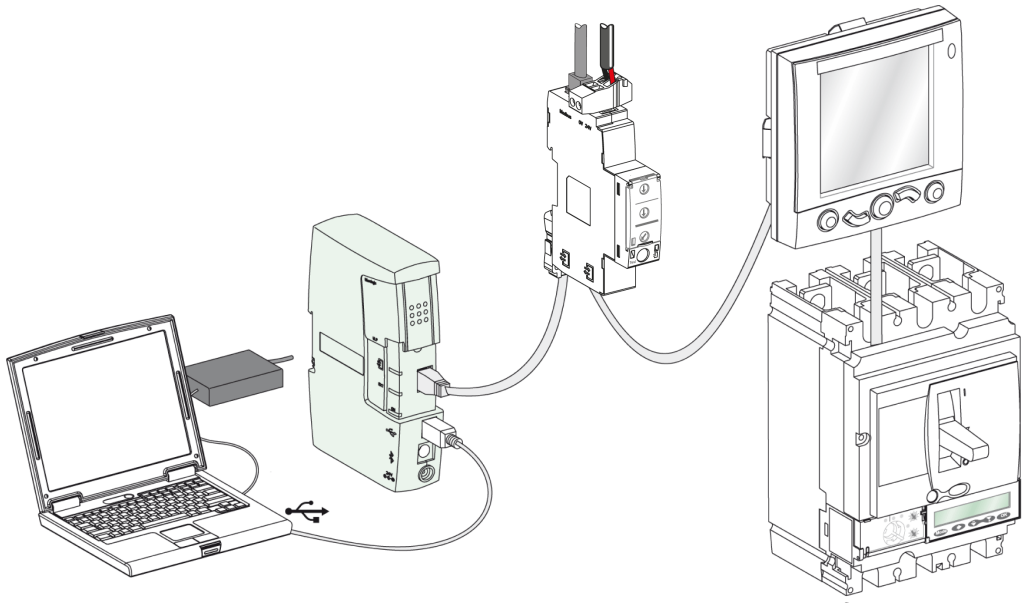
Connect the UTA maintenance module to the IMU by using the RJ45 male/male ULP cord provided in the maintenance kit. Place the UTA module sliding mechanical cap in the ULP position.

When the UTA module is connected to a communicating IMU over Modbus, it is important that the Modbus connection rules are followed.

For more information, see how to connect to the Modbus master *(see page 57)*.

Example of ULP Connection

The following example shows an IMU consisting of a Compact NSX circuit breaker, an FDM121 display, and an IFM interface. The UTA maintenance module is connected on the ULP port of the IFM interface in place of the ULP line termination.



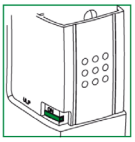
Using the UTA Maintenance Module Connected to the Test Port on the Micrologic Trip Unit in Compact NSX Circuit Breakers

Offline Mode

In offline mode, the UTA maintenance module is not connected to a computer. It is connected to the test port on the Compact NSX Micrologic trip unit and is powered by the 24 Vdc external power supply unit provided in the maintenance kit.

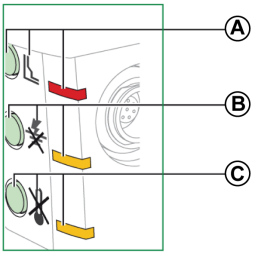
ON LED

The green **ON** LED indicates that the UTA module is supplied with power and operating correctly.



Test Functions

Carry out tests by using the three test buttons. A pictogram and a LED are associated with each button.



A Push-to-trip
B Inhibit ground fault protection
C Inhibit thermal memory

The following table describes the functions possible with the UTA module connected in offline mode to the test port on the Micrologic trip unit:

Function	Description
Push-to-trip	• Press the push-to-trip button to trip the Compact NSX circuit breaker. • The behavior of the associated LED is described in the specific topic *(see page 125)*.
Inhibit ground fault protection	• Press the inhibit ground fault protection button to inhibit ground fault protection and the thermal memory for 15 minutes. • The behavior of the associated LED is described in the specific topic *(see page 126)*.
Inhibit thermal memory	• Press the inhibit thermal memory button to inhibit the thermal memory for 15 minutes. • The behavior of the associated LED is described in the specific topic *(see page 126)*.

NOTE: Pressing any other test button during the 15 minutes stops the test in progress and starts the test associated with the test button that has been pressed.

Push-to-Trip LED

The red push-to-trip LED shows execution of the electronic trip test:

LED status	Meaning
ON for 2 s then OFF	The trip command is sent to the Micrologic trip unit.
Always OFF	The trip command is refused by the Micrologic trip unit.

Inhibit Ground Fault Protection LED

The orange inhibit ground fault protection LED shows execution of the inhibit ground fault protection test:

LED status	Meaning
ON for 15 minutes then OFF	• Pressing the inhibit ground fault protection button starts the test and lights up the LED for 15 minutes (inhibit duration). At the end of the inhibit test, the LED goes off. • Pressing the inhibit ground fault protection button during the 15 minutes stops the test and extinguishes the LED. • The LED goes off and the test stops if the test cable is disconnected during the 15 minutes.
Flashing for 3 s	The ground fault protection function is not available while the Micrologic trip unit is in test mode.

Inhibit Thermal Memory LED

The orange inhibit thermal memory LED shows execution of the inhibit thermal memory test:

LED status	Meaning
ON for 15 minutes then OFF	• Pressing the inhibit thermal memory button starts the test and lights up the LED for 15 minutes (inhibit duration). At the end of the inhibit test, the LED goes off. • Pressing the inhibit thermal memory button during the 15 minutes stops the test and extinguishes the LED. • The LED goes off and the test stops if the test cable is disconnected during the 15 minutes.

NOTE: Pressing any other test button during the 15 minutes stops the test in progress and starts the test associated with the test button that has been pressed.

Connection to a Computer

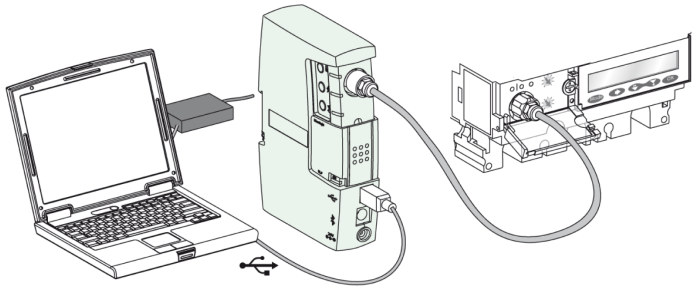
In addition to the test functions described above, the UTA module connected to a computer by using a USB port or Bluetooth connection can be used to carry out the complete range of checks, tests, and adjustments on the IMU ULP modules by using the RSU and LTU software:

- Use the LTU software to test the protection functions (such as short time, long time, and instantaneous), simulate the Micrologic trip unit alarms, display the currents, and test the ZSI (Zone Selective Interlocking) function.
- Use the RSU software to check and configure the protection, metering, and alarm parameters. It can also be used to check and configure the parameters of the IFM Modbus-SL interface for one circuit breaker, the BSCM circuit breaker status control module, and the SDx module.

