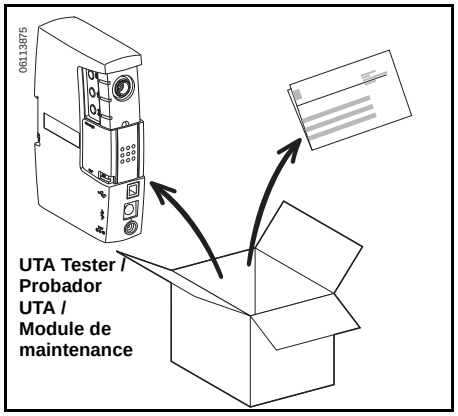
Replaces / Reemplaza / Remplace 48940-330-01, 01/2011

UTA Tester for PowerPact™ H-, J- and L-Frame Circuit Breakers
Probador UTA para interruptores automáticos PowerPact™ marcos H, J y L
Module de maintenance (UTA) pour disjoncteurs PowerPact^{MC} à châssis H, J et L

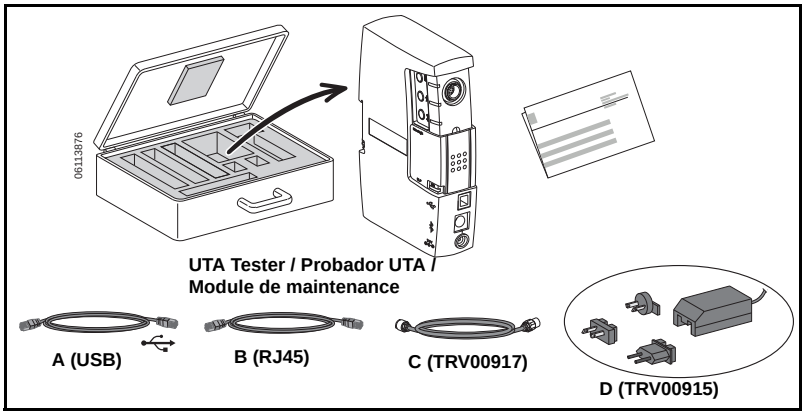
Retain for future use. / Conservar para uso futuro. / À conserver pour usage ultérieur.

Required for Installation | Necesarios para la instalación | Requis pour l'installation

STRV00911



STRV00910



Precautions | Precauciones | Précautions

⚠ DANGER / PELIGRO / DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

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

PELIGRO DE DESCARGA ELÉCTRICA, EXPLOSIÓN O DESTELLO POR ARQUEO

- Utilice equipo de protección personal (EPP) apropiado y siga las prácticas de seguridad eléctrica establecidas por su Compañía, consulte la norma 70E de NFPA y NOM-029-STPS.
- Solamente el personal eléctrico especializado deberá instalar y prestar servicio de mantenimiento a este equipo.
- Desenergice el equipo antes de realizar cualquier trabajo dentro o fuera de él.
- Siempre utilice un dispositivo detector de tensión nominal adecuado para confirmar la desenergización del equipo.
- Vuelva a colocar todos los dispositivos, las puertas y las cubiertas antes de volver a energizar el equipo.

El incumplimiento de estas instrucciones podrá causar la muerte o lesiones serias.

RISQUE D'ÉLECTROCUTION, D'EXPLOSION OU D'ÉCLAIR D'ARC

- Portez un équipement de protection personnelle (ÉPP) approprié et observez les méthodes de travail électrique sécuritaire. Voir NFPA 70E.
- Seul un personnel qualifié doit effectuer l'installation et l'entretien de cet appareil.
- Coupez toutes les alimentations de l'appareil avant d'y travailler.
- Utilisez toujours un dispositif de détection de tension à valeur nominale appropriée pour vous assurer que l'alimentation est coupée.
- Replacez tous les dispositifs, les portes et les couvercles avant de mettre l'appareil sous tension.

Si ces directives ne sont pas respectées, cela entraînera la mort ou des blessures graves.

Installation

1. Turn off all power supplying this equipment before working on or inside equipment.
2. Secure UTA Tester by installing on DIN rail (Figure 1, a–b) or attaching to inside of enclosure door using magnetic strip (c–d).

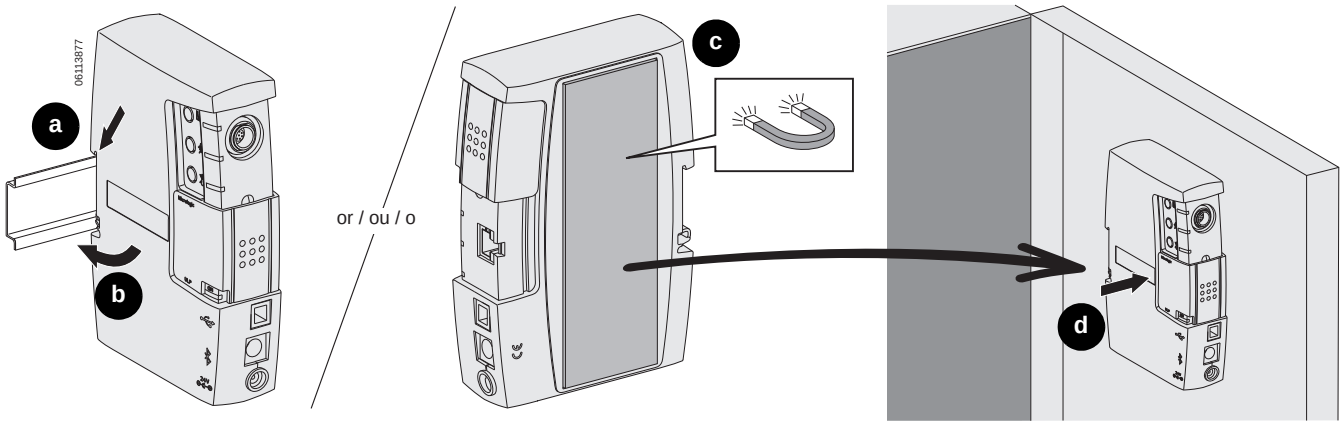
Instalación

1. Desenergice el equipo antes de realizar cualquier trabajo dentro o fuera de él.
2. Sujete el probador UTA instalándolo sobre el riel DIN (figura 1, a–b) o dentro en la puerta del gabinete empleando una tira magnética (c–d).

Installation

1. Couper toutes les alimentations de l'appareil avant d'y travailler.
2. Installer le module de maintenance (UTA) sur le rail DIN (figure 1, a–b) ou le fixer à l'intérieur de la porte du coffret à l'aide d'un ruban magnétique (c–d).

FIG. 1 : Installation / Instalación / Installation



UTA Tester Interface Setup

Set up UTA Tester as shown in Figures 2 through 4.

To download LTU (Local Test Utility) software for the UTA Tester:

- Go to www.schneider-electric.com and choose United States under “Select your country”. Click OK.
- Under the “Support” tab, select “Product Support Resources”
- Click on “Software, Calculators & Visual Product Configurators”
- Click on “Software” and find the “LTU (Local Test Utility) Software for UTA Tester” to download the LTU software

Preparación de la interfaz del probador UTA

Prepare el probador UTA como se muestra en las figuras 2 a 4.

Para descargar el software de prueba LTU para el probador UTA:

- Vaya al sitio web: www.schneider-electric.com y seleccione “United States” bajo “Select your country”. Haga clic en OK.
- Bajo la lengüeta “Support”, seleccione “Product Support Resources”
- Haga clic en “Software, Calculators & Visual Product Configurators”
- Haga clic en “Software” y localice “LTU (Local Test Utility) Software for UTA Tester” para descargar el software de prueba LTU

Configuration de l’interface du module de maintenance (UTA)

Configurer le module de maintenance comme indiqué aux figures 2 à 4.

Pour télécharger le logiciel LTU (utilitaire d’essais local) pour le module de maintenance (UTA) :

- Aller à www.schneider-electric.com et choisir United States sous « Select your country ». Cliquer sur OK.
- Sous l’onglet « Support », sélectionner « Product Support Resources »
- Cliquer sur « Software, Calculators & Visual Product Configurators »
- Cliquer sur « Software » et trouver « LTU (Local Test Utility) Software for UTA Tester » afin de télécharger le logiciel LTU.

For more information, see bulletin 48940-329-01, *ULP System—User Guide*, found on our website:

http://www.schneider-electric.us

In the search box, type “PowerPact H, J, L”. Click on “PowerPact H/J/L Frame Molded Case Circuit Breakers”, then click on the “Documents and Downloads” tab. The user guides and trip curves are found within this tab.

For additional assistance, please call 1-888-SQUARED.

Para obtener más información, consulte el boletín 48940-329-01, *Sistema ULP — Guía de usuario*, en el sitio web:

http://www.schneider-electric.us

En la casilla de búsqueda, escriba “PowerPact H, J, L”. Haga clic en “PowerPact H/J/L Frame Molded Case Circuit Breakers”, luego en “Documents and Downloads”. Las guías de usuario y curvas de disparo también se encuentran en esta página.

Comuníquese al 1-888-SQUARED (en EUA) o al 01 (800) SCHNEIDER (en México) para obtener asistencia adicional.

Pour plus d’informations, voir les directives d’utilisation 48940-329-01, *Système ULP—Guide de l’utilisateur*, qui se trouve sur notre site Web:

http://www.schneider-electric.us

Dans la case de recherche, taper « PowerPact H, J, L ». Cliquer sur « PowerPact H/J/L Frame Molded Case Circuit Breakers », puis cliquer sur l’onglet « Documents and Downloads ». Les guides de l’utilisateur et courbes de déclenchement se trouvent dans cet onglet.

Pour obtenir assistance supplémentaire, appeler le 1-888-SQUARED.

FIG. 2 : Standalone UTA Tester / Probador UTA independiente / Module de maintenance UTA autonome

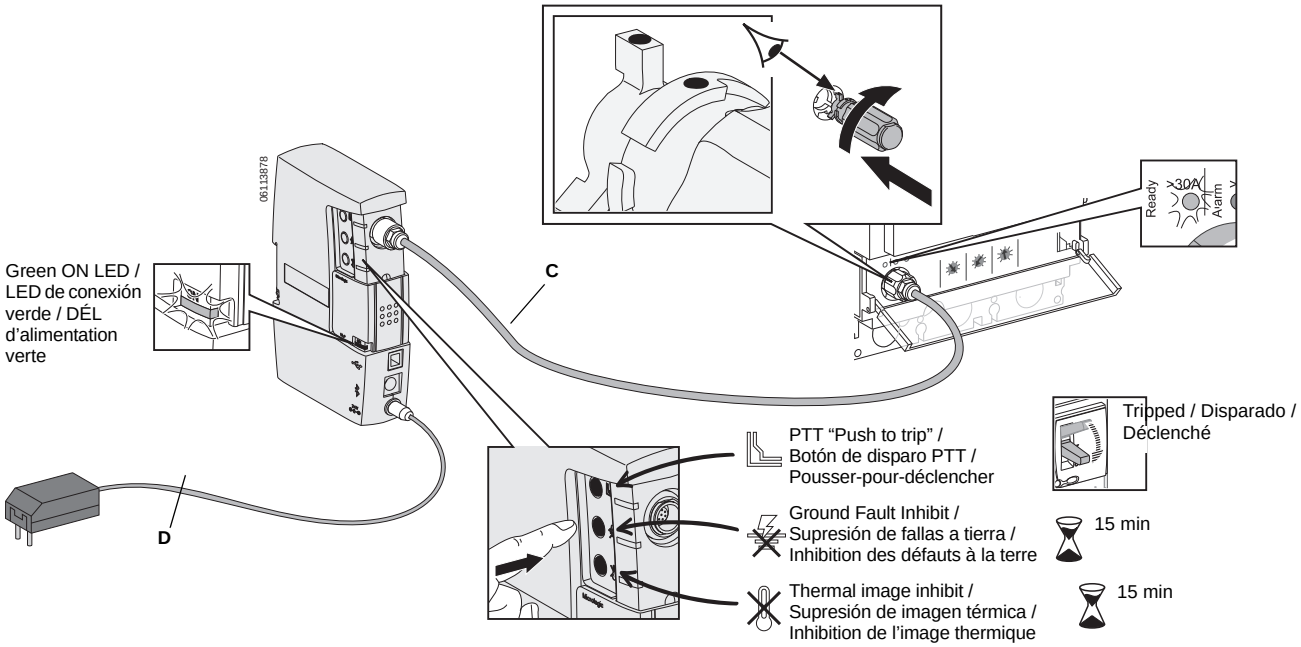
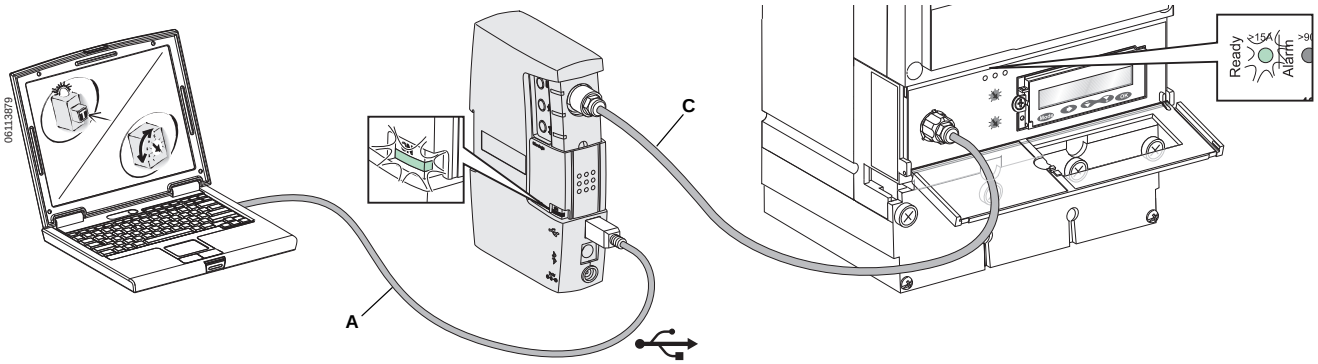


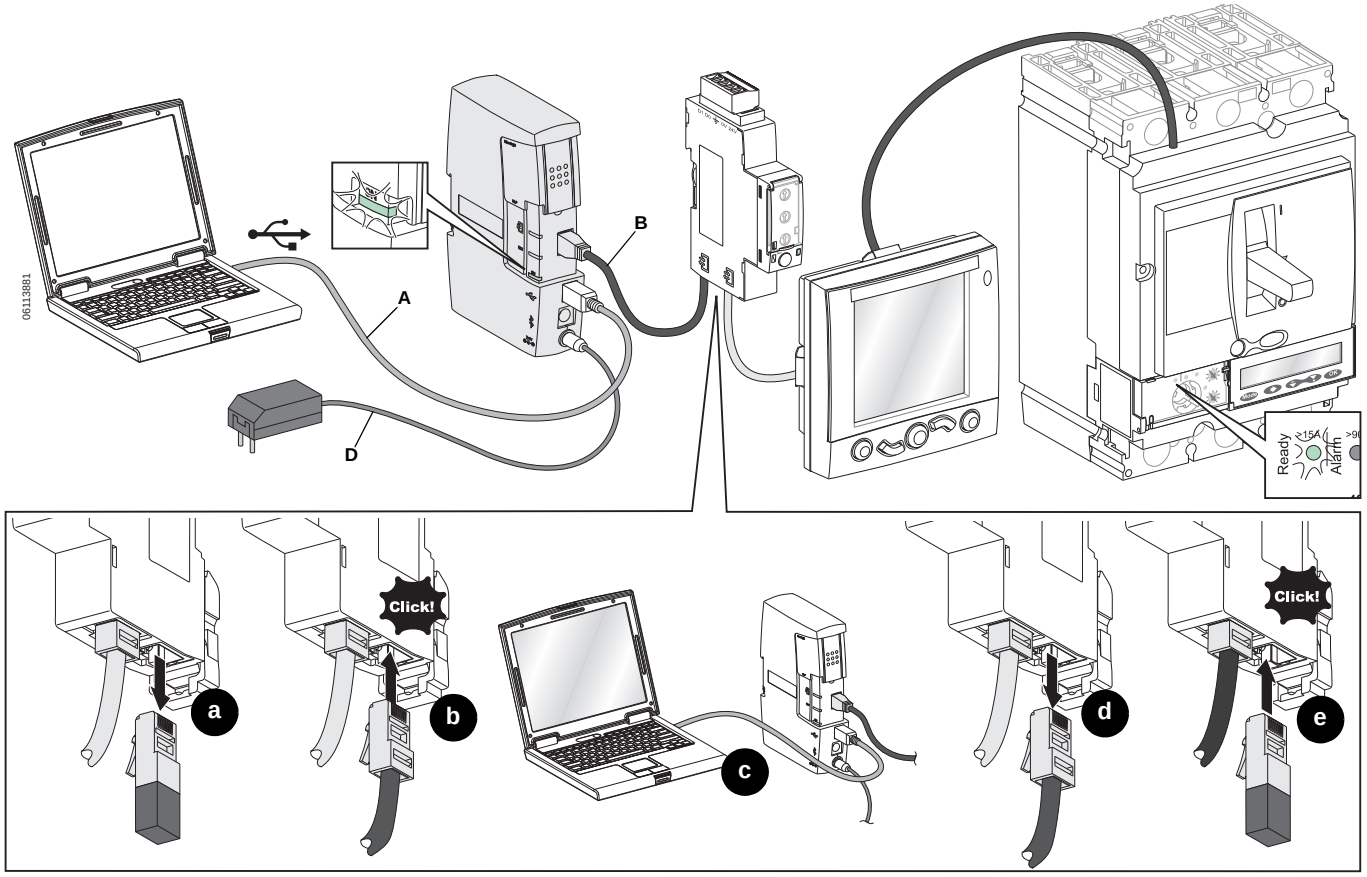
FIG. 3 : UTA Tester Online with Computer and LTU Software / Probador UTA en línea con la computadora y el software LTU / Module de maintenance UTA en ligne avec un ordinateur et le logiciel LTU



CAUTION / PRECAUCIÓN / ATTENTION

HAZARD OF EQUIPMENT DAMAGE Read ULP system bulletin before activating any ULP components. **Failure to follow this instruction can result in equipment damage.**	**PELIGRO DE DAÑO AL EQUIPO** Lea cuidadosamente el boletín del sistema ULP antes de activar cualquier componente de éste. **El incumplimiento de esta instrucción puede causar daño al equipo.**	**RISQUE DE DOMMAGES MATÉRIELS** Lisez les directives du système ULP avant d'activer tous les composants ULP. **Si cette directive n'est pas respectée, cela peut entraîner des dommages matériels.**

FIG. 4 : UTA Tester Online with FDM and RSU Software / Probador UTA en línea con el visualizador FDM y el software RSU / Module de maintenance UTA en ligne avec un afficheur de tableau FDM et le logiciel RSU



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Solamente el personal especializado deberá instalar, hacer funcionar y prestar servicios de mantenimiento al equipo eléctrico. Schneider Electric no asume responsabilidad alguna por las consecuencias emergentes de la utilización de este material.

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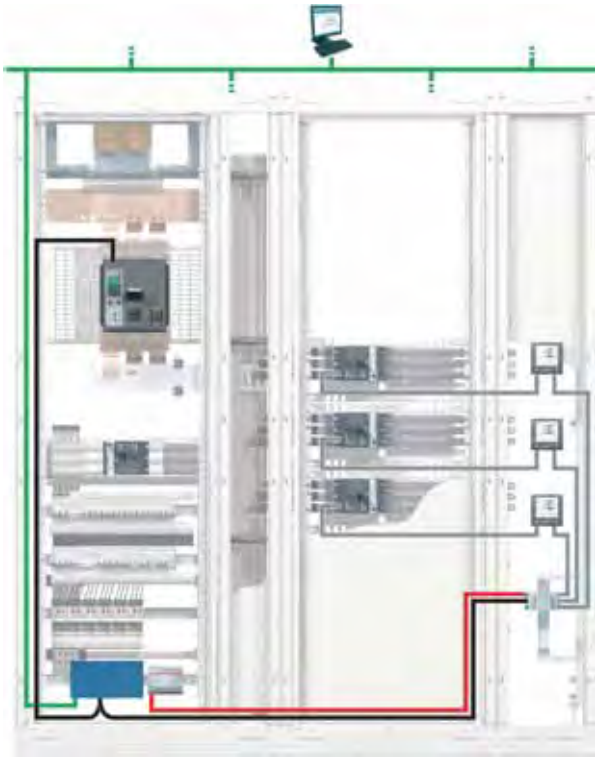
www.schneider-electric.ca

ULP (Universal Logic Plug) Connection System—User Guide

Instruction Bulletin

48940-329-01

Retain for future use.



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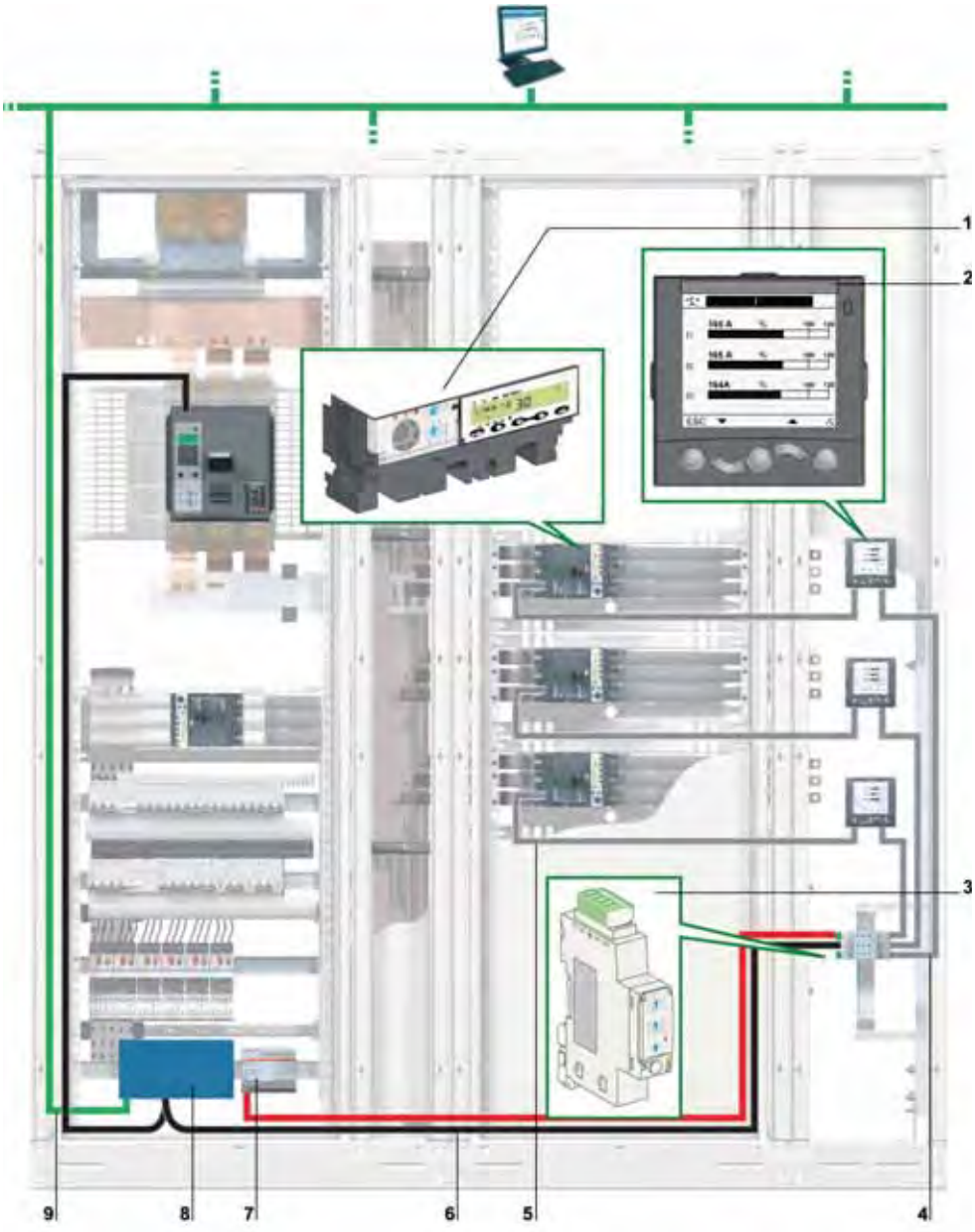
Section 1—ULP System

Description of ULP System

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

Figure 1: ULP Electrical Distribution Solution



1. Micrologic 5 or 6 trip unit
2. Front Display Module (FDM121)
3. Modbus interface module
4. ULP cable
5. NSX cord
6. Modbus network
7. 24 Vdc auxiliary power supply
8. Communication gateway (EGX300)
9. Ethernet network

Use the ULP system to enhance the PowerPact H-, J-, or L-frame circuit breaker functions by:

- Local display of measurements and operating assistance data with the front display module (FDM121)
- A Modbus™ communication link for access and remote monitoring with the Modbus interface module
- Test, setup, and maintenance functions with the UTA tester and the Local Test Utility (LTU) and Remote Setting Utility (RSU) software

The ULP system allows the PowerPact H-, J-, and L-frame circuit breakers to become metering and supervision tools to assist energy efficiency, to:

- Optimize energy consumption by zone or application, according to the load peaks or priority zones
- Better manage the electrical equipment

Intelligent Modular Unit (IMU)

An intelligent modular unit (IMU) is a mechanical and electrical assembly containing one or more products to perform a function in a switchboard (incoming protection, motor command, or control). The modular units install easily in the switchboard.

The modular unit can be enhanced with the addition of the front display module. This module can display the measurement and operating data supplied by the Micrologic 5 or 6 trip units or a Modbus interface module for a link to a Modbus network.

In the ULP system, the modular unit becomes intelligent when it includes metering functions and/or communication functions

Table 1: ULP System Using Modular Units

Choice	Trip Unit	Working With
No Intelligence	Thermal-Magnetic	Stand Alone Unit
Local Intelligence	Advanced	Stand Alone Unit
Local Intelligence Plus	Advanced	With FDM
Networked Intelligence	Advanced	Modbus Interface
Local and Networked Intelligence	Advanced	With FDM and Modbus Interface

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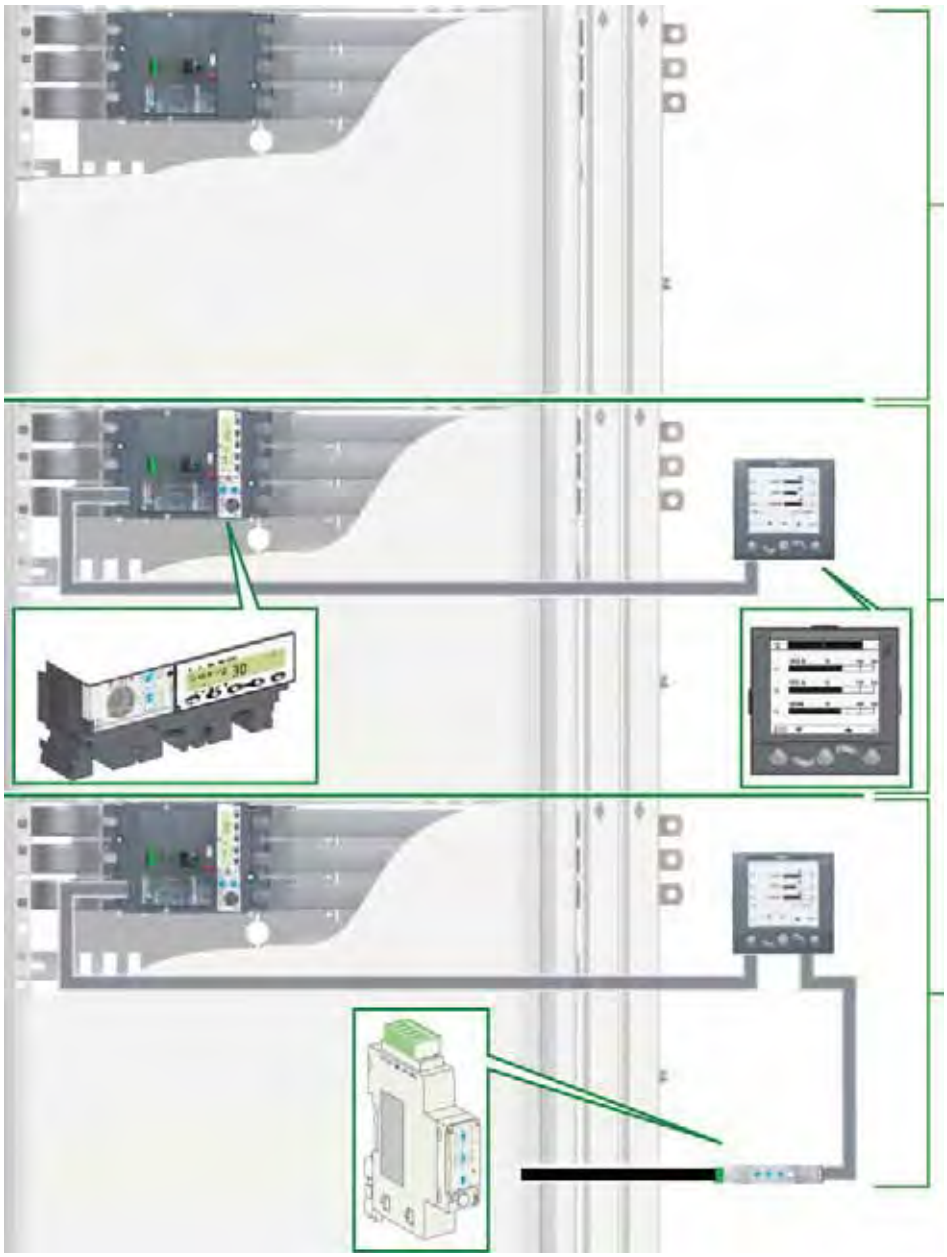
Figure 2: ULP System with Intelligent Modular Units



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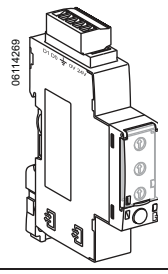
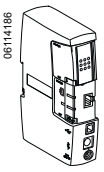
ULP System Modules and Accessories

ULP Modules

Table 2: ULP Modules

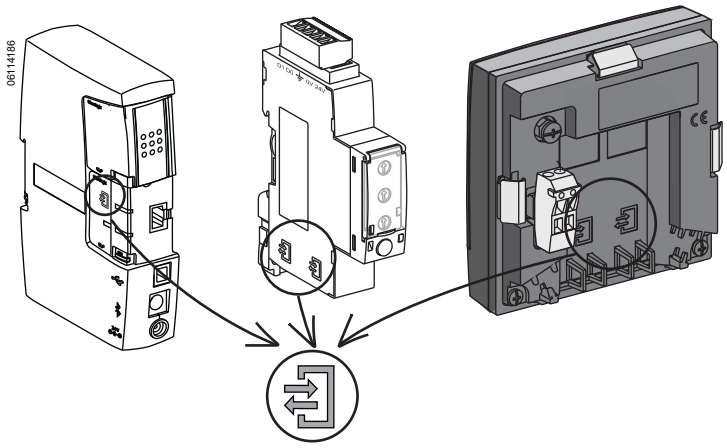
ULP Module		Description	Part Number
Modbus interface module (IFM)		The Modbus interface module allows intelligent modular units (IMUs) in the ULP system to communicate using the Modbus protocol. The Modbus interface module is described in “Modbus™ Interface Module” on page 60.	STRV00210
Front Display Module (FDM121)		The FDM121 is a local display unit displaying measurements and operating assistance data from the IMU. The FDM121 is described in “Front Display Module (FDM121)” on page 66	STRV00121
UTA tester		Use the UTA tester to test, set-up, and maintain the IMU modules, using the RSU and LTU software. The UTA tester is described in “UTA Tester” on page 81.	STRV00911
		RSU software	LV4ST100
		LTU software	LV4ST121

RJ45 Connector

ULP modules have RJ45 connectors, identified by the pictogram  .

Generally, each ULP module has two identical RJ45 connectors in parallel to connect the IMU ULP modules in a daisy chain, in any order, using ULP cables.

Figure 3: RJ45 Connectors



Updating the Firmware in ULP Modules

The user can update the ULP module (IFM, FDM121, UTA Tester) firmware using the RSU software.

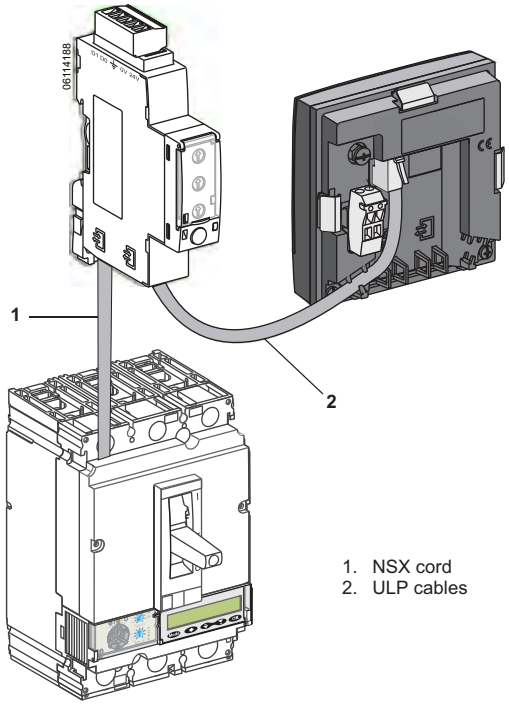
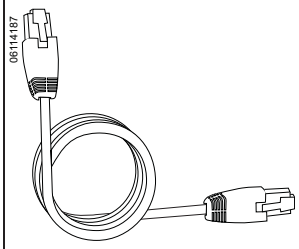
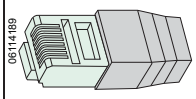
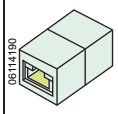
Download the update files from the Schneider Electric website at: www.schneider-electric.com. For more information, refer to Section 6- Remote Setting Utility (RSU) Software on page 94.

The operating compatibility matrix of firmware versions can also be downloaded. Use the compatibility matrix to check that the ULP system functions correctly depending on the firmware version in each IMU module.

ULP Connections

ULP modules interconnect using simple plug-and-play ULP cables, without prior set-up.

Table 3: ULP Connections

ULP Module Interconnection	Connection	Description		Part Number
 1. NSX cord 2. ULP cables	**ULP Cable** 	Use ULP cables to interconnect ULP modules within a single IMU. They have male RJ45 connectors at both ends and are available in several lengths.	L = 0.98 ft (0.3 m) (10 cables)	TRV00803
			L = 1.98 ft (0.6 m) (10 cables)	TRV00806
			L = 3.28 ft (1 m) (5 cables)	TRV00810
			L = 6.56 ft (2 m) (5 cables)	TRV00820
			L =9.84 ft (3 m) (5 cables)	TRV00830
			L = 16.4 ft (5 m) (1 cable)	TRV00850
	ULP Line Termination 	The ULP line termination closes the unused ULP connector on a ULP module. It consists of an RJ45 connector and passive components in a sealed unit.	10 ULP line termination	TRV00880
	RJ45 Female/Female Connector 	Use the RJ45 female/female connector to connect two ULP cables end-to-end and thus extend them. It consists of two female RJ45 connectors linked by a direct electrical connection. For an example of use of the RJ45 female/female connector, see “Hole Mounting” on page 68.	10 RJ45 female/female connectors	TRV00870

Isolated Repeater

Use a two-wire RS485 Isolated Repeater to insulate between voltage differences. Install only one insulated repeater in any switchboard or panelboard.