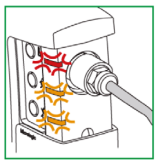
For more information about the RSU and LTU software functions, refer to the *LTU and RSU Online Helps*.

USB Connection

For a USB connection, the UTA module is powered through the USB port.



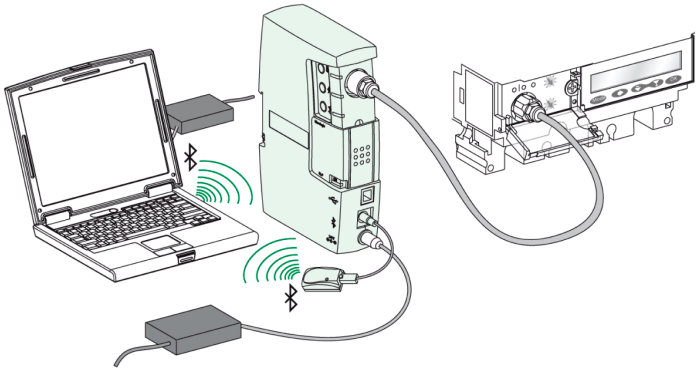
NOTE: If the USB port cannot supply power to the UTA module (computer running on low battery), the three test LEDs blink.



In this case, power the UTA module with the 24 Vdc external power supply unit provided in the maintenance kit. Connect the 24 Vdc external power supply unit to a 110/230 V power supply, overvoltage category II, in accordance with standard IEC 60664 for the protection of persons.

Bluetooth Connection

For a Bluetooth connection, power the UTA module with the 24 Vdc external power supply unit provided in the maintenance kit.



Using the UTA Maintenance Module Connected to the ULP System

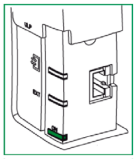
Introduction

When the sliding mechanical cap is in the ULP position, the UTA maintenance module allows communication between the IMU ULP modules and the RSU software.

The LTU software only works with a connection to the test port on the Compact NSX Micrologic trip unit.

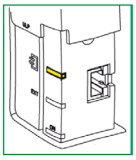
ON LED

The green **ON** LED indicates that the UTA module is supplied with power and operating correctly.



ULP LED

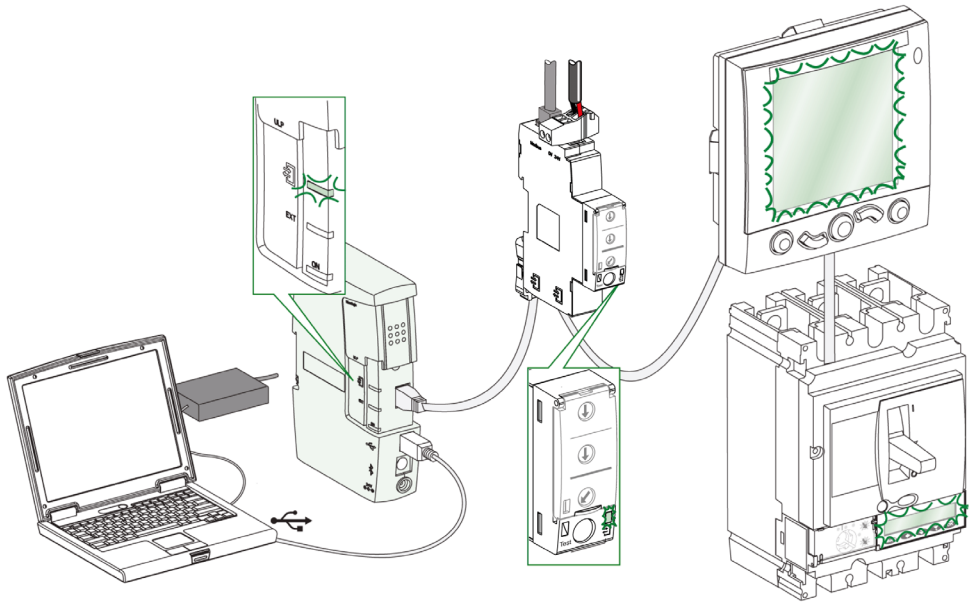
The yellow ULP LED describes the connection between the ULP modules and the UTA module.



The following table describes the ULP LED status.

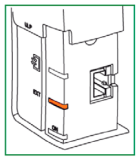
LED status	Meaning
ON: 50 ms/OFF: 950 ms	Nominal operation: The UTA module is supplied with power and the ULP connection is operating correctly.
ON: 250 ms/OFF: 250 ms	Prohibited configuration: Two identical modules are connected to the UTA module in a daisy chain.
ON: 500 ms/OFF: 500 ms	Degraded mode (EEPROM off, faulty button)
ON: 1,000 ms/OFF: 1,000 ms	Test mode
Steady ON	The UTA module is supplied with power but the ULP connection is not functioning.
Steady OFF	The UTA module is not supplied with power.

The following figure shows an IMU in test mode. In test mode, the backlighting on the FDM121 ULP display for one circuit breaker unit and the Micrologic trip unit, the test LED on the IFM Modbus-SL interface for one circuit breaker and the ULP LED on the UTA module blink simultaneously (ON: 1,000 ms/OFF: 1,000 ms).



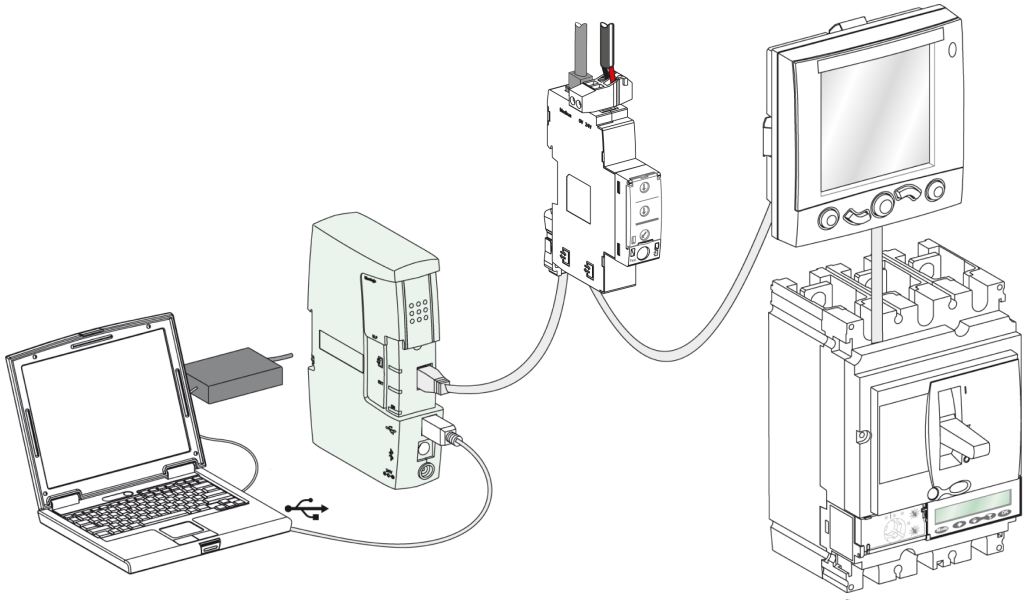
External Power Supply LED

The orange external power supply LED lights up when the UTA module does not have enough power (for example, with USB connection on a computer running on low battery). In this case, it is necessary to use the external power supply unit provided in the maintenance kit. The LED goes off when the external power supply unit is connected.