The Insulated Repeater is required when:

- there is not another interface (such as an EGX) at the switchboard level in the installation
- when the Modbus RS485 network is wired across the site.

The Insulated Repeater creates an interface between RS485 network disturbances and the switchboard, protecting against voltage differences between remote grounds.

The Insulated Repeater acts as a switchboard access point.

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Connecting the Circuit Breaker to the ULP System

Use the NSX cord to connect the PowerPact H-, J-, and L-frame circuit breakers to the ULP system. The circuit breaker must have a BSCM or a Micrologic 5 or 6 trip unit.

Micrologic 5 and 6 Trip Units

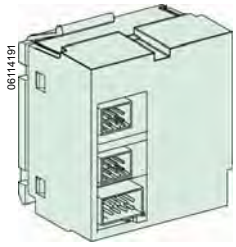
Micrologic 5 and 6 trip units provide multiple functions.

- Protecting the electrical distribution system or specific applications
- Metering instantaneous and 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 5 and 6 trip units, refer to the *Micrologic 5 and 6 Electronic Trip Units—User Guide*.

Breaker Status Control Module (BSCM)

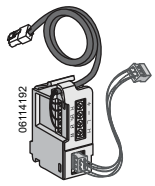
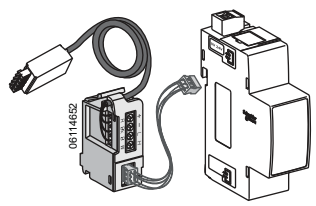
Table 4: BSCM

	Description	Part Number
 06114191	The BSCM (Breaker Status Control Module): • Provides status indication functions for PowerPact H-, J-, and L-frame circuit breakers • Controls of the communicating electrical motor operator • Provides operating assistance functions Use the BSCM with standard and advanced Micrologic electronic trip units. For more information, refer to the circuit breaker instructions shipped with the circuit breaker.	S434205

NSX Cord

NSX Cords are internal connection blocks used to connect a PowerPact H-, J-, or L-frame circuit breaker equipped with the BSCM and/or the Micrologic 5 or 6 trip unit to a ULP module with its RJ45 connector.

Table 5: NSX Cord

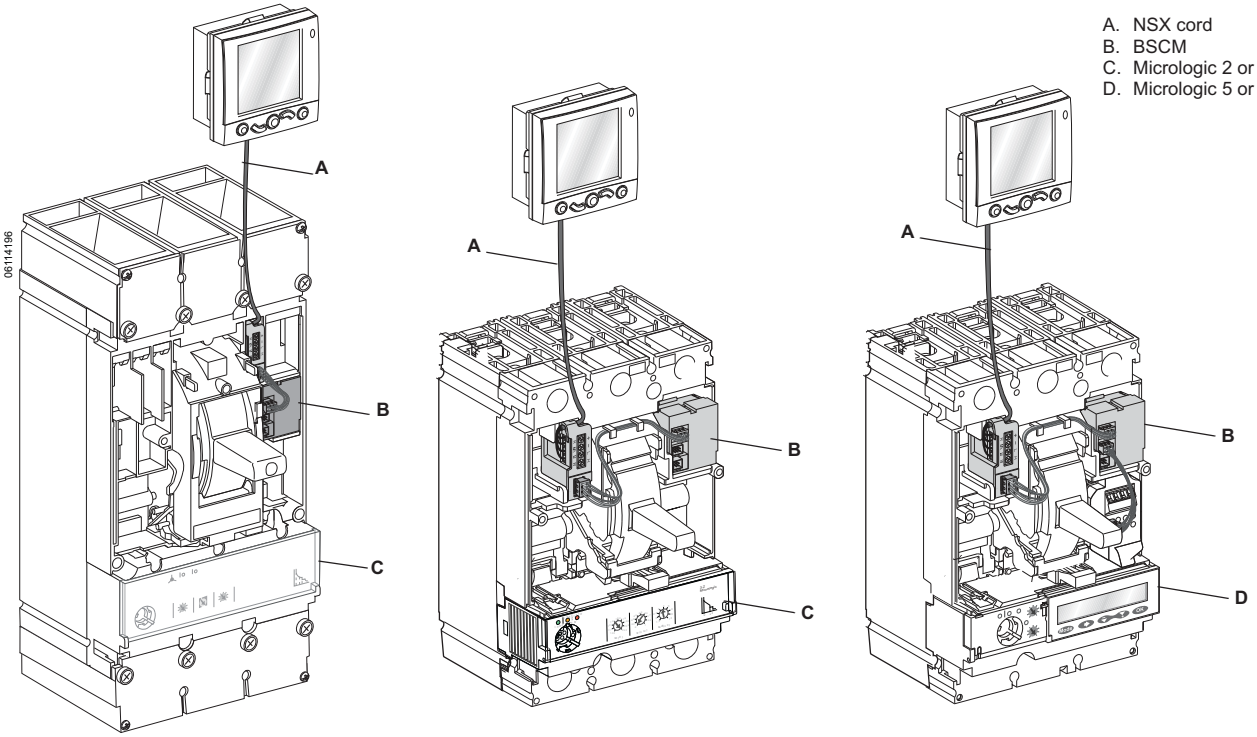
	Description	Length	Part Number
 06114192	NSX Cord Cable with male RJ45 connector for direct connection to a ULP module.	L = 4.3 ft (1.3 m)	S434201
		L = 9.8 ft (3 m)	S434202
		L = 14.7 ft (4.5 m)	S434304
 06114652	NSX Cord V > 480 Vac Cable with female RJ45 connector. Use a ULP cable to connect the NSX Cord > 480 Vac and its Insulation Module to a ULP module.	L = 4.3 ft (1.3 m)	S434204
		L = 9.8 ft (3 m)	S434303
		L = 14.7 ft (4.5 m)	S434305

For more information about the NSX cord, refer to the circuit breaker instructions shipped with the circuit breaker.

Connection to the ULP System

Connect the PowerPact H-, J-, or L-frame circuit breaker to the IMU with the NSX cord.

Figure 4: Connection to ULP System



L-frame circuit breaker with NSX cord and standard Micrologic trip unit

H-frame circuit breaker with NSX cord, BSCM, and standard Micrologic trip unit

H-frame circuit breaker with NSX cord, BSCM, and Micrologic 5 or 6 trip unit

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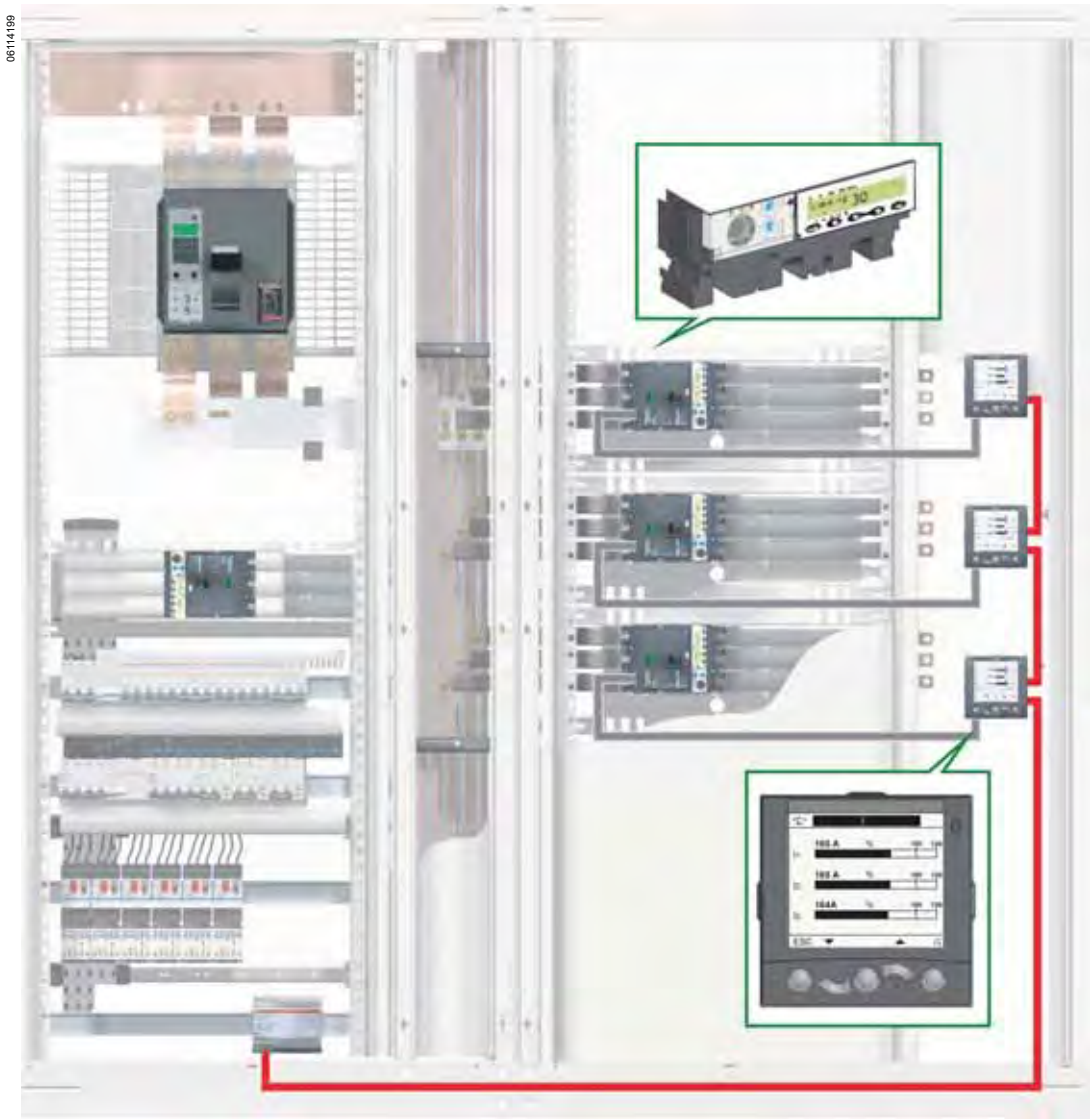
Applications

Increase functionality of a switchboard containing PowerPact H-, J-, or L-frame circuit breaker modular units with the addition of metering, display, and Modbus communication functions.

Metering and Display Functions

To incorporate metering functions, the PowerPact H-, J-, or L-frame circuit breaker must have a Micrologic 5 or 6 trip unit. The Micrologic trip unit provides the metering values on its local display, on the FDM121, or through supervisory software using the communcation system.

Figure 5: Panelboard with Metering Functions



The Micrologic 5 or 6 trip unit gives the IMUs all the Power Meter data as well as assistance with operation of the PowerPact H-, J- or L-frame circuit breaker (alarms associated with measurements, history, and tables of time-stamped events, maintenance indicators).

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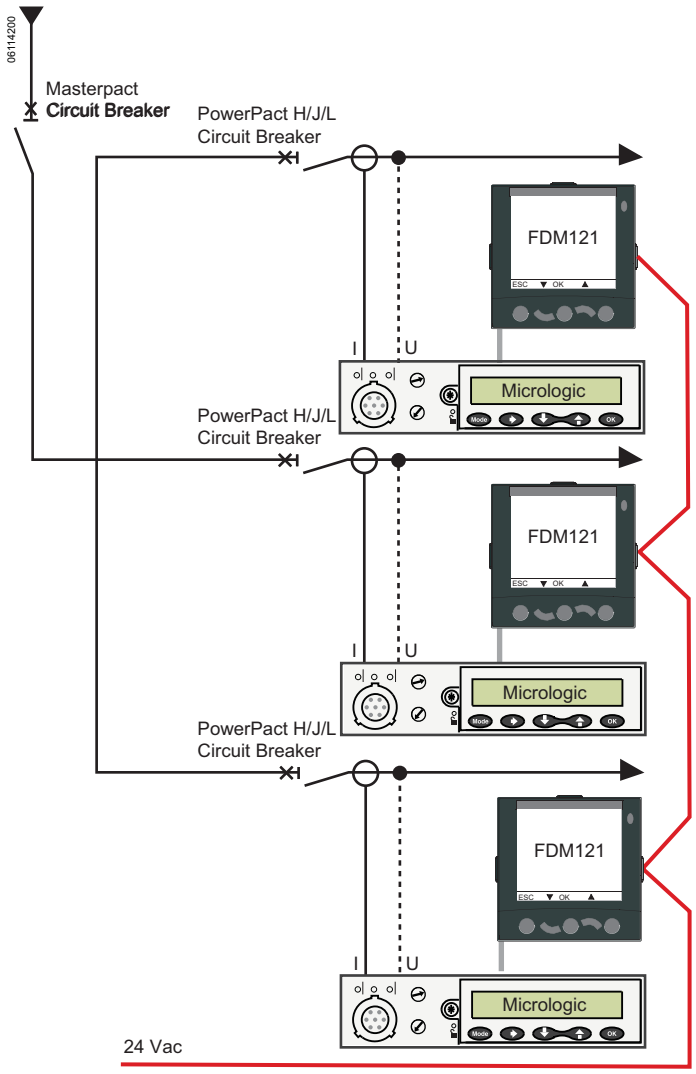
Figure 6: Wiring Diagram for Panelboard with Metering Functions



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Modbus Communication Function

Connect the IMUs to a Modbus communication network with the Modbus interface module. Use an EGX100 or EGX300 gateway for connection to the Ethernet network:

Figure 7: Modbus Communication Function

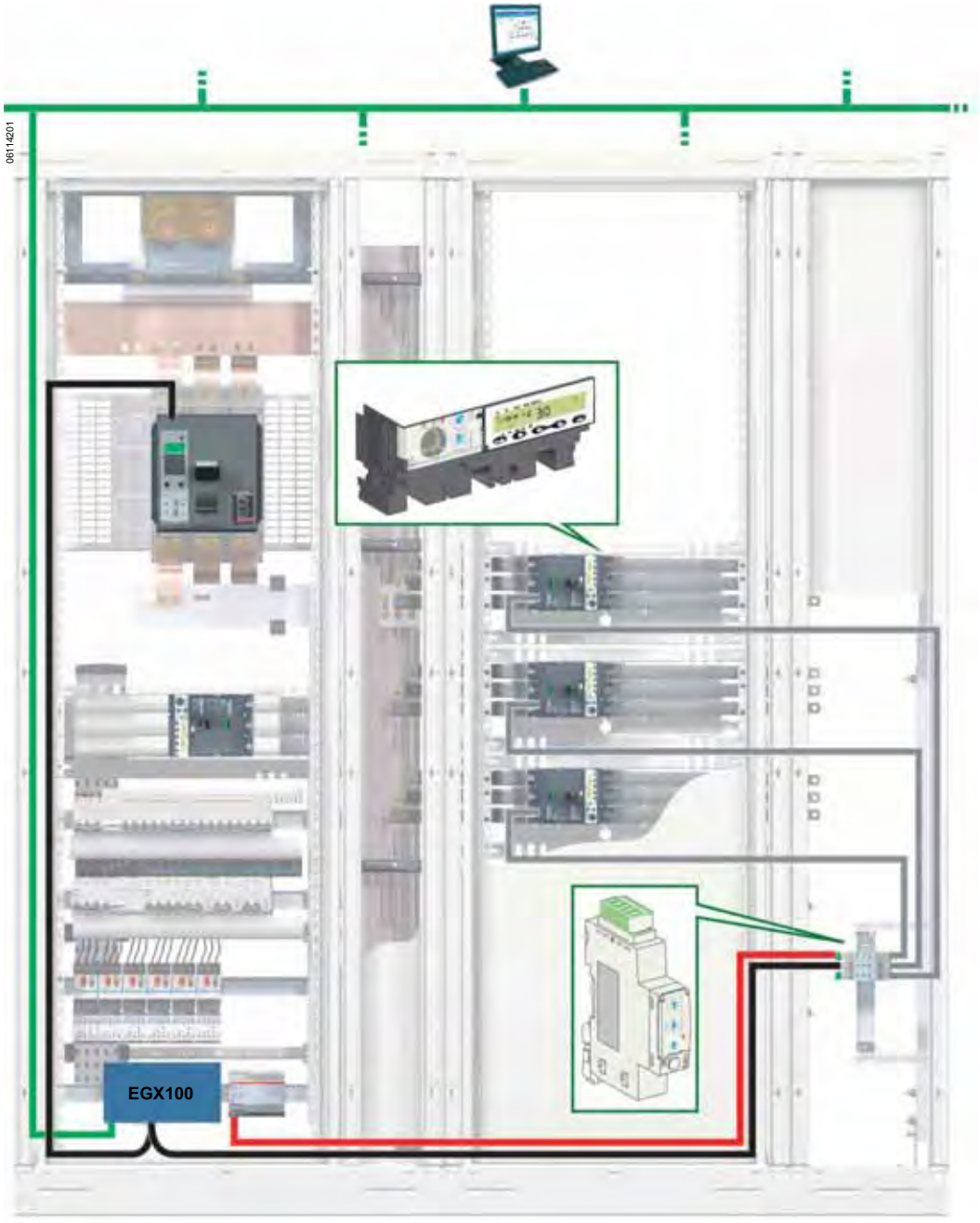

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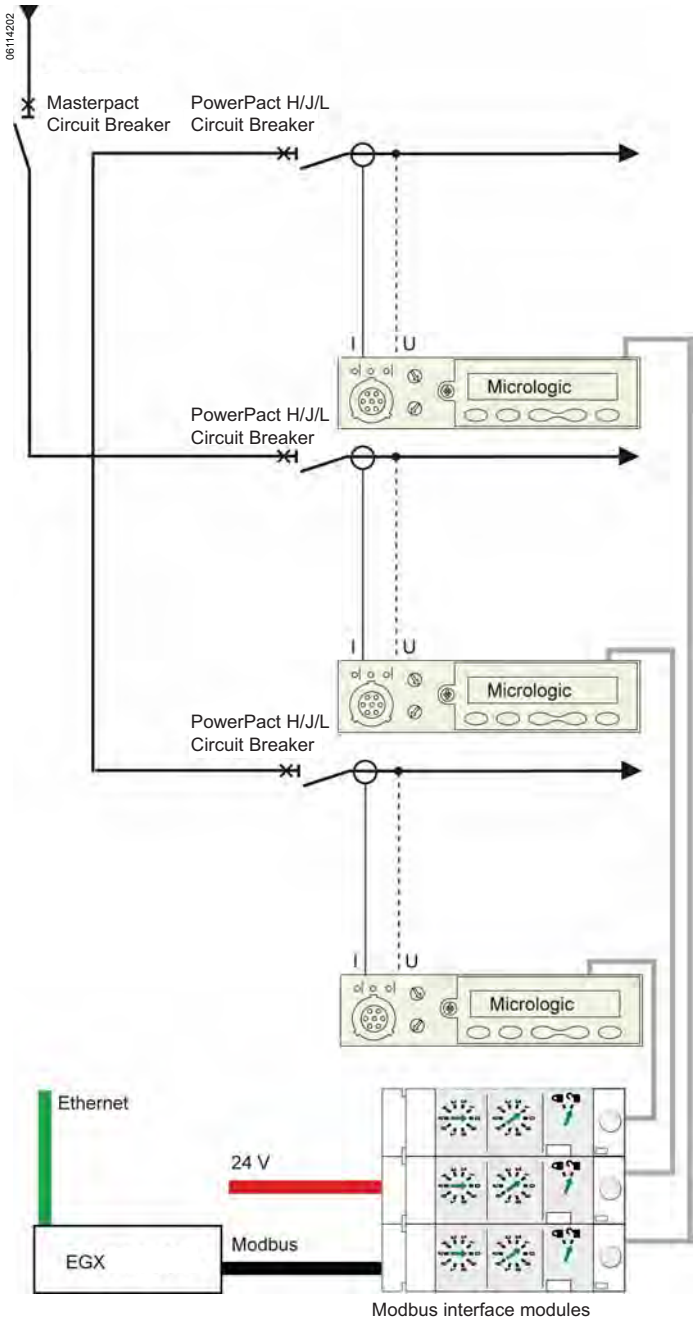
Figure 8: Wiring Diagram for Modbus Communication Function