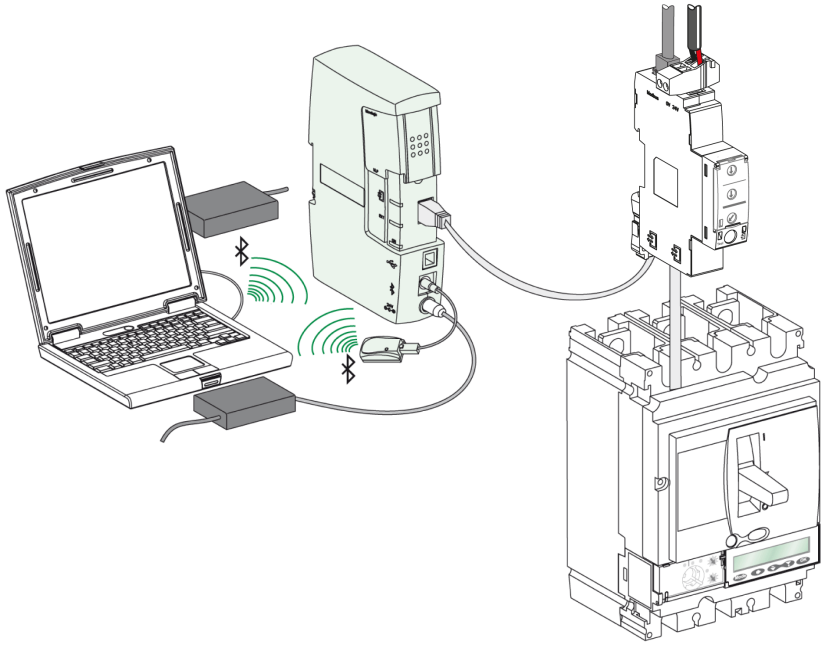
USB Connection

In the case of a USB connection, the UTA module is powered through the USB port.



Bluetooth Connection

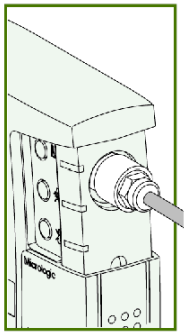
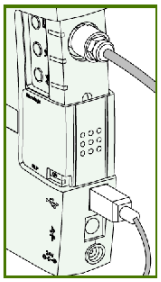
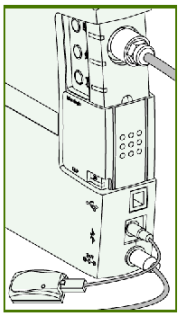
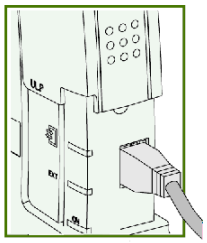
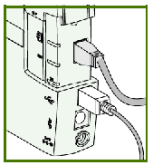
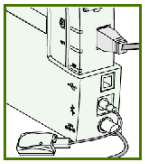
For a Bluetooth connection, power the UTA module with the 24 Vdc external connection power supply unit provided in the UTA module kit.



Use - Summary

Summary of Connection and Power Supply Procedures

The following table summarizes the connection and the power supply procedures:

Connection to the IMU	Connection to the computer	Associated functions
Connection to the test port on the Micrologic trip unit in Compact NSX circuit breakers 	No connection to the computer	• The UTA maintenance module is in offline mode. • The UTA module is powered by its 24 Vdc external power supply unit. • The user can test Compact NSX circuit breaker tripping, thermal memory inhibition, and ground fault protection inhibition.
	USB connection 	• The UTA module is powered through the USB port. • The three test LEDs blink if the power supply through the USB port is inadequate. In this case, use the 24 Vdc external power supply unit of the UTA module. • The offline mode functions are available. • The user can test Compact NSX circuit breaker tripping and simulate alarms with LTU. • The user can check and configure the parameters of the Micrologic trip unit and the IMU ULP modules with RSU.
	Bluetooth connection 	• The UTA module is powered by its 24 Vdc external power supply unit. • The offline mode functions are available. • The user can test Compact NSX circuit breaker tripping and simulate alarms with LTU. • The user can check and configure the parameters of the Micrologic trip unit and the IMU ULP modules with RSU.
ULP connection 	USB connection 	• The UTA module is powered through the USB port. • The external power supply LED blinks if the power supply through the USB port is inadequate. If so, use the 24 Vdc external power supply unit of the UTA module. • The user can check and configure the parameters of the Micrologic trip unit and the IMU ULP modules with the RSU software.
	Bluetooth connection 	• The UTA module is powered by its 24 Vdc external power supply unit. • The user can check and configure the parameters of the Micrologic trip unit and the IMU ULP modules with the RSU software.

ULP Module Power Supplies

- If the UTA module is connected to an IMU powered by the electrical equipment, the USB port or the 24 Vdc external power supply unit (in the case of a Bluetooth connection) only power the UTA module.
- If the UTA module is connected to an IMU without a power supply, use the 24 Vdc external power supply unit of the UTA module to power all the ULP modules.
- If the UTA module is connected to a ULP module without a power supply, the USB port is capable of supplying power to the UTA module and the ULP module. If not, use the 24 Vdc external power supply unit of the UTA module.

Appendices

What Is in This Appendix?

The appendix contains the following chapters:

Appendix A
Technical Characteristics

What Is in This Chapter?