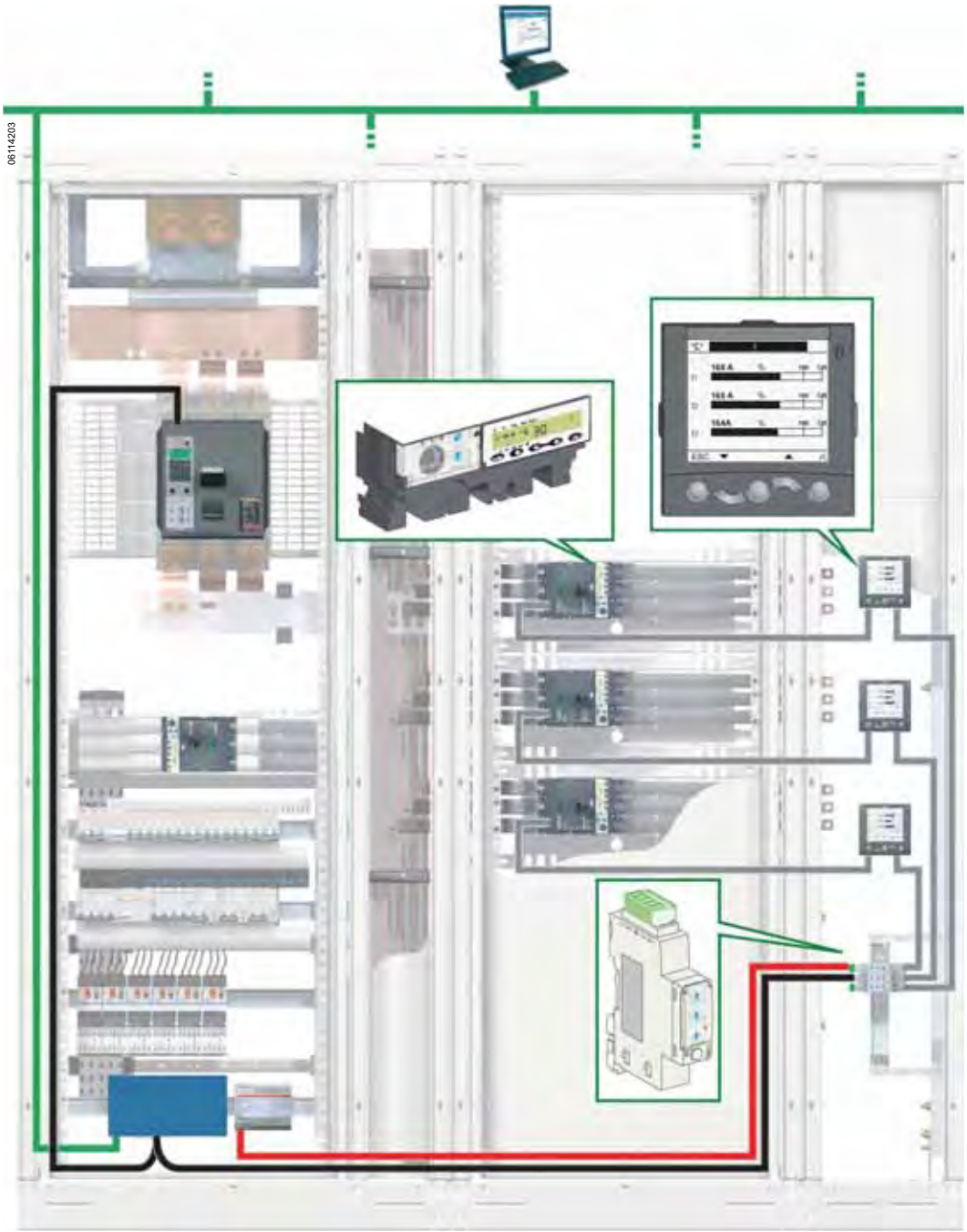


Metering, Display, and Modbus Communication Functions

IMUs can contain metering, display, and Modbus communication functions:

- The metering function is by the Micrologic trip unit.
- The display function is by the FDM121.
- The communication function is by the Modbus interface module.

Figure 9: Metering, Display, and Modbus Communication Functions



The IMUs have, in addition to power meter and operating data, communication and supervision functions.

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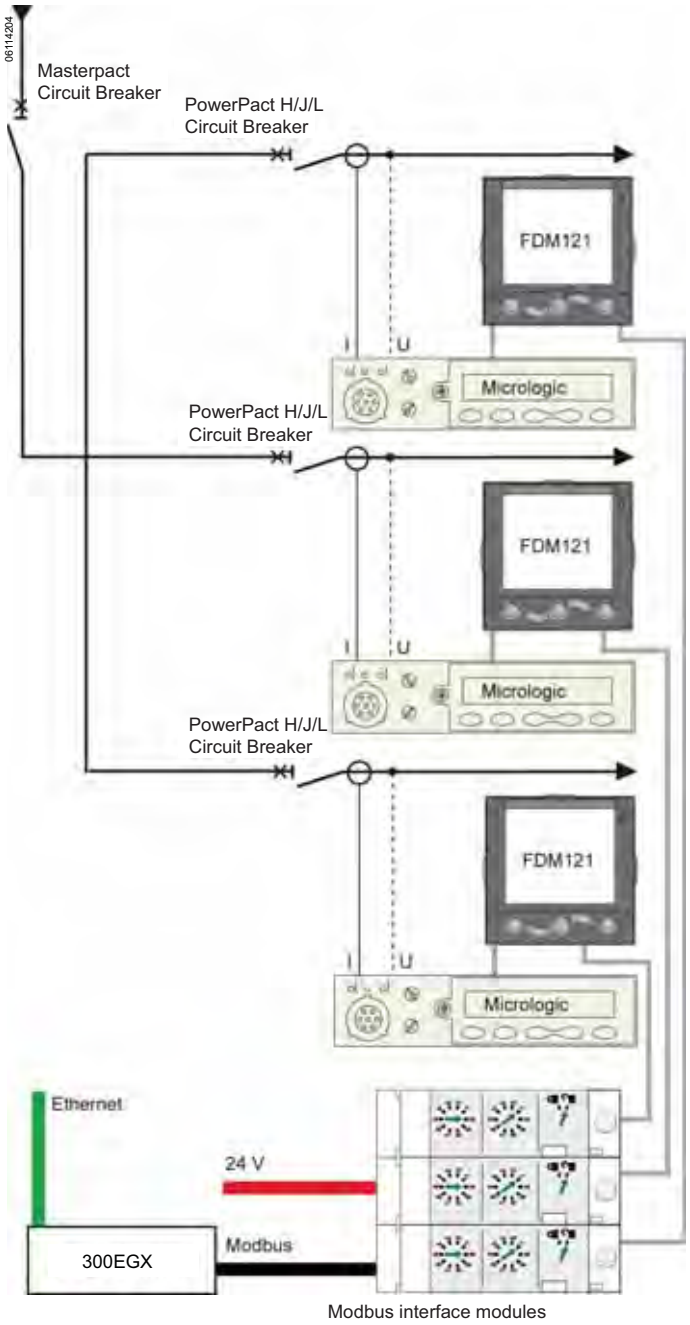
Figure 10: Wiring Diagram for Metering, Display, and Modbus Communication Functions



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Section 2—ULP System Architecture

ULP Connection and Power Supply Rules

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

General Rules

Table 6: ULP System General Rules

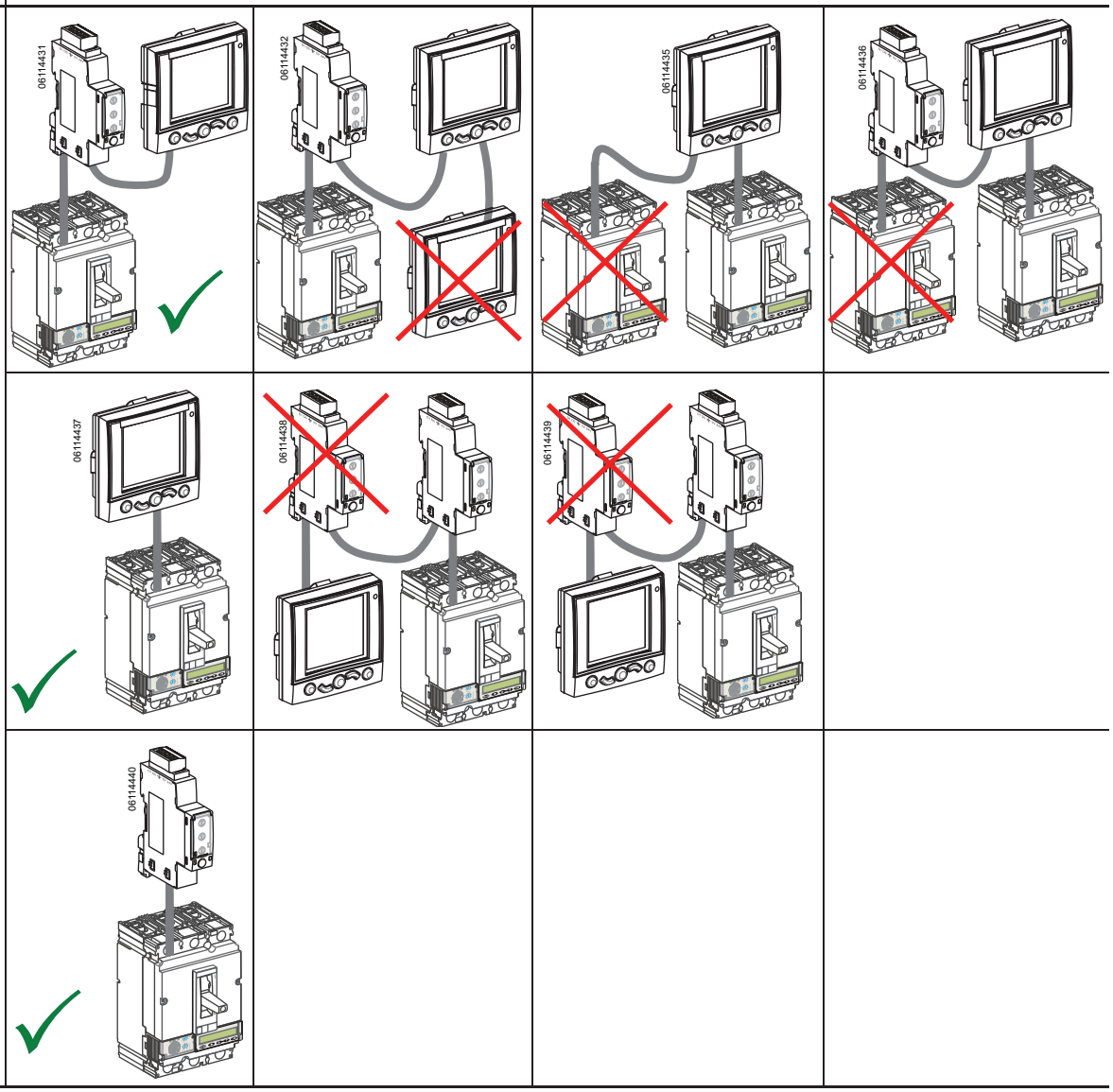
Rule	Examples
An IMU contains a maximum of one ULP module of any particular type. For example, an IMU cannot contain more than one front display module (FDM121) or more than one PowerPact H-, J- or L-frame circuit breaker.	

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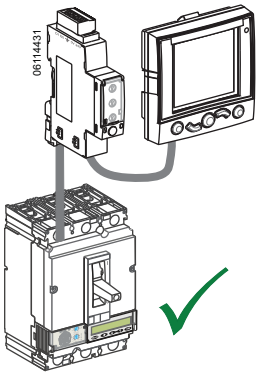
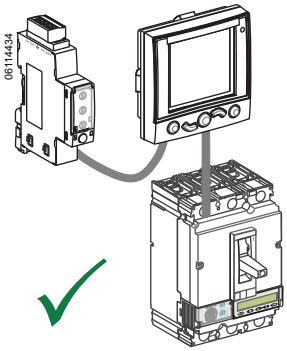
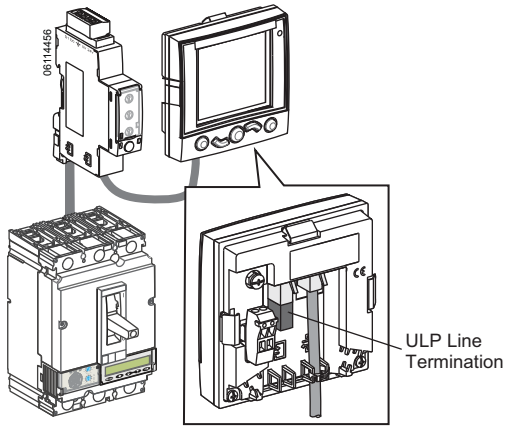
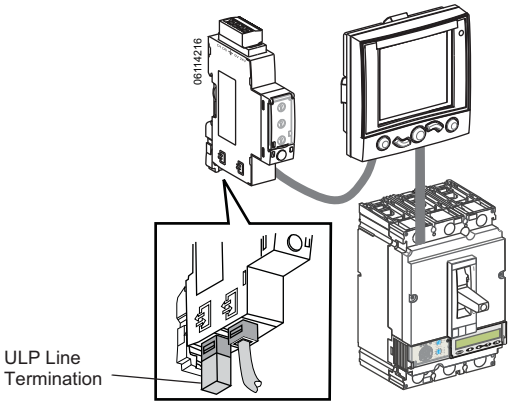
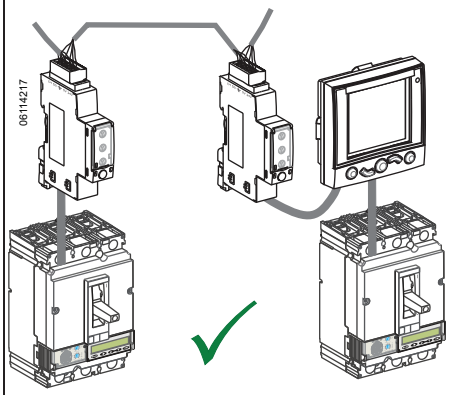
Table 6: ULP System General Rules *(continued)*

Rule	Examples	
Connect the ULP modules in a single IMU in any order. Base the connection on the cable routing and the desired layout for the ULP modules in the switchboard.		
The ULP modules placed at the end of the ULP line take a ULP line termination on the unused ULP connector. Place ULP modules which have an integral ULP line termination, such as PowerPact H, J-, or L-frame circuit breakers, at the end of the ULP line.		
Do not connect the IMUs to one another by ULP cables.		
Use only the Modbus cable to interconnect IMUs connected to a Modbus network.		