This chapter contains the following topics:

Technical Characteristics of IFE Ethernet Interfaces for Circuit Breakers

Environmental Characteristics

Characteristic		Value
Conforming to standards		• IEC 60950 • IEC 60947-6-2
		• UL508 • UL60950 • IACS E10
Certification		CE, cULus, EAC, and FCC marking
Ambient temperature	Storage	-40 °C to +85 °C (-40 °F to +185 °F)
	Operation	-25 °C to +70 °C (-13 °F to +158 °F)
Protective treatment		ULV0, conforming to IEC/EN 60068-2-30
Pollution		Level 3

Mechanical Characteristics

Characteristic	Value
Shock resistance	Conforming to IEC 60068-2-27 15 g/11 ms, 1/2 sinusoidal
Resistance to sinusoidal vibrations	Conforming to IEC/EN 60068-2-6

Electrical Characteristics

Characteristic		Value
Power supply		24 Vdc, -20%/+10% (19.2–26.4 Vdc)
Consumption	Typical	24 Vdc, 100 mA at 20 °C
	Maximum with IFE server	19.2 Vdc, 140 mA at 60 °C

Physical Characteristics

Characteristic	Value
Dimensions	72 x 105 x 71 mm (2.83 x 4.13 x 2.79 in)
Mounting	DIN rail
Weight	187 g (0.41 lb)
Degree of protection of the installed module	• On the front panel (wall-mounted enclosure): IP4• • Connectors: IP2• • Other parts: IP3•
Connections	Screw type terminal blocks

24 Vdc Power Supply Characteristics

It is recommended to use a UL listed/UL recognized limited voltage/limited current or a class 2 SELV power supply with a 24 Vdc, 3 A maximum.

Characteristic	Value
Power supply type	Regulated switch type
Rated power	72 W
Input voltage	100–120 Vac for single phase
	200–500 Vac phase-to-phase
PFC filter	With IEC 61000-3-2
Output voltage	24 Vdc
Power supply output current	3 A

Technical Characteristics of EIFE Embedded Ethernet Interface for One Masterpact MTZ Drawout Circuit Breaker

Environmental Characteristics

Characteristic		Value
Conforming to standards		• IEC 61000-6-2 • IEC 61000-6-4
Certification		CE
Ambient temperature	Storage	-40 to +85 °C (-104 to +185 °F)
	Operation	-20 to +70 °C (-68 to +158 °F)
Relative humidity		5 to 85 %
Protective treatment		ULV0, conforming to IEC/EN 60068-2-30
Pollution		Level 3

Mechanical Characteristics

Characteristic	Value
Shock resistance	Same as Masterpact MTZ circuit breakers.
Resistance to sinusoidal vibrations	Same as Masterpact MTZ circuit breakers.

Electrical Characteristics

Characteristics	Value
Power supply	24 Vdc, -20%/+10% (19.2–26.4 Vdc)
Consumption	24 Vdc, 100 mA at 25 °C
Resistance to electrostatic discharge	Confirming to IEC/EN 6100-4-2 8 kV AD
Immunity to radiated fields	Confirming to IEC/EN 6100-4-3 10 V/m
Immunity to surges	Confirming to IEC/EN 6100-4-3 Class 2

Physical Characteristics

Characteristic	Value
Dimensions	51 x 51 x 52.5 mm (2.01 x 2.01 x 2.07 in)
Mounting	Embedded in the cradle of the circuit breaker
Weight	75 g (0.17 lb)
Degree of protection of the installed module	• Connectors: IP20 • Other parts: IP30
Connections	• RJ45 for Ethernet • Industrial USB type connector for ULP

Technical Characteristics of IFM Modbus-SL Interface for One Circuit Breaker

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 • CSA
Ambient temperature	Storage	-40 °C to +85 °C (-40 °F to +185 °F)
	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	21 mA/24 Vdc at 20 °C (68 °F)
	Maximum	30 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)
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)

24 Vdc Power Supply Characteristics

It is recommended to use a UL listed/UL recognized limited voltage/limited current or a Class 2 power supply with a 24 Vdc with the same characteristics as the power supply for IFE interfaces *(see page 134)*.

Technical Characteristics of IO Input/Output Application Module for One Circuit Breaker

Environmental Characteristics

Characteristic		Value
Conforming to standards		• IEC/EN 60947-1 • IACS E10
		• UL508 • UL60950
		IACS E10
Certification		CE, cULus, EAC, and FCC marking
Ambient temperature	Storage	-40 °C to +85 °C (-40 °F to +185 °F)
	Operation	-25 °C to +70 °C (-13 °F to +158 °F)
Protective treatment		ULV0, conforming to IEC/EN 60068-2-30
Pollution		Level 3

Mechanical Characteristics

Characteristic	Value
Shock resistance	Conforming to IEC 60068-2-27 15 g/11 ms, 1/2 sinusoidal
Resistance to sinusoidal vibrations	Conforming to IEC/EN 60068-2-6

Electrical Characteristics

Characteristics		Value
Power supply		24 Vdc, -20%/+10% (19.2–26.4 Vdc)
Consumption	Typical	24 Vdc, 165 mA at 20 °C
	Maximum with ULP	19.2 Vdc, 420 mA at 60 °C

Physical Characteristics

Characteristic	Value
Dimensions	72 x 115 x 71 mm (2.83 x 4.52 x 2.79 in)
Mounting	DIN rail
Weight	229.5 g (0.51 lb)
Degree of protection of the installed module	• On the front panel (wall-mounted enclosure): IP4• • IO module parts: IP3• • Connectors: IP2•
Connections	Screw type terminal blocks

24 Vdc Power Supply Characteristics

It is recommended to use a UL listed/UL recognized limited voltage/limited current or a Class 2 power supply with a 24 Vdc with the same characteristics as the power supply for IFE interfaces *(see page 134)*.

Digital Inputs Characteristics

Characteristic	Value
Digital input type	Self-powered digital input with current limitations as per IEC 61131-2 type 2 standards (7 mA)
Input limit values at state 1 (close)	19.8–25.2 Vdc
	6.1–8.8 mA
Input limit values at state 0 (open)	0–19.8 Vdc
	0 mA
Maximum cable length	10 m (33 ft) **NOTE:** For a length between 10 m (33 ft) and 300 m (1,000 ft), it is mandatory to use a shielded twisted cable. The shield cable is connected to the functional ground of the IO module.

Digital Outputs Characteristics

Characteristic	Value
Digital output type	Bistable relay
Rated load	5 A at 250 Vac
Rated carry current	5 A
Maximum switching voltage	380 Vac, 125 Vdc
Maximum switch current	5 A
Maximum switching power	1250 VA, 150 W
Minimum permissible load	10 mA at 5 Vdc
Contact resistance	30 mΩ
Maximum operating frequency	• 18,000 operations/hour (mechanical) • 1,800 operations/hour (electrical)
Digital output relay protection	External fuse of 5 A or less
Maximum cable length	10 m (33 ft)

Analog Inputs Characteristics

The IO module analog input can be connected to a Pt100 temperature sensor.