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Length of ULP Cables

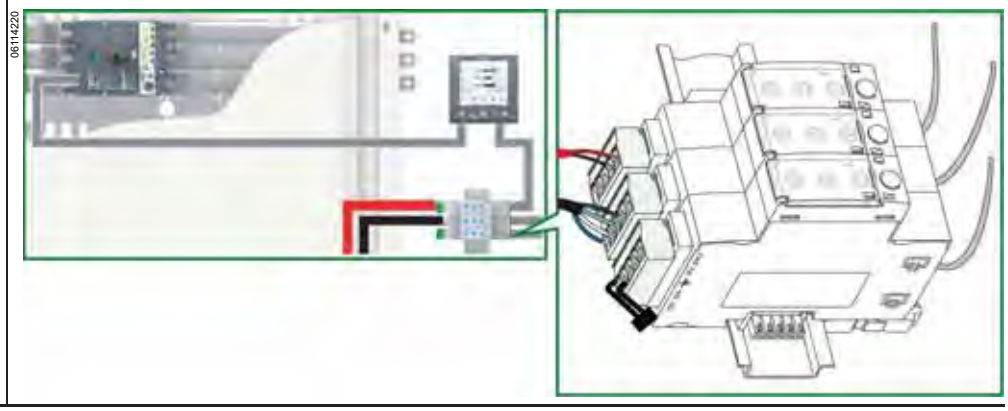
Table 7: ULP Cable Length Rules

Case	Rule
Maximum length of the ULP cable between two IMU ULP modules	32.8 ft (10 m)
Maximum length of all the ULP cables on a single IMU	65.6 ft (20 m)
Bending radius of the ULP cables	1.97 in. (50 mm) minimum.

24 Vdc Power Supply

The 24 Vdc power supply connects to a single ULP module, which then distributes it to the other IMU modules through the ULP cables.

Table 8: 24 Vdc Power Supply Connections

Application	Connection	Example
Standalone Architecture (See "Standalone Architecture" on page 31)	Connect the 24 Vdc power supply to the FDM121 supply terminal block.	 06114219
Other Than Standalone Architecture See "Connection to the Modbus Interface Module" on page 26):	Connect the 24 Vdc power supply to the Modbus interface module.	 06114220

For more information about supplying power to the IMUs, refer to "ULP System Power Supply" on page 23

Summary of Connection Rules

Table 9: Summary of Rules

Characteristics	Characteristic Value
Connection	Daisy-chaining of ULP cables and ULP line termination at the end of the ULP line
Maximum length	• 65.6 ft (20 m) in total for the IMU • 32.8 ft (10 m) between two ULP modules • 39.4 ft (12 m) for the fixed part in the case of an installation with a withdrawable drawer
Voltage range supported	24 Vdc -20% (19.2 Vdc) to 24 Vdc +10% (26.4 Vdc)
Maximum consumption per IMU	300 mA (see "ULP Module Consumption" on page 23)

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ULP System Power Supply

ULP Module Consumption

Power ULP modules by a 24 Vdc voltage distributed through the ULP cables.

To limit voltage drops on the ULP cables and the Modbus cable, the consumption of each intelligent modular unit (IMU) is limited to 300 mA.

Table 10: ULP Module Consumption

Module	Typical Consumption (24 Vdc at 20°C)	Maximum Consumption (19.2 Vdc at 60°C)
Micrologic 5 or 6 trip unit for PowerPact H-, J-, or L-frame circuit breakers	30 mA	55 mA
BSCM for PowerPact H-, J-, or L-frame circuit breakers	Consumption Value	15 mA
FDM121	21 mA	0 mA
Modbus interface module	21 mA	30 mA
UTA tester (the UTA tester has its own power supply)	0 mA	0 mA

Power Supply Rating

Table 11: Power Supply Rating Rules

Rule	Explanation
The rating of the 24 Vdc power supply for the ULP modules must not exceed 3 A.	This maintains coordination between the power supply current limiting and the protection integrated in the ULP modules on an overload or short-circuit.
The rating of the 24 Vdc power supply voltage for the furthest ULP module must be 24 Vdc +10%/-20% (19.2–26.4 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: • +/- 3% (23.3 V–24.7 V) for 3 A power supplies • +/-5% (22.8 V–25.2 V) for 1 A power supplies

Examples of 24 Vdc Power Supplies

Table 12: 24 Vdc Power Supplies

Description	Rating	Type of Installation	Part Number
Merlin Gerin: 24/30 Vdc -24 Vdc - 1 A Primary overvoltage category IV Temperature: -25°C to +70°C	1 A	Installation limited to a few IMUs	685823
Merlin Gerin: 48/60 Vdc -24 Vdc - 1 A Primary overvoltage category IV Temperature: -25°C to +70°C			685824
Merlin Gerin: 100/125 Vdc -24 Vdc - 1 A Primary overvoltage category IV Temperature: -25°C to +70°C			685825
Merlin Gerin: 110/130 Vac -24 Vdc - 1 A Primary overvoltage category IV Temperature: -25°C to +70°C			685826
Merlin Gerin: 200/240 Vac -24 Vdc - 1 A Primary overvoltage category IV Temperature: -25°C to +70°C			685827
Merlin Gerin: 380/415 Vac -24 Vdc - 1 A Primary overvoltage category IV Temperature: -25°C to +70°C			685829
Telemecanique: 100/500 Vac - 24 Vdc - 3 A Primary overvoltage category II Temperature: 0°C to +60°C (derated to 80% of the current above 50°C)	3 A	Large installation	ABL8RPS24030

Segmented Power Supply

Table 13: Segmented Power Supply Cases

Case	Segmented Power Supply Requirement
When the IMUs are divided between a number of switchboards	Each switchboard must have its own 24 Vdc power supply.
When the total cumulative consumption of the IMUs within a single switchboard exceeds 3 A	Power the IMUs by different 24 Vdc power supplies, keeping to a maximum consumption of 3 A for each power supply.
When the IMUs communicate over Modbus using the Modbus interface module (part number TRV00210), 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 49.2 ft (15 m) 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 for a single Modbus network, with a maximum rating of 3 A for each power supply segment.
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 are independent from one another.

The 24 Vdc external power supply for the Micrologic 2.x and 3.x trip units for PowerPact H-, J-, and L-frame circuit breakers may be shared with the ULP/communications system. This supply is connected to earth ground as described in Table 14.

NOTE: The 24 Vdc external power supply for Micrologic 0.x A/P/H trip units for Masterpact NT and NW and PowerPact P and R circuit breakers must be a separate power supply the ULP/communications power supply. Use one 24 Vdc external power supply per Micrologic 0.x A/P/H trip unit for Masterpact NT and NW and PowerPact P and R circuit breakers. This supply is NOT connected to earth ground.

Connection of the 0 V

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

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

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

Table 14: Rules for Connection of the 0 V

0 V Connection Rule
Connect the 0 V (Modbus common and 0 V of the 24 Vdc power supply) to the earth ground.
Only one 0 V connection to the earth ground is accepted on a single Modbus network, at Modbus master or Ethernet gateway level, or at the top of each segment isolated by an Isolated Modbus Repeater Module.
Do not connect the 24 V of the 24 Vdc power supply to the earth ground.
If there are several power supply segments on a single Modbus network, the power supply on the second and third segments should not be grounded.

Segments of the Modbus network that are isolated from the main trunk line and that are all located within one piece of equipment must be earth grounded within that section of equipment.

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Rules for Connection to the Modbus Network

This section sets out the rules for connecting intelligent modular units (IMUs) to the Modbus network.

Connection of Intelligent Modular Units (IMUs)

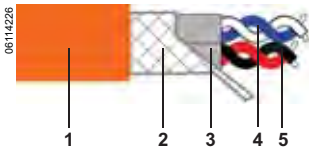
Connect intelligent modular units (IMUs) to the Modbus network with the Modbus interface module (see “Modbus™ Interface Module” on page 60).

Use the Modbus cable to interconnect the IMUs, supply them with power, and connect them to the Modbus master.

The maximum theoretical number of IMUs permitted on the same Modbus network is 31. To obtain acceptable communication performance (response times less than 2 s), limit the number of IMUs on the same Modbus network to twelve.

Composition of the Modbus Cable

Table 15: Modbus Cable[1]

 1. Outer sheath 2. Shielding braid 3. Twisted pair sheaths 4. Communication pair (white/blue) 5. Power supply pair (red/black)	**Description**	**Part Number**
	Merlin Gerin: Shielded cable with two twisted pairs. L= 196.8 ft (60 m)	50965

[1] This cable construction is not used with the Isolated Modbus Repeater Module.

Table 16: Modbus Cable Characteristics

Shielded cable with 2 twisted pairs:	1 pair with 24 AWG (0.25 mm^2) cross-section for the RS485 signal (D0, D1)
	1 pair with 20 AWG (0.5 mm^2) cross-section for the power supply (0 V, 24 V)
Shielding braid	Connected to the ground terminal of the Modbus interface module 5-pin connector
External diameter:	0.35–0.38 in. (8.7–9.6 mm)
Color of outer sheath:	Orange
The 0 V of the power supply pair is also the Modbus common, that is, the 0 V for the RS485 earth leakage protection pair (D0, D1).	
The 0 V (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 “Modbus Cable Characteristics” on page 99	

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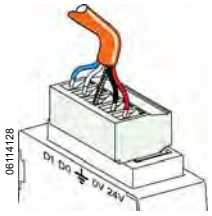
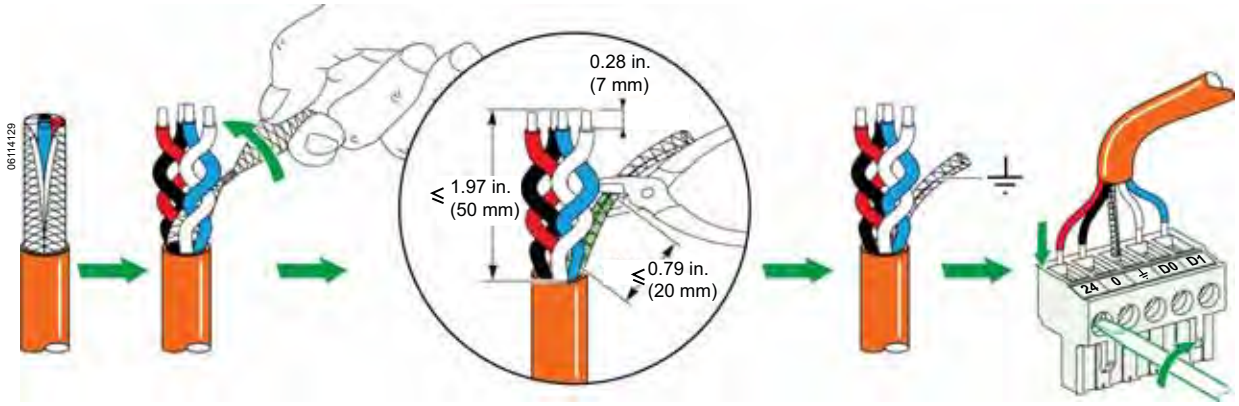
Connection to the Modbus Interface Module

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

Table 17: Modbus Interface Module Connection

Connector	Marking	Color	Description	Unsheathed Length	Stripped Length
	D1	Blue	D1: RS 485 B/B' or Rx+/Tx+ signal	1.99 in (5 cm) max.	0.28 in. (7 mm)
	D0	White	D0: RS 485 A/A' or Rx-/Tx- signal		
		—	Modbus cable shielding braid, connected to the local machine ground in the Modbus interface module	0.79 in. (2 cm) max. [1]	0.28 in. (7 mm)
	0 V	Black	0 V for Modbus common and power supply	1.99 in (5 cm) max.	0.28 in. (7 mm)
	24 Vdc	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 Modbus interface module 5-pin connector.

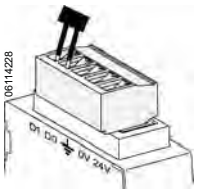
Modbus Line Termination

The Modbus cable communication pair has typical impedance of 120 Ω. The Modbus cable must therefore be terminated at each end by a Modbus line termination with 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 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 with an RC cell: 120 Ω in series with a 1 nF capacitor and two 10 cm wires for direct connection (between D0 and D1) to the 5-pin connector on the last Modbus interface module.

Table 18: Modbus Line Termination

	Description	Part Number
	Telemecanique: 2 Modbus line terminations (120 Ω + 1 nF)	VW3A8306DRC

General Rules for Modbus Cable Length

Table 19: Rules for Modbus Cable Length

Condition	Rule
The maximum permitted length for the Modbus network (for the trunk cable, excluding derivations)	1640 ft (500 m) at 38400 baud and 3281 ft (1000 m) at 19200 baud.
The Modbus cable connecting the Modbus interface modules in the ULP system incorporates both the Modbus communication network and the 24 Vdc power supply.	• 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 V (2 V on +24 V wire and 2 Von 0 V wire). A minimum supply voltage of 24 V -20% (19.2 V) is thus obtained on the last Modbus interface module, with a 24 V power supply regulated at: — +/- 3% (23.3 V–24.7 V) for 3 A power supplies —+/-5% (22.8 V–25.2 V) for 1 A power supplies
Because of the stresses caused by a drop in the supply voltage, more restrictive limitations are imposed:	• For optimum quality of Modbus communication, the voltage on the 0 V terminal on each Modbus interface module (Modbus common) must not vary by more than +/-4 V 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.

For more information about the instructions for installing the Modbus cable, refer to the Modbus Communications—User Guide.

For more details of the Modbus cable lengths for each architecture in the ULP system, refer to “ULP System Connections” on page 30.

Connection to the Modbus Master

Connection to the Modbus master varies according to whether:

- The Modbus network is contained within the switchboard
- The Modbus network is not contained within the switchboard

Modbus Network Contained in Switchboard

The Modbus network is contained within the switchboard when both:

- The Modbus network between the Modbus interface modules is connected to the Modbus master integrated in the switchboard (a PLC, for example) or an EGX Ethernet gateway.
- The Modbus network between the Modbus interface modules does not exit the switchboard to extend to another switchboard.

In this case, the Modbus master can be connected directly to the Modbus network of the Modbus interface modules in the switchboard.

An example of a Modbus network contained within the switchboard is provided in “Ethernet Connection Linking Two Switchboards” on page 28.

Modbus Network Not Contained in Switchboard

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Do not connect the Modbus network inside the switchboard to a Modbus network outside the switchboard without inserting an isolation barrier.

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

The Modbus network is not contained within the switchboard when either:

- The Modbus network between the Modbus interface modules is connected to a Modbus master outside the switchboard.
- The Modbus network between the Modbus interface modules exits the switchboard to extend to another switchboard.

In this case, an isolation barrier (Isolated Modbus Repeater Module or fiber-optic link interface) must be inserted at the Modbus entry of each switchboard, between the Modbus network outside the switchboard and the Modbus network inside the switchboard.

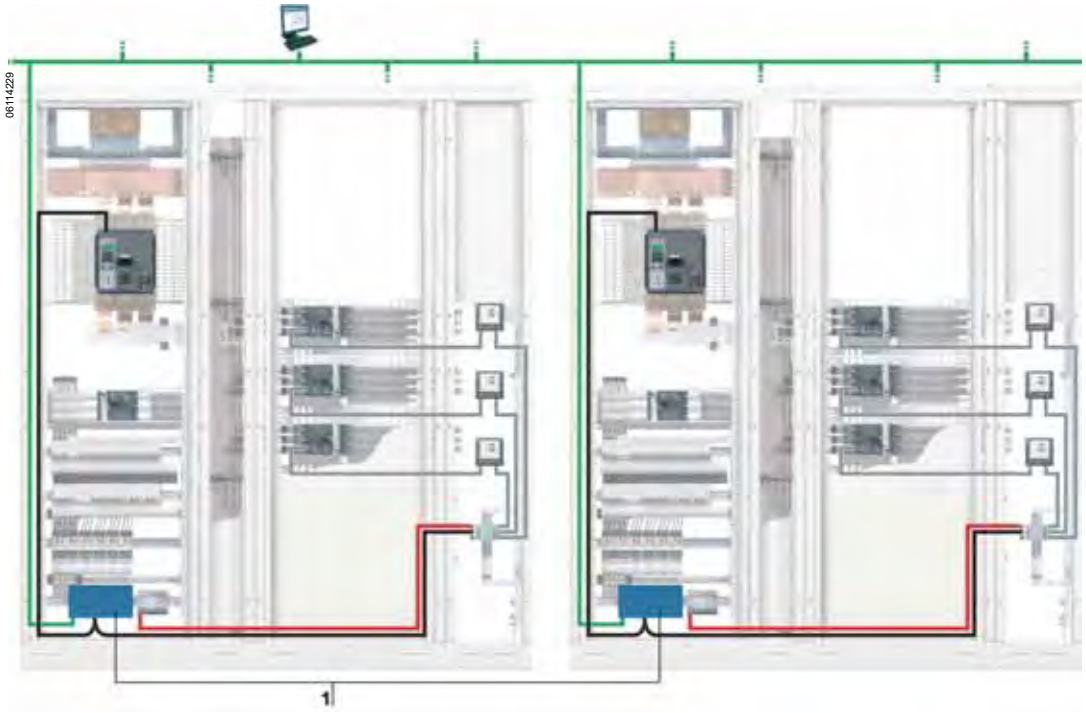
An example of a Modbus network not contained within the switchboard is provided in “Modbus Connection Linking Two Switchboards” on page 29.

Ethernet Connection Linking Two Switchboards

Two remote switchboards can be linked by an Ethernet connection, regardless of the distance or the ground equipotential between the two switchboards. In this case, the Modbus network is contained within the switchboards.

This solution is preferable to the isolation barrier (Isolated Modbus Repeater Module or fiber-optic link interface).

Figure 11: Ethernet Connection Linking Two Switchboards



1. EGX300 gateway

Connection of an EGX Ethernet gateway to the Modbus network inside the switchboard is shown in detail in “Wiring Diagram for Ethernet Gateway Power Supply” on page 34.

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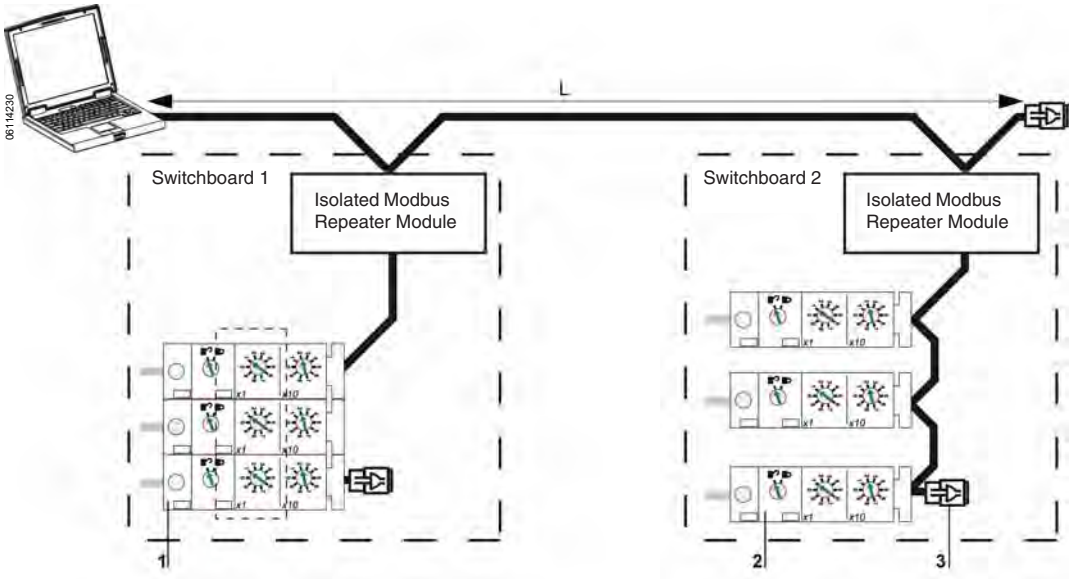
Modbus Connection Linking Two Switchboards

When the Modbus network is not contained within the switchboard, an Isolated Modbus Repeater Module must be inserted between the Modbus network inside the switchboard and the Modbus network outside the switchboard.

Table 20: Modbus Link Connecting Two Switchboards, Using Isolated Modbus Repeater Modules



1. Modbus interface modules grouped in islands with the stacking accessory
2. Modbus interface modules daisy-chained with the Modbus cable
3. Modbus line terminations

Table 21: Isolated Modbus Repeater Module Connection Rules

Description	Connection Rule
Each isolated Modbus segment must include a polarization at one point, and a Modbus line termination at each end:	On the segment outside the switchboard: • The line polarization and a termination are integrated in the Modbus master. • A Modbus line termination (part number VW3A8306DRC) must be connected at the other end, on the last Isolated Modbus Repeater Module.
	On the segment inside the switchboard: • The polarization and a Modbus line termination must be integrated in the Isolated Modbus Repeater. • A Modbus line termination must be connected at the other end, on the last Modbus Interface Module or other Modbus slave.
L is the length of the Modbus trunk cable (excluding derivations):	Lmax = 1640 ft (500 m) at 38400 baud
	Lmax = 3281 ft (1000 m) at 19200 baud

Connection of the Isolated Modbus Repeater Module to the Modbus networks inside and outside the switchboard is shown in detail in “Isolated Modbus Repeater Module Characteristics” on page 101.

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ULP System Architectures

ULP System Connections

The ULP system architecture is defined by the way in which the Modbus cable interconnects the intelligent modular units (IMUs).

The various possible ULP system connections define three architectures:

- Standalone architecture: The IMUs are not communicating.
- Centralized Modbus architecture: The IMUs are communicating. The Modbus interface modules are grouped in islands, mounted side-by-side on a DIN rail and interconnected by the stacking accessory (see “Mounting on the Stacking Accessory” on page 61).
- Distributed Modbus architecture: The IMUs are communicating. The Modbus interface modules are distributed as close as possible to their IMU ULP modules and linked by the Modbus cable. There are two possible configurations for the distributed Modbus architecture:
  - — Daisy-chained distributed Modbus architecture
  - — Derivated distributed Modbus architecture

  Both these distributed architectures can be combined to form a mixed architecture.

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

Choice of Architecture

Table 22 lists the advantages and disadvantages of ULP system architectures:

Table 22: ULP System Architecture

Architecture	Advantages	Disadvantages
Centralized Modbus	• Easy wiring due to the stacking accessory • Ease of maintenance due to the grouping of Modbus interface modules in islands • Option of connecting other Modbus products through derivations, on the unused connectors of Modbus interface modules in the islands • Minimized Modbus cable length	• Need for a dedicated place in the cubicle where the Modbus interface modules can be grouped • Vertical distribution of ULP cables between the Modbus interface modules and their associated ULP modules
Daisy-chained distributed Modbus	• No need for a dedicated place in the cubicle where the Modbus interface modules can be grouped	• Additional wiring needed for daisy-chaining the Modbus cable between the Modbus interface modules • Longer Modbus cable • Space taken up in the cubicle by the upstream and downstream Modbus cables
Derivated distributed Modbus	• No need for a dedicated place in the cubicle where the Modbus interface modules can be grouped • Shorter Modbus cable than that needed for the daisy-chained distributed Modbus architecture	• Additional wiring needed for daisy-chaining the Modbus cable between the Modbus interface modules • Need for a derivation terminal block at the top of each cubicle

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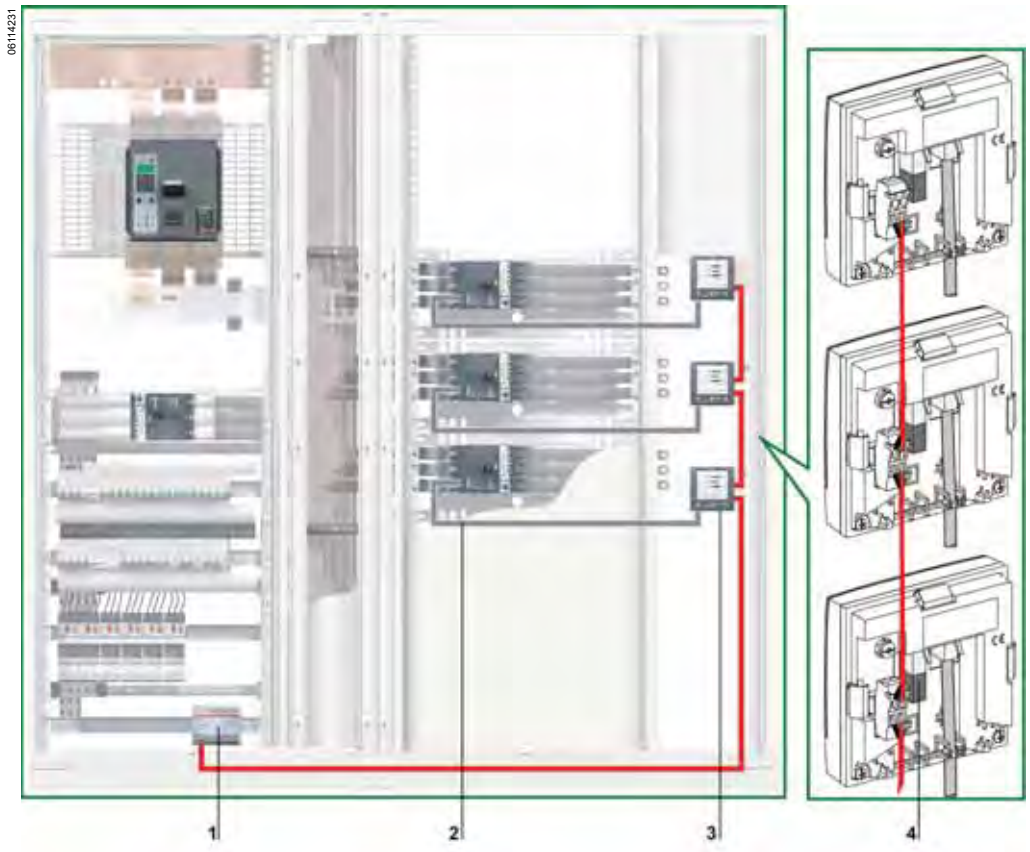
Standalone Architecture

When the intelligent modular units (IMUs) are not communicating, the architecture is classified as standalone.

Figure 12 shows an example of a standalone architecture with IMUs consisting of an FDM121 and a PowerPact H-, J-, or L-frame circuit breaker equipped with a Micrologic trip unit.

The IMUs do not communicate and do not therefore include a Modbus interface module. Power the IMUs using an external power supply connected to the FDM121.

Figure 12: Standalone Architecture



1. 24 Vdc power supply
2. NSX cord
3. FDM121
4. ULP line termination

The FDM121 mounting options are described in Installing the “Front Display Module (FDM121)” on page 66.

The 24 Vdc power supply is selected from the list supplied in “Examples of 24 Vdc Power Supplies” on page 23.

The power supply rating must be selected according to IMU consumption.

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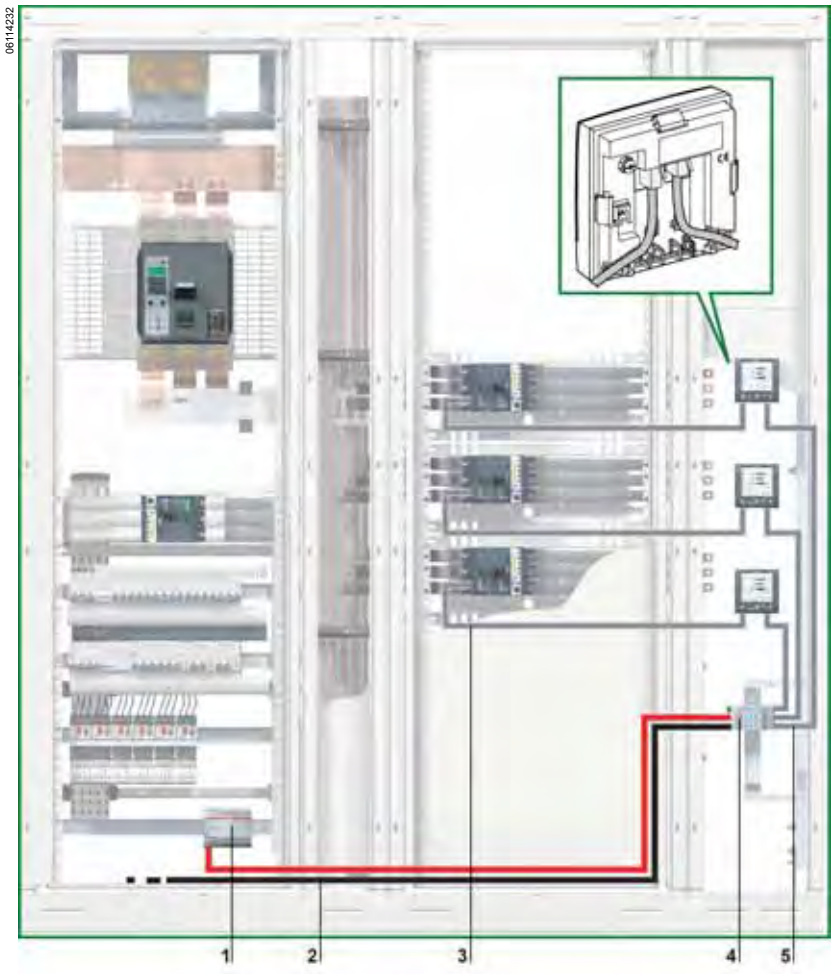
Centralized Modbus Architecture

In a centralized Modbus architecture, the intelligent modular units (IMUs) are communicating. The Modbus interface modules are grouped in islands, mounted side-by-side on a DIN rail and interconnected using the stacking accessory (see “Mounting on the Stacking Accessory” on page 61).

Figure 13 shows an example of a centralized Modbus architecture with IMUs consisting of a PowerPact H-, J-, or L-frame circuit breaker, an FDM121, and a Modbus interface module.

Figure 13: Centralized Modbus Architecture



1. 24 Vdc power supply
2. Modbus cable coming from the Modbus master
3. NSX cord
4. Modbus interface modules grouped with the stacking accessory
5. ULP cable

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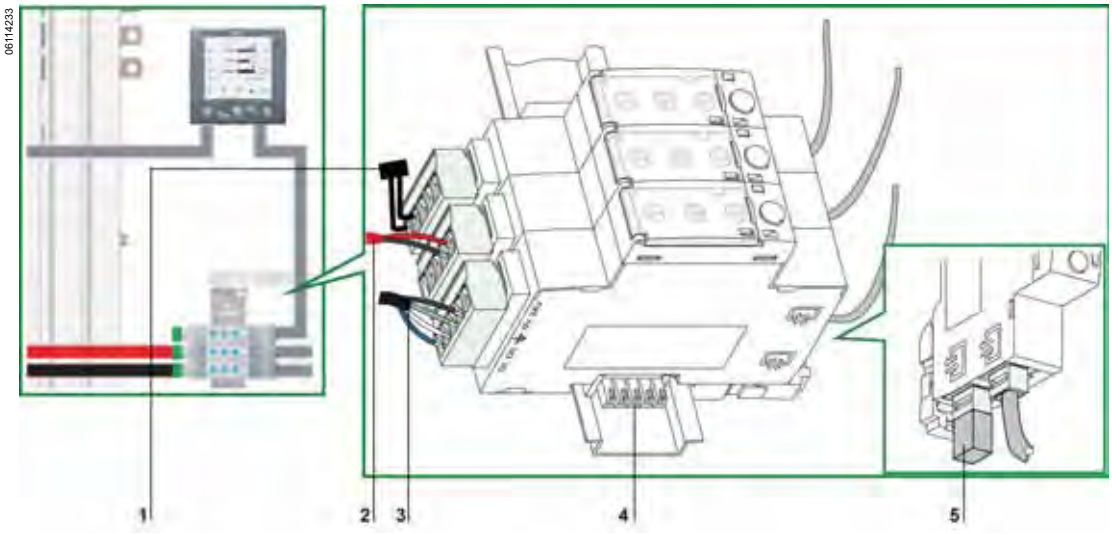
Modbus Cable Connection

Figure 14 shows the grouping of Modbus interface modules in detail:

Figure 14: Grouping of Modbus Interface Modules

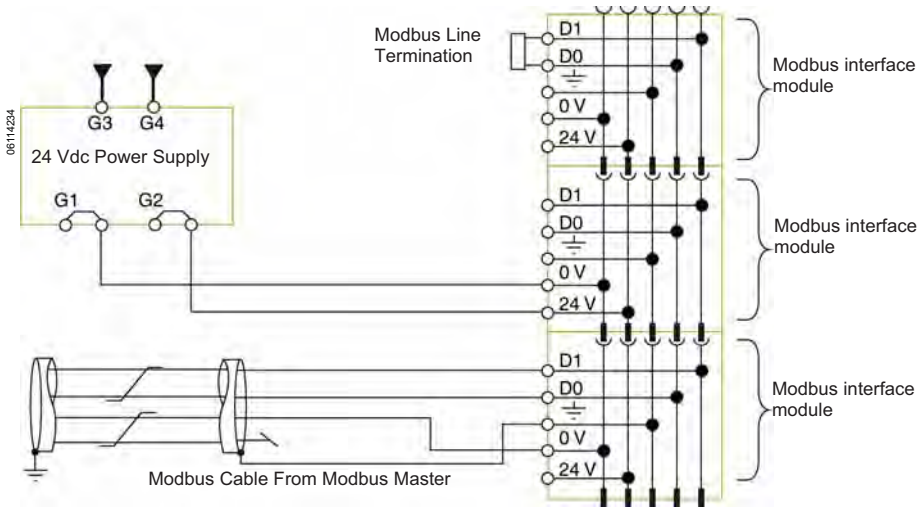


1. Modbus line termination
2. 24 Vdc power supply
3. Modbus cable coming from the Modbus master
4. Stacking accessory
5. ULP line termination

The Modbus cable coming from the Modbus master is connected to a Modbus interface module. It ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected when the master is powered separately.

Unused 5-pin connectors can be used to connect a Modbus derivation cable to another Modbus product (such as Modbus interface module for Masterpact circuit breaker or PM800 communicating power meter) or to connect the 24 Vdc power supply.

Figure 15: Wiring Diagram for Modbus Cable and 24 Vdc Power Supply

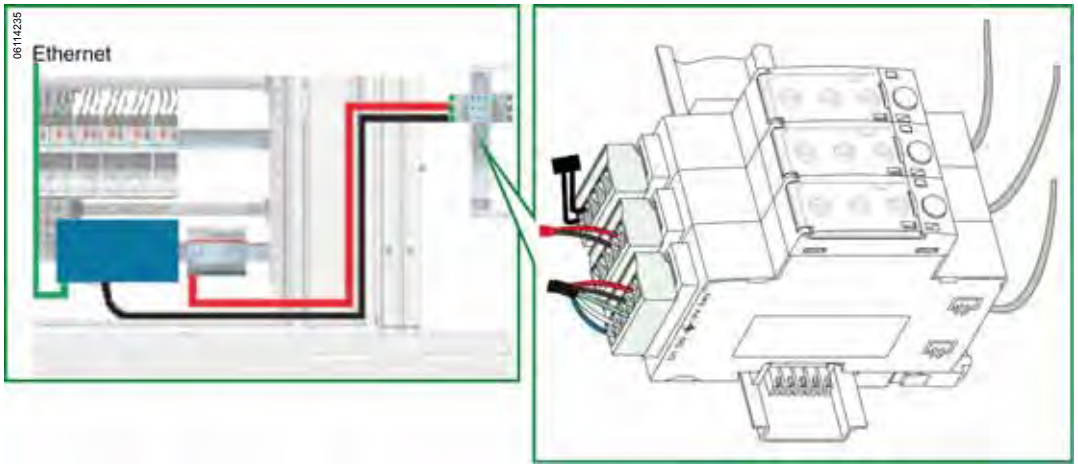


ENGLISH

Ethernet Gateway Power Supply

When the Modbus master is an EGX Ethernet gateway placed directly in the switchboard, power it using the ULP system's 24 Vdc power supply.