Characteristic	Values	
Range	-30 to 200 °C	-22 to 392 °F
Accuracy	• ± 2 °C from -30 to 20 °C • ± 1 °C from 20 to 140 °C • ± 2 °C from 140 to 200 °C	• ± 3.6 °F from -22 to 68 °F • ± 1.8 °F from 68 to 284 °F • ± 3.6 °F from 284 to 392 °F
Refresh interval	5 seconds	5 seconds

Technical Characteristics of FDM121 ULP Display for One Circuit Breaker

Environmental Characteristics

Characteristic		Value
Conforming to standards		• IEC/EN 60947-1 • IACS E10
		• UL508 - Industrial Control Equipment • 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 ❍ CSA C22.2 No.14-10
Certification		• CE and C-Tick marking
		• UL • CSA
Ambient temperature	Storage	-40 °C to +85 °C (-40 °F to 85 °F)
	Operation	-10 °C to +55 °C (14–131 °F) (on the front panel)
Relative humidity	Conforming to IEC/EN 60068-2-78	Four days, 40 °C (104 °F), 93% RH, energized
Protective treatment	Conforming to IEC/EN 60068-2-30	Six cycles of 24 hours, 25/55 °C (77/131°F), 95% RH, energized
Pollution		3
Corrosive atmosphere	Conforming to IEC 60068-2-60	Four gases (H_2S, SO_2, NO_2, Cl_2)
Level of pollution	Access to hazardous parts and water penetration	IP53 (splashing outside the protective cover)
	Conforming to IEC/EN 60947-1 and IEC/EN 60529	IP2• (connectors)
	Conforming to IEC 62262/EN 50102	IK05 (external mechanical impacts)
Flame resistance	Conforming to IEC/EN 60947-1 and IEC/EN 60695-2-11	• 650 °C (1,202 °F) 30 s/30 s on de-energized insulating parts • 960 °C (1,760 °F) 30 s/30 s on de-energized insulating parts
	Conforming to UL94	V0

Mechanical Characteristics

Characteristic		Value
Degree of protection of the installed module		• Part projecting beyond the escutcheon: IP4• • Other module parts: IP3• • Connectors: IP2•
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

Characteristic		Value
Power supply		24 Vdc, -20%/+10% (19.2–26.4 Vdc)
Consumption	Typical	21 mA/24 Vdc at 20 °C (68 °F)
	Maximum	30 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)
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	96 x 96 x 33.1 mm (3.8 x 3.8 x 1.3 in)
	With power supply terminal block	96 x 96 x 43.2 mm (3.8 x 3.8 x 1.7 in)
Mounting		• Flush-mounted • Surface-mounted, with surface-mounting accessory
Weight		200 g (7.06 oz)
Display	Screen	128 x 128 pixels
	Viewing angle	• Horizontal: ± 30° • Vertical: ± 60°

Technical Characteristics of UTA Maintenance Module

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)
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: 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 Male/Male 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 male RJ45 connector at each end, 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 (see the RJ45 pin connection *(see page 46)*)
- 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

Part Numbers for ULP System Components

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

Product	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 female RJ45 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
BSCM circuit breaker status control module	–	LV434205
FDM121 ULP display for one circuit breaker	–	TRV00121
Surface-mounting accessory	–	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
Maintenance kit	UTA maintenance module, 24 Vdc external power supply unit, and associated cables	TRV00910
UTA maintenance module	–	TRV00911
UTA maintenance module power supply unit	–	TRV00915
Micrologic test cable	–	TRV00917
Bluetooth option	–	VW3A8114

Product	Description	Part number
RSU software	–	LV4ST100
LTU software	–	LV4ST121
RJ45 male/male 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
Modbus serial link cable with one RJ45 male connector and free wires at other end	L = 0.3 m (0.98 ft)	VW3A8306D30
RJ45 female/female connector	Ten RJ45 female/female connectors	TRV00870
ULP line termination	Ten ULP line terminations	TRV00880
Modbus line termination	Two Modbus cable line terminations with impedance of 120 Ω + 1 nF	VW3A8306RC
24 Vdc power supply	24/30 Vdc - 24 Vdc - 1 A - overvoltage category IV	54440
	48/60 Vdc - 24 Vdc - 1 A - overvoltage category IV	54441
	100/125 Vdc - 24 Vdc - 1 A - overvoltage category IV	54442
	110/130 Vac - 24 Vdc - 1 A - overvoltage category IV	54443
	200/240 Vac - 24 Vdc - 1 A - overvoltage category IV	54444
	380/415 Vac - 24 Vdc - 1 A - overvoltage category IV	54445
	100/500 Vac - 24 Vdc - 3 A - overvoltage category II	ABL8RPS24030
Cable for Modbus serial link (two male RJ45 connectors)	L = 0.3 m (0.98 ft)	VW318306R03
	L = 1 m (3.28 ft)	VW318306R10
	L = 3 m (9.8 ft)	VW318306R30
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 protective ground terminal block (green/yellow)	AB1 RRNETP235U4
	End plate	AB1 RRNACE244
	Clip-on plastic end stop	AB1 AB8R35
	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

Appendix B
IFM Interface with Part Number TRV00210

What Is in This Chapter?

This chapter contains the following sections:

Section B.1
IFM Interface with Part Number TRV00210

What Is in This Section?

This section contains the following topics:

IFM Interface with Part Number TRV00210

Introduction

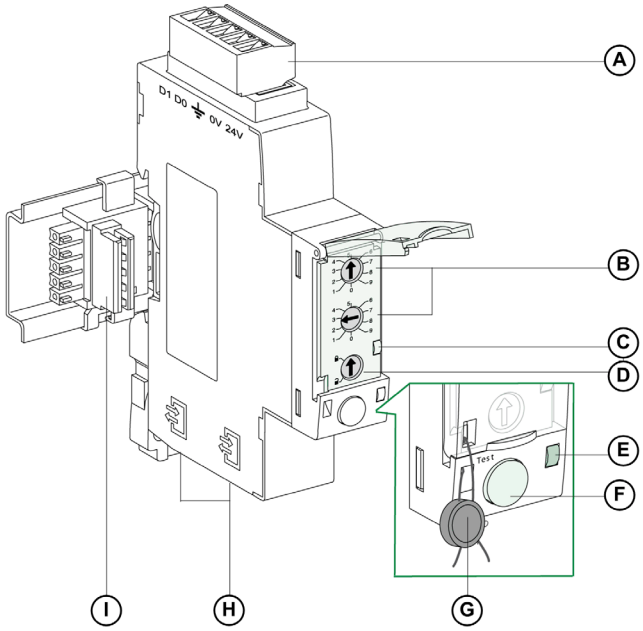
The IFM interface with part number TRV00210 is substituted by the IFM interface with part number LV434000.

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

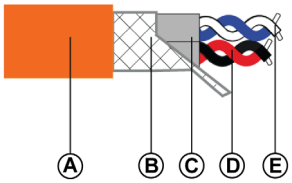
Use the Modbus cable *(see page 156)* to interconnect the intelligent modular units comprising IFM interfaces TRV00210, supply them with power, and connect them to the Modbus master.

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.

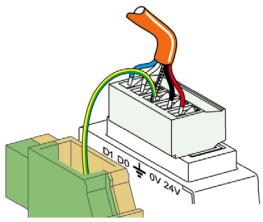
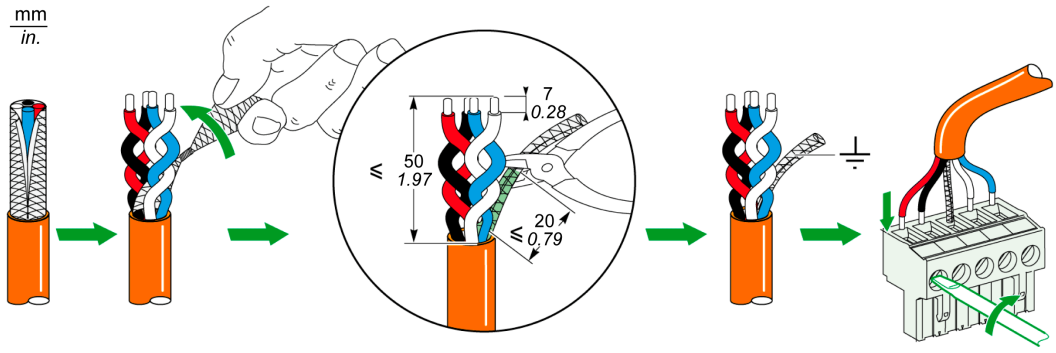
The 0 V terminal of the power supply pair is also the Modbus common, that is, the 0 V for the RS 485 signal (D0, D1).

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

Other Modbus cable part numbers are given in appendix *(see page 156)*.

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 Protective Ground Terminal Block

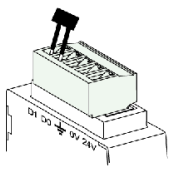
The 0 V terminal on IFM interfaces is connected to the protective ground terminal block at only one point of the Modbus line (first stacked IFM interface or at the Modbus master if IFM interfaces are not stacked with IFE server). No other devices must have 0 V connected to ground.

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 master 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 (32.8 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.

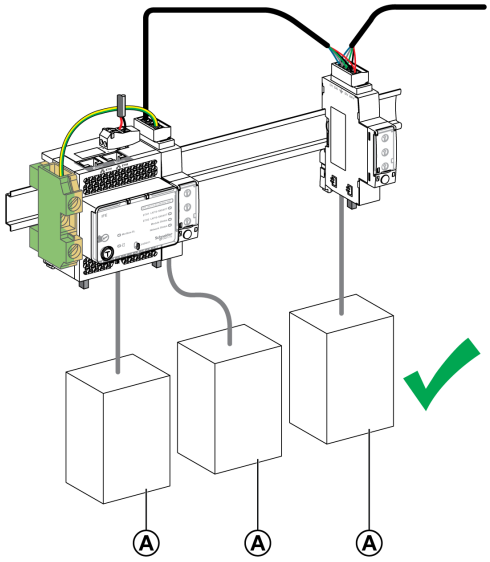
The Modbus cable connecting the IFM interfaces in the ULP system incorporates both the Modbus communication network and the 24 Vdc power supply. Because of the stresses caused by a drop in the supply voltage, more restrictive limitations are imposed:

- 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 product 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

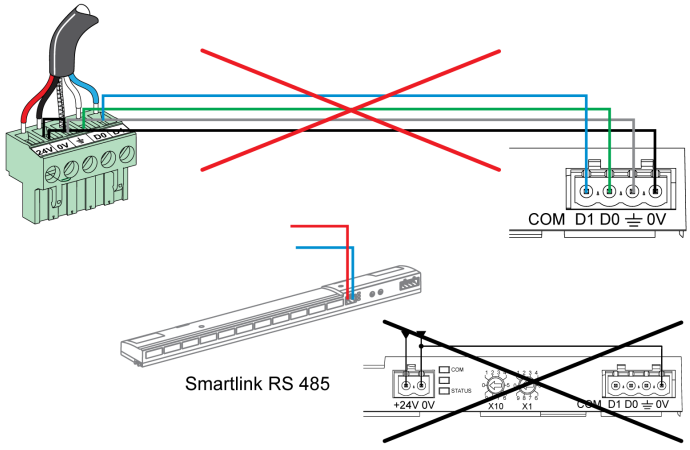
Power Supply Connection Rules

- The 0 V terminal on IFM interfaces is connected to a protective 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 master 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 the 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

⚠ WARNING

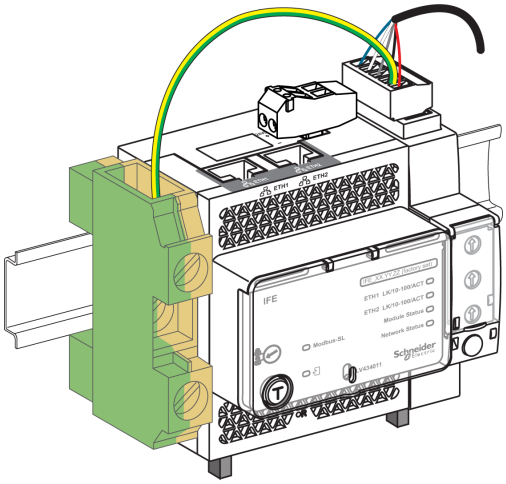
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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 can result in death, serious injury, or equipment damage.

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.



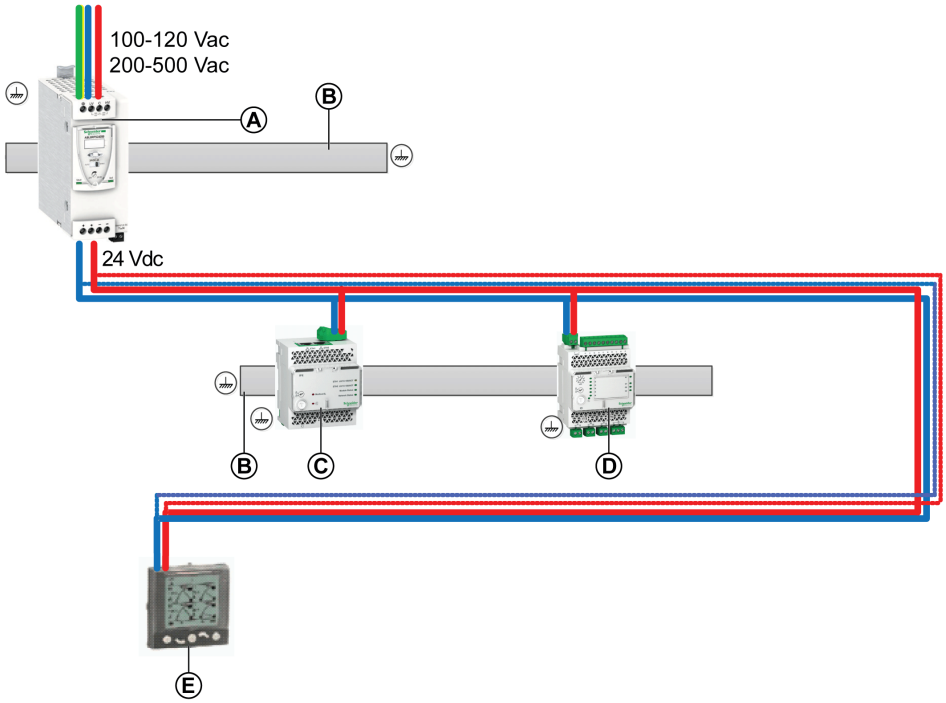
NOTICE

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.