Figure 16: Ethernet Gateway Power Supply



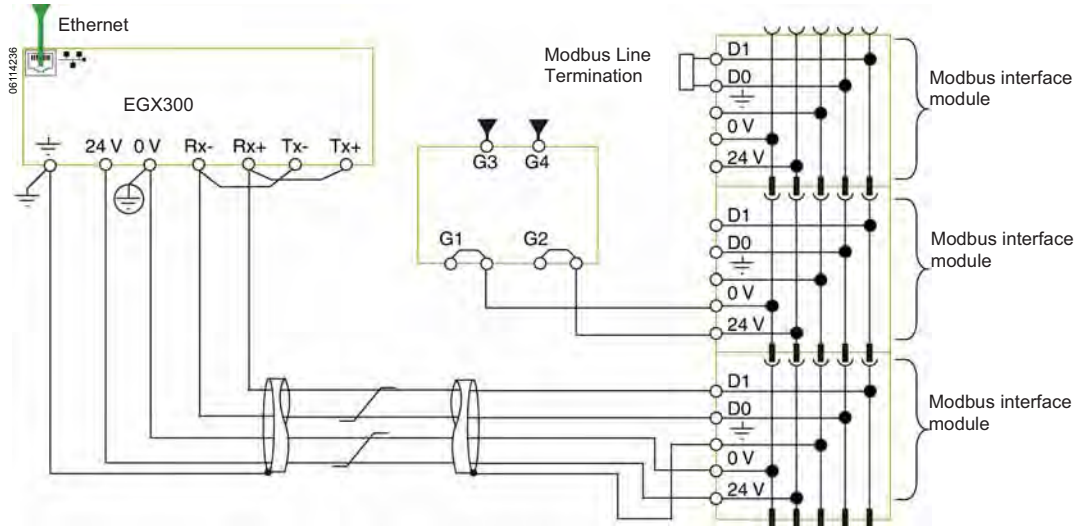
The 24 V wire of the Modbus cable coming from the EGX Ethernet gateway is connected: the EGX Ethernet gateway is therefore powered from the Modbus interface module.

Confirm that the 24 Vdc power supply used corresponds to the power supply rules for the EGX Ethernet gateway and that its rating is sufficient to power the Ethernet gateway and the IMUs in the switchboard.

For more information, refer to the EGX Ethernet gateway installation manual.

Figure 17 shows the connections for the EGX Ethernet gateway and the 24 Vdc power supply in detail:

Figure 17: Wiring Diagram for Ethernet Gateway Power Supply



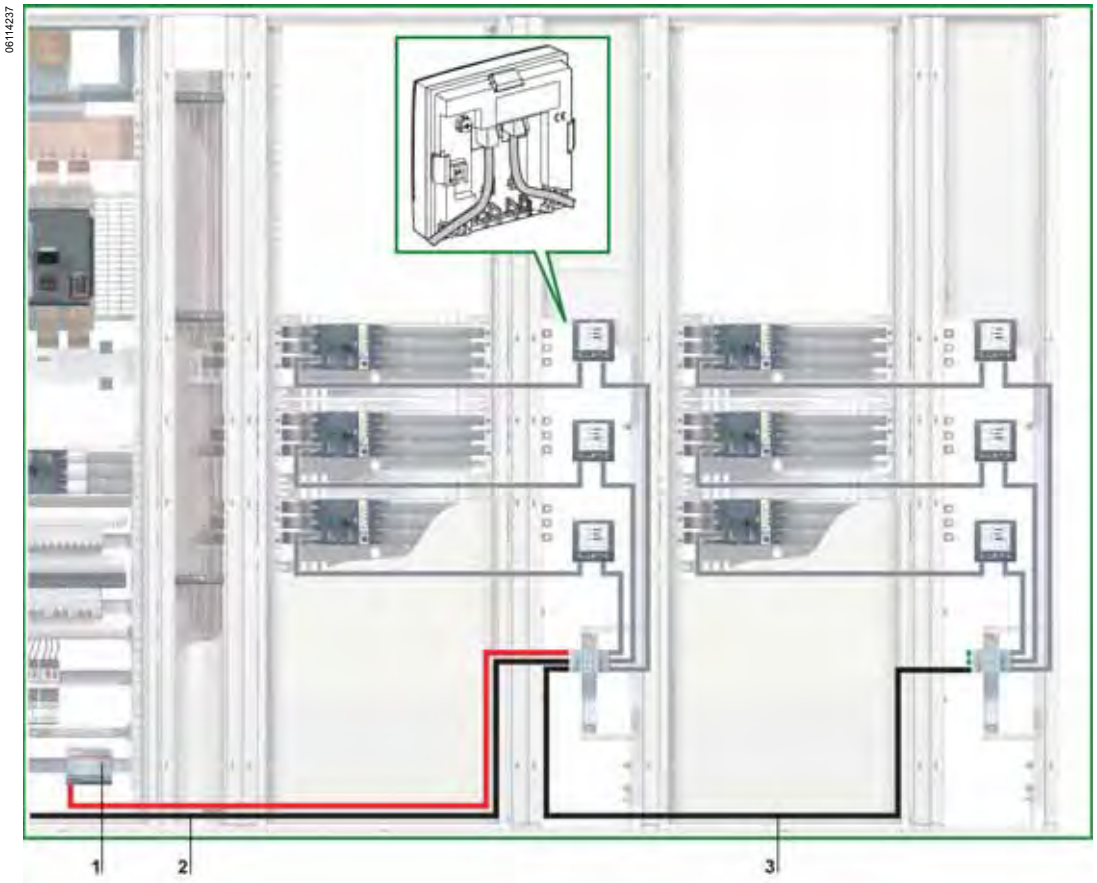
- The Modbus cable shielding and the EGX Ethernet gateway's functional ground terminal are connected to the local machine ground.
- The 0 V (Modbus common and 0 V of the 24 Vdc power supply) is connected to the protective ground, once and only once, in the EGX Ethernet gateway.

ENGLISH

Case of a Single Power Supply Segment

Figure 18 shows a centralized Modbus architecture with two cubicles and a single power supply segment:

Figure 18: Centralized Modbus Architecture with Single Power Supply Segment



1. 24 Vdc power supply
2. Modbus cable coming from the Modbus master
3. Modbus cable running to the second cubicle

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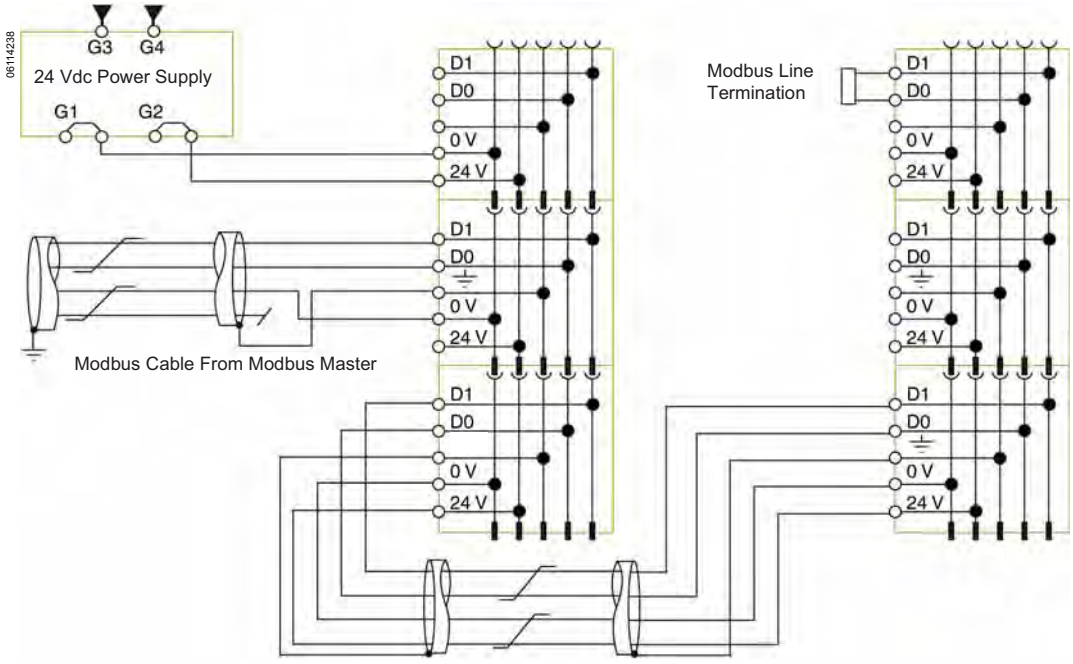
Modbus Cable Connection with a Single Power Supply Segment

- The Modbus cable coming from the Modbus master is connected to a Modbus interface module. It ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected when the master is powered separately.
- The Modbus cable running to the second cubicle can be connected to any Modbus interface module in the group. It ensures the continuity of the Modbus signal and the 24 Vdc power supply to the second cubicle.

Figure 19 shows the connections for the Modbus cables and the 24 Vdc power supply in the case of a single power supply segment:

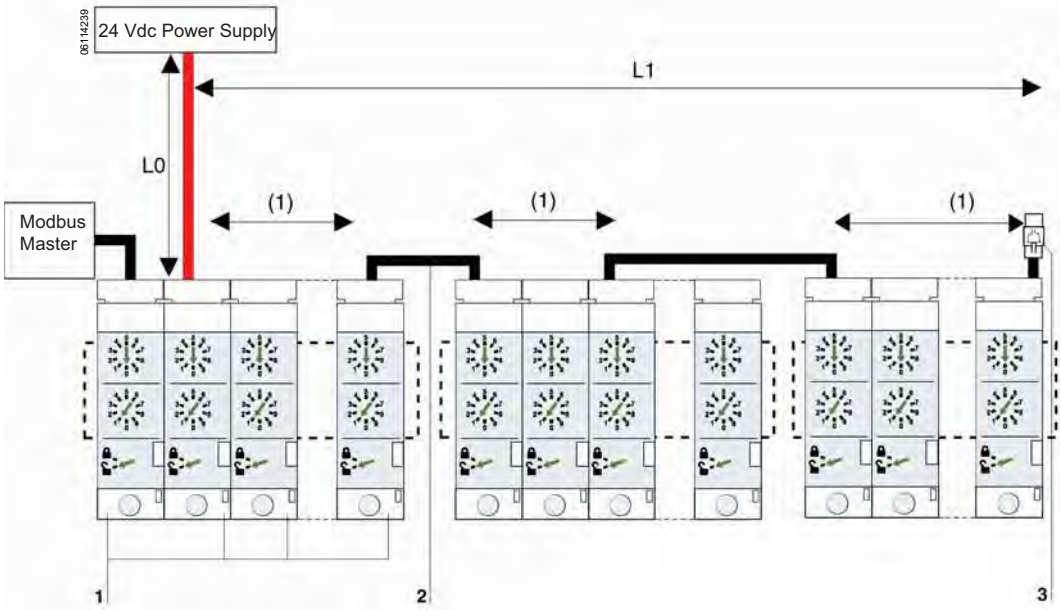
Figure 19: Wiring Diagram for Modbus Cable Connection with a Single Power Supply Segment



Modbus Cable Lengths for a Single Power Supply Segment

Figure 20 shows the Modbus cable lengths in detail, in the case of a centralized Modbus architecture with a single power supply segment:

Figure 20: Single Power Supply Segment Cable Lengths



1. Modbus interface modules grouped with stacking accessories
2. Modbus cable ensuring continuity of the Modbus signal and the 24 Vdc power supply
3. Modbus line termination

(1) The contact resistance between two 5-pin connectors in the group of Modbus interface modules should be counted as 3.28 ft (1 m) of Modbus cable when both Modbus cables are connected to two of the first seven Modbus interface modules, and as 6.56 ft (2 m) of Modbus cable thereafter.

The table below 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 “Connection to the Modbus Interface Module” on page 26.

24 Vdc Rating	L0 (in 18 AWG [0.75 mm^2] wires)	L1
1 A	16.4 ft (5 m)	148 ft (45 m)
3 A	9.84 ft (3 m)	49 ft (15 m)

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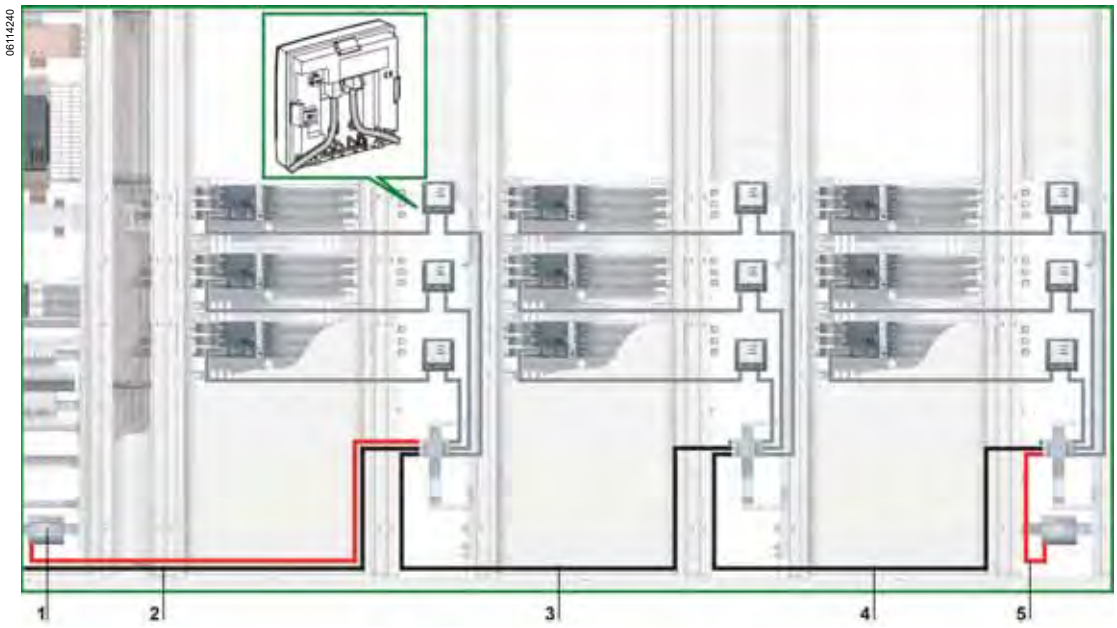
Case of Several Power Supply Segments

When more than one 24 Vdc power supply is needed (see “Segmented Power Supply” on page 24), then several power supply segments are used along the Modbus cable. Figure 21 shows a centralized Modbus architecture with two power supply segments:

Figure 21: Centralized Modbus Architecture with Two Power Supply Segments

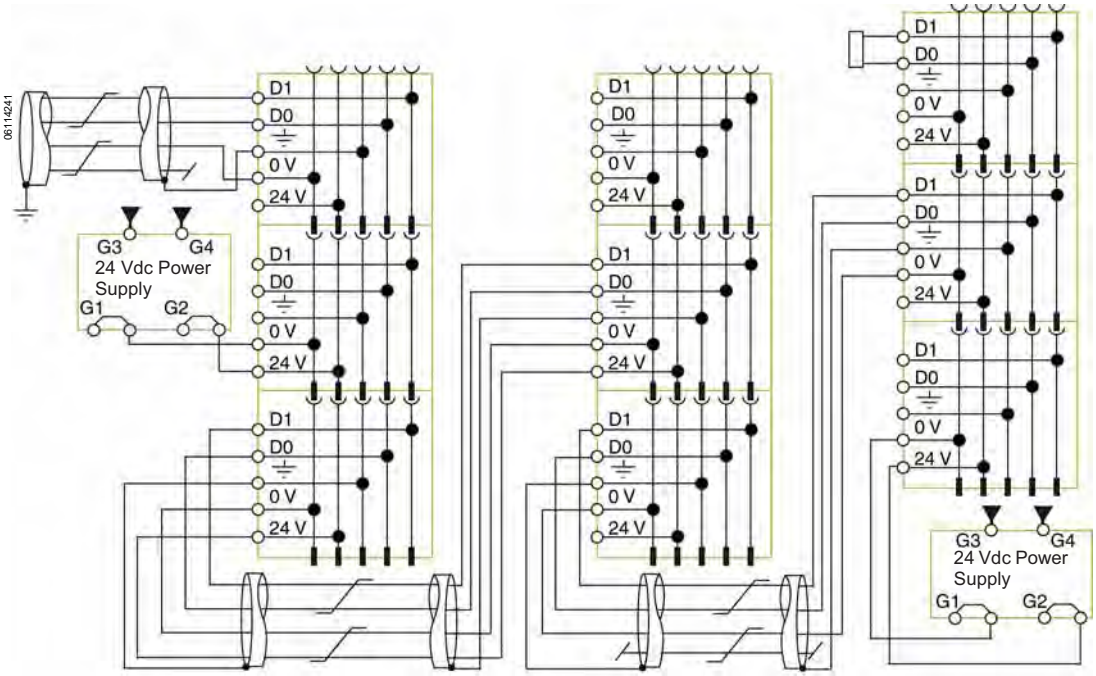


1. 24 Vdc power supply
2. Modbus cable coming from the Modbus master
3. Modbus cable running to the second cubicle
4. Modbus cable running to the third cubicle
5. Insertion of a new 24 Vdc power supply unit

Connection of Modbus Cable with Several Power Segments

- The Modbus cable coming from the Modbus master ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected when the master is powered separately.
- The Modbus cable running to the second cubicle ensures continuity of the Modbus signal (D0, D1, and 0 V) and the 24 Vdc power supply for the second cubicle.
- The Modbus cable running to the third cubicle ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected since a new 24 Vdc power supply is connected for the third cubicle.