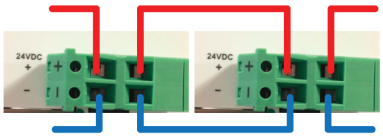
Failure to follow these instructions can result in equipment damage.

- 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 ABL8 power supply
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 master ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 Vdc wire is not connected when the master 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 slave 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, see the connection of IFM interface *(see page 150)*.

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
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.				

Modbus Cable Lengths

Maximum Modbus cable lengths for a centralized Modbus architecture including one or several IFM interfaces with part number TRV00210:

24 Vdc rating	Cross-section of power supply pair	L0 (in 0.75 mm^2 (18 AWG) wires)	L1	Sum of the L1s (for all power supply segments)	Sum of the L1s and L3s (total length)
1 A	0.34 mm^2 (22 AWG)	5 m (16.4 ft)	30 m (98 ft)	75 m (246 ft)	500 m (1,640 ft)
	0.5 mm^2 (20 AWG)	5 m (16.4 ft)	45 m (148 ft)	105 m (344 ft)	500 m (1,640 ft)
3 A	0.34 mm^2 (22 AWG)	Cross-section not compatible with currents > 1 A			
	0.5 mm^2 (20 AWG)	3 m (9.8 ft)	15 m (49 ft)	35 m (115 ft)	500 m (1,640 ft)
	0.75 mm^2 (18 AWG)	3 m (9.8 ft)	25 m (82 ft)	60 m (197 ft)	500 m (1,640 ft)
	1 mm^2 (17 AWG)	3 m (9.8 ft)	30 m (98 ft)	70 m (230 ft)	500 m (1,640 ft)
	1.5 mm^2 (16 AWG)	3 m (9.8 ft)	50 m (164 ft)	120 m (394 ft)	500 m (1,640 ft)

Maximum Modbus cable lengths for a daisy-chained distributed Modbus architecture including one or several IFM interfaces with part number TRV00210:

24 Vdc rating	Cross-section of power supply pair	L0 (in 0.75 mm^2 (18 AWG) wires)	L1	Sum of the L1s (for all power supply segments)	Sum of the L1s and L3s (total length)
1 A	0.34 mm^2 (22 AWG)	5 m (16.4 ft)	30 m (98 ft)	75 m (246 ft)	500 m (1,640 ft)
	0.5 mm^2 (20 AWG)	5 m (16.4 ft)	45 m (148 ft)	105 m (344 ft)	500 m (1,640 ft)
3 A	0.34 mm^2 (22 AWG)	Cross-section not compatible with currents > 1 A			
	0.5 mm^2 (20 AWG)	3 m (9.8 ft)	15 m (49 ft)	35 m (115 ft)	500 m (1,640 ft)
	0.75 mm^2 (18 AWG)	3 m (9.8 ft)	25 m (82 ft)	60 m (197 ft)	500 m (1,640 ft)
	1 mm^2 (17 AWG)	3 m (9.8 ft)	30 m (98 ft)	70 m (230 ft)	500 m (1,640 ft)
	1.5 mm^2 (16 AWG)	3 m (9.8 ft)	50 m (164 ft)	120 m (394 ft)	500 m (1,640 ft)

Maximum Modbus cable lengths for a tap-linked distributed Modbus architecture including one or several IFM interfaces with part number TRV00210:

24 Vdc rating	Cross-section of power supply pair	L0 (in 0.75 mm^2 (18 AWG) wires)	L1	L2	Sum of the L2s (for all power supply segments)	Sum of the L1s, L2s, and L3s (total length)
1 A	0.34 mm^2 (22 AWG)	5 m (16.4 ft)	20 m (66 ft)	10 m (33 ft)	40 m (131 ft)	500 m (1,640 ft)
	0.5 mm^2 (20 AWG)	5 m (16.4 ft)	35 m (115 ft)	10 m (33 ft)	40 m (131 ft)	500 m (1,640 ft)
3 A	0.34 mm^2 (22 AWG)	Cross-section not compatible with currents > 1 A				
	0.5 mm^2 (20 AWG)	3 m (9.8 ft)	10 m (33 ft)	5 m (16.4 ft)	40 m (131 ft)	500 m (1,640 ft)
	0.75 mm^2 (18 AWG)	3 m (9.8 ft)	15 m (49 ft)	10 m (33 ft)	40 m (131 ft)	500 m (1,640 ft)
	1 mm^2 (17 AWG)	3 m (9.8 ft)	20 m (66 ft)	10 m (33 ft)	40 m (131 ft)	500 m (1,640 ft)
	1.5 mm^2 (16 AWG)	3 m (9.8 ft)	40 m (131 ft)	10 m (33 ft)	40 m (131 ft)	500 m (1,640 ft)

Section B.2
Two-Wire RS 485 Isolated Repeater Module

What Is in This Section?

This section contains the following topics:

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.

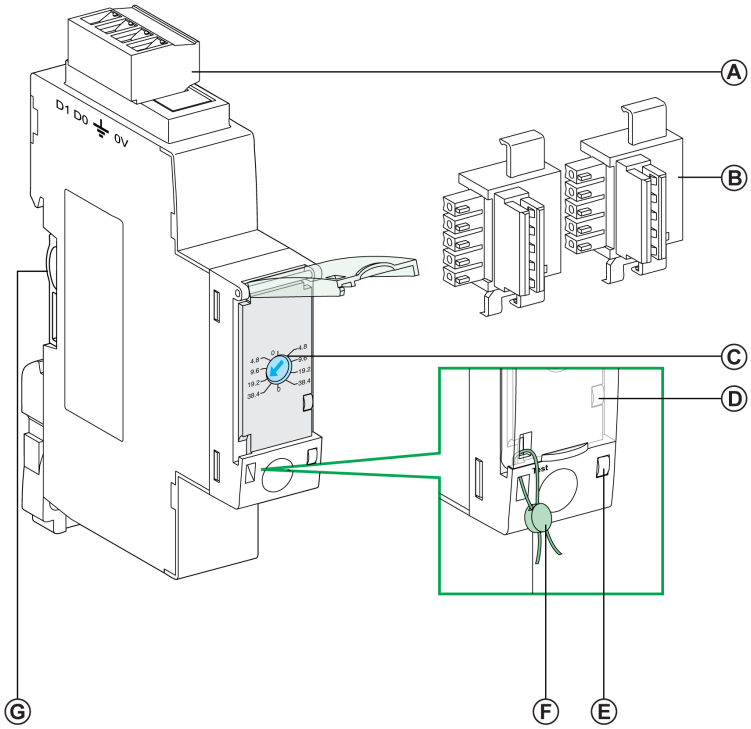
For installation information, refer to *Two-Wire RS 485 Isolated Repeater Instruction Sheet* (S1A2181101).

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 to use a two-wire RS 485 isolated repeater module in a Modbus network.

Hardware Description

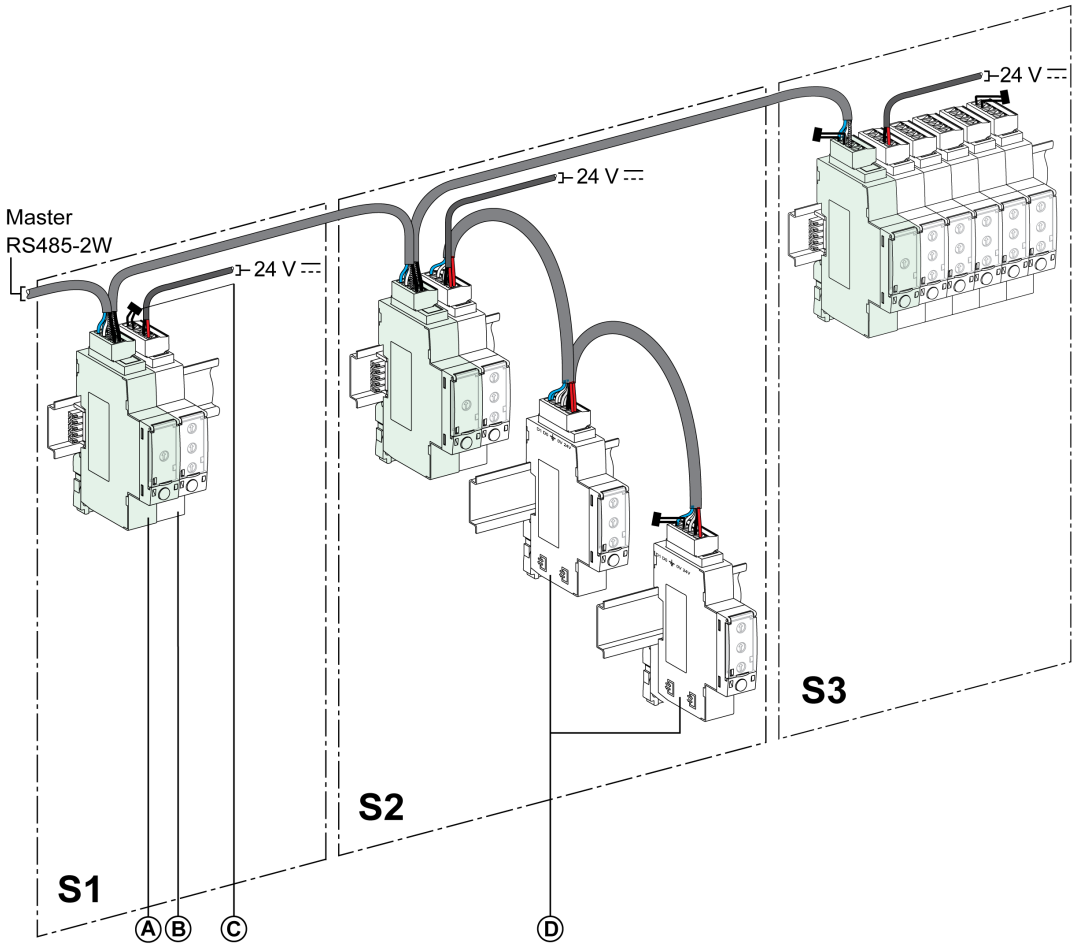


A Modbus 4-pin connector
B 2 stacking accessories (supplied with the repeater)
C Rotary switch (to set the transmission speed and format)
D Modbus traffic LED
E Status LED
F Mechanical lock
G Stacking accessory connection

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 master 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

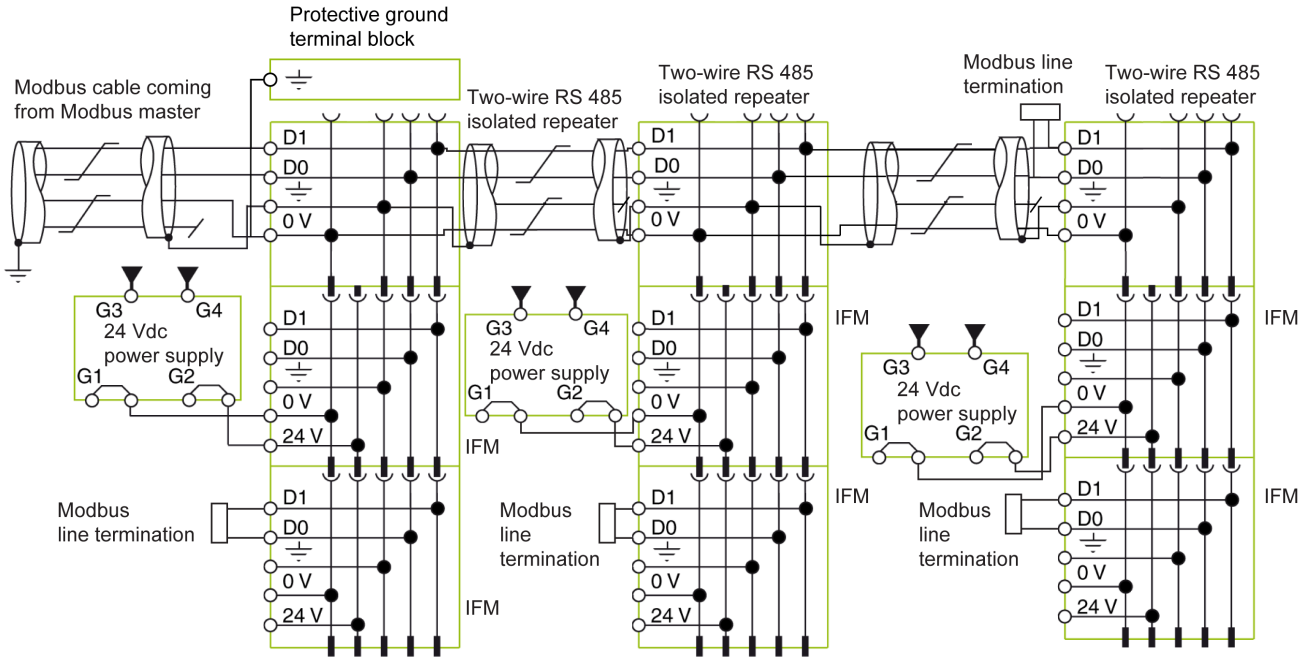
The rules below must be followed:

- 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 master, 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 slave (on the last IFM interface in pieces of electrical equipment **S1** and **S2** in this case).
- L is the length 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:



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)
	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)

DOCA0093EN-02

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07/2017