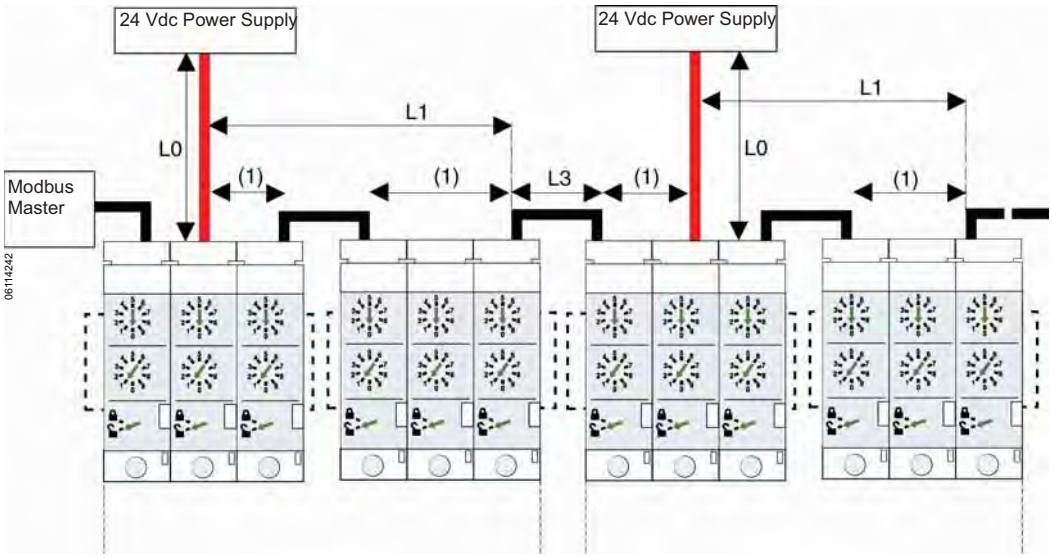
Figure 22: Wiring Diagram for Connection of Modbus Cable with Several Power Segments



Modbus Cable Lengths for Several Power Supply Segments

Figure 23 shows the Modbus cable lengths in detail, in the case of a centralized Modbus architecture with several power supply segments:

Figure 23: Modbus Cable Lengths for Several Power Supply Segments



(1) Count the contact resistance between two 5-pin connectors in the group of Modbus interface modules as 3.28 ft (1 m) of Modbus cable when both Modbus cables are connected to two of the first seven Modbus interface modules, and as 6.56 ft (2 m) of Modbus cable thereafter.

Modbus cable L3 ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected since the power supply is connected separately.

The table below summarizes the maximum lengths of Modbus cable for the centralized architecture with several power supply segments. The Modbus cable under consideration is described in “Connection to the Modbus Interface Module” on page 26.

24 Vdc Rating	L0 (in 18 AWG [0.75 mm^2] wires)	L1	Sum of all L1s (for all power supply segments)	Sum of the L1s and L3s (total length)
1 A	16.4 ft (5 m)	147.6 ft (45 m)	344.5 ft (105 m)	1640 ft (500 m)
3 A	9.84 ft (3 m)	49 2 ft (15 m)	114.8 ft (35 m)	1640 ft (500 m)

NOTE: The maximum number of power supply segments is three segments for a single Modbus network, with a maximum rating of 3 A for each power supply segment (see “Segmented Power Supply” on page 24).

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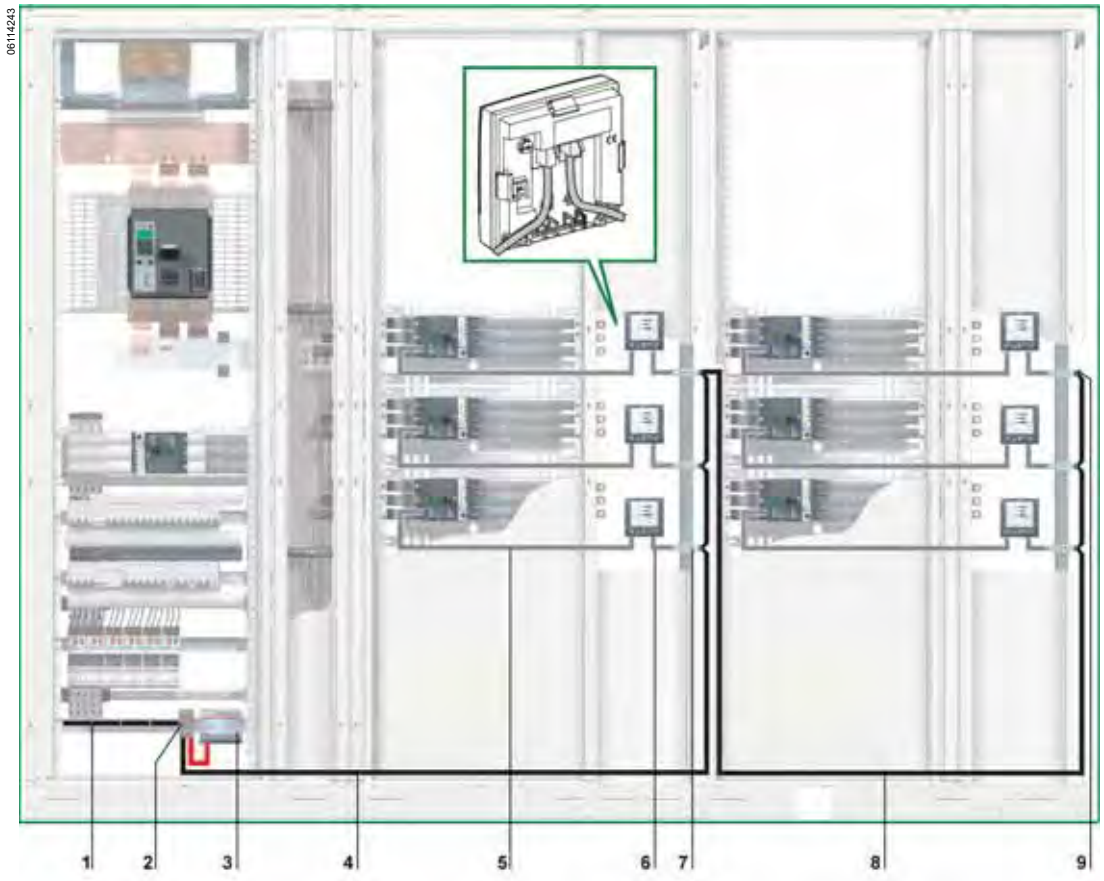
Daisy-Chained Distributed Modbus Architecture

In the distributed Modbus architecture, the Modbus interface modules are distributed as close as possible to their IMU ULP modules and linked by the Modbus cable.

For a daisy-chained distributed Modbus architecture, the main segment of the Modbus cable rises and falls directly in each switchboard cubicle.

Figure 24 shows an example of a daisy-chained distributed Modbus architecture with IMUs consisting of a PowerPact H-, J- or L-frame circuit breaker, an FDM121, and a Modbus interface module:

Figure 24: Daisy-Chained Distributed Modbus Architecture



1. Modbus cable coming from the Modbus master
2. Derivation terminal block on the switchboard incomer
3. 24 Vdc power supply
4. Modbus cable running to the first cubicle
5. NSX cord
6. ULP cable
7. Modbus interface module
8. Modbus cable running to the second cubicle
9. Modbus line termination

For a distributed Modbus architecture, the Modbus interface module 5-pin connector can be used to connect the upstream Modbus cable and the downstream Modbus cable in the same screw terminal.

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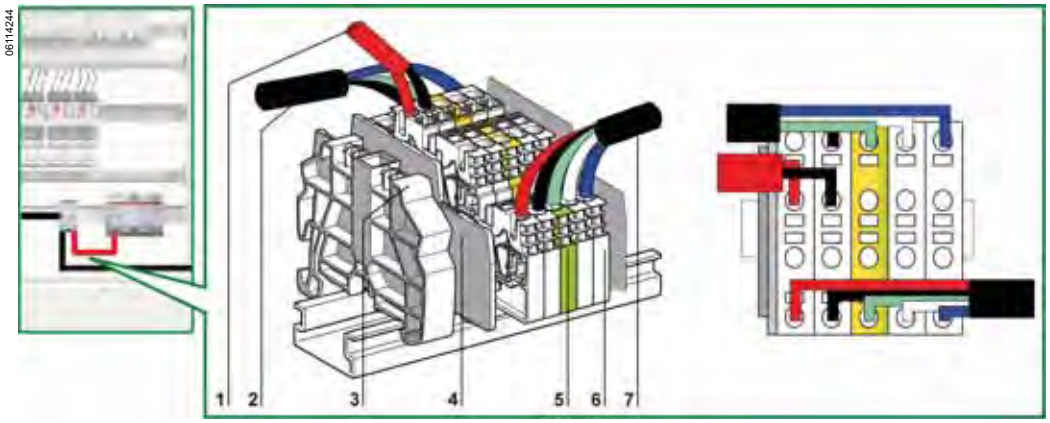
Derivation Terminal Block on the Switchboard Incomer

The derivation terminal block on the switchboard incomer can connect the Modbus cable and the power supply for all the IMUs. The derivation 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.

Figure 25 shows the derivation terminal block on the switchboard incomer in detail:

Figure 25: Derivation Terminal Block on the Switchboard Incomer



1. 24 Vdc power supply
2. Modbus cable coming from the Modbus master
3. Snap-in plastic end stop
4. End cover
5. Protective ground terminal block
6. Spring terminal block
7. Modbus cable running to the first cubicle

Table 23: Part Numbers for the Derivation Terminal Block

Component	Nominal Cross-Section	Telemecanique Part Number
4-channel spring terminal block	14 AWG (2.5 mm^2)	AB1 RRNETV235U4 (gray)
Protective ground terminal block	14 AWG (2.5 mm^2)	AB1 RRNETP235U4 (green/yellow)
End cover	—	AB1 RRNACE244
Snap-in plastic end stop	—	AB1 AB8R35

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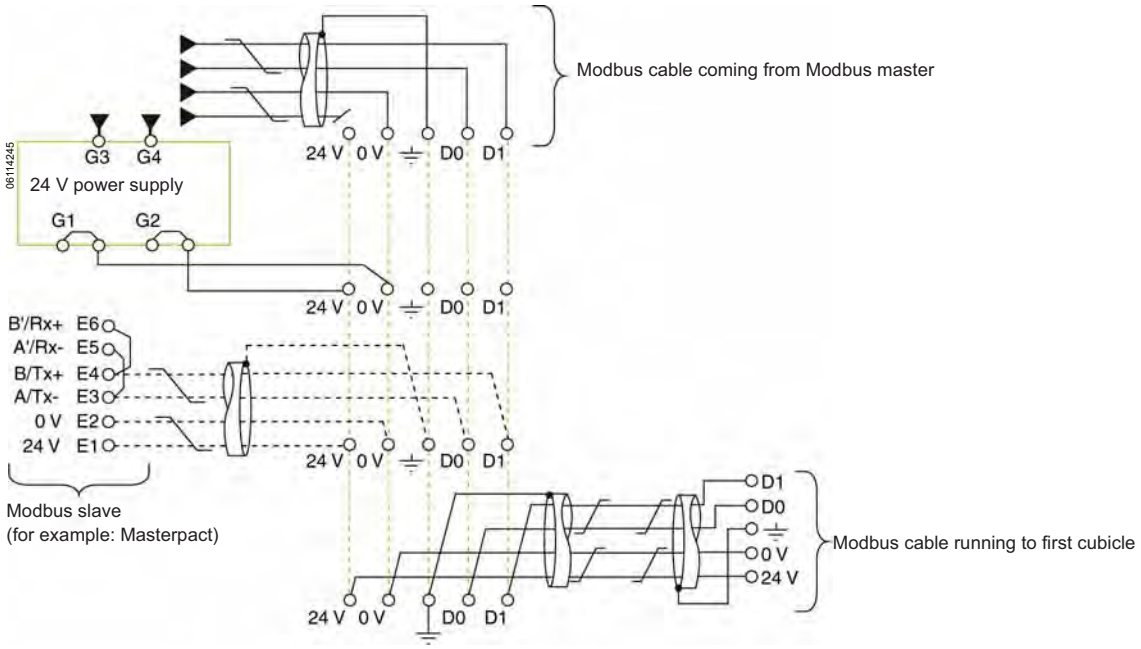
Modbus Cable Connection

- The Modbus cable coming from the Modbus master ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V 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 derivation terminal block can be used to connect another Modbus slave in the switchboard (a Masterpact circuit breaker, 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 Modbus interface module (same order of connection, same unsheathed length, and same stripped length). For more information, refer to “Connection to the Modbus Interface Module” on page 26.

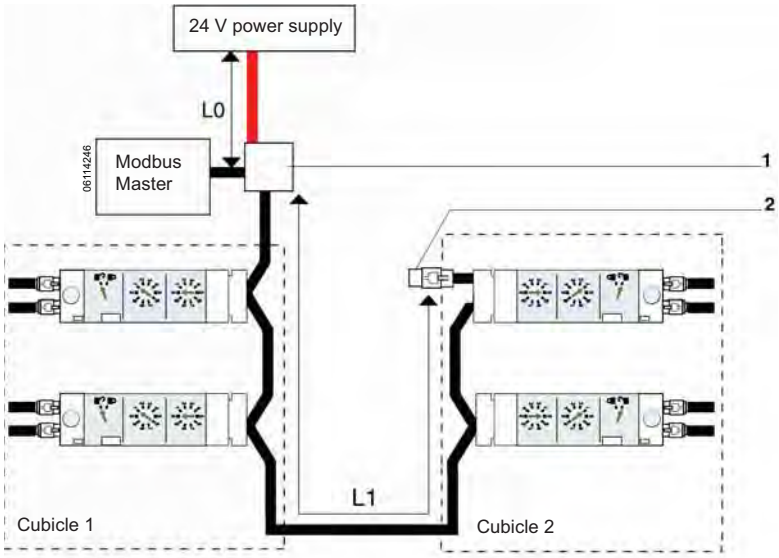
Figure 26: Wiring Diagram of Derivation Terminal Block on the Switchboard Incomer



Modbus Cable Lengths for a Single Power Supply Segment

Figure 27 shows the Modbus cable lengths in detail for a daisy-chained distributed Modbus architecture with a single power supply segment:

Figure 27: Modbus Cable Lengths for a Single Power Supply Segment



1. Derivation terminal block on the switchboard incomer
2. Modbus line termination

The table below 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 “Connection to the Modbus Interface Module” on page 26.

24 Vdc Rating	L0 (in 18 AWG [0.75 mm^2] wires)	L1
1 A	5 m	45 m
3 A	3 m	15 m

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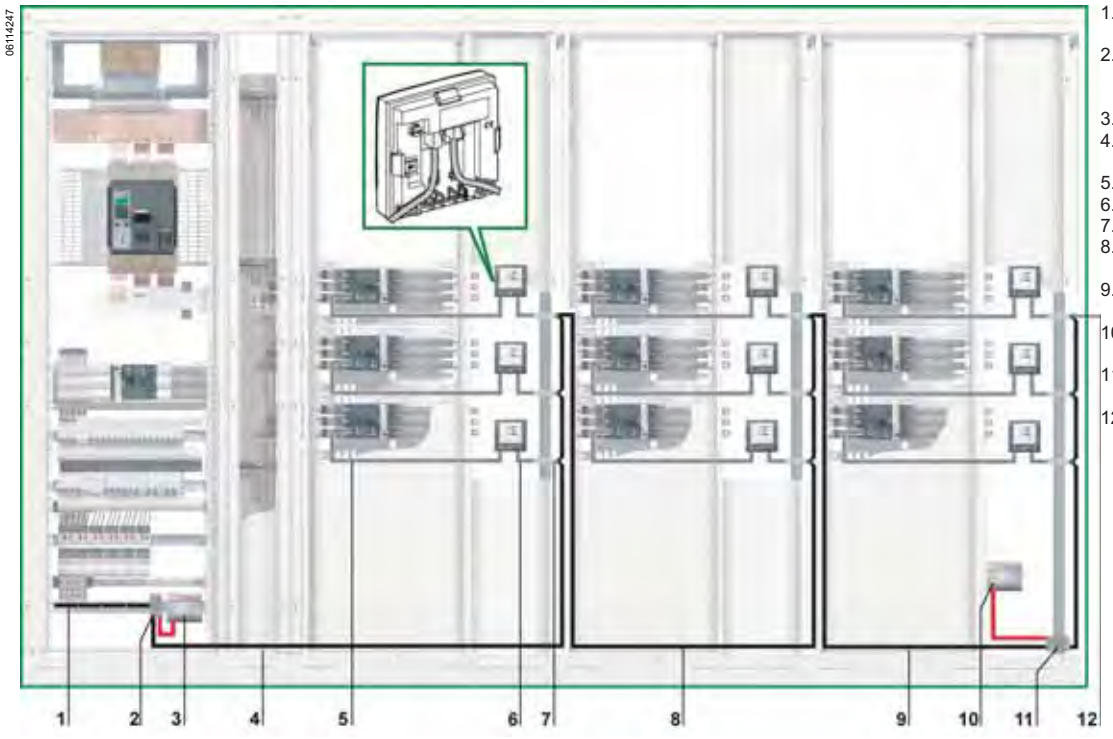
Case of Several Power Supply Segments

When more than one 24 Vdc power supply is needed (see “Segmented Power Supply” on page 24), then several power supply segments are used along the Modbus cable. Figure 28 shows a daisy-chained distributed Modbus architecture with two power supply segments:

Figure 28: Case of Several Power Supply Segments



1. Modbus cable coming from the Modbus master
2. Derivation terminal block on the switchboard incomer
3. 24 Vdc power supply
4. Modbus cable running to the first cubicle
5. NSX cord
6. ULP cable
7. Modbus interface module
8. Modbus cable running to the second cubicle
9. Modbus cable running to the third cubicle
10. Insertion of a new 24 Vdc power supply unit
11. Derivation terminal block on the cubicle incomer
12. Modbus line termination

Derivation Terminal Block on the Incomer of the Third Cubicle

The derivation 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 derivation 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.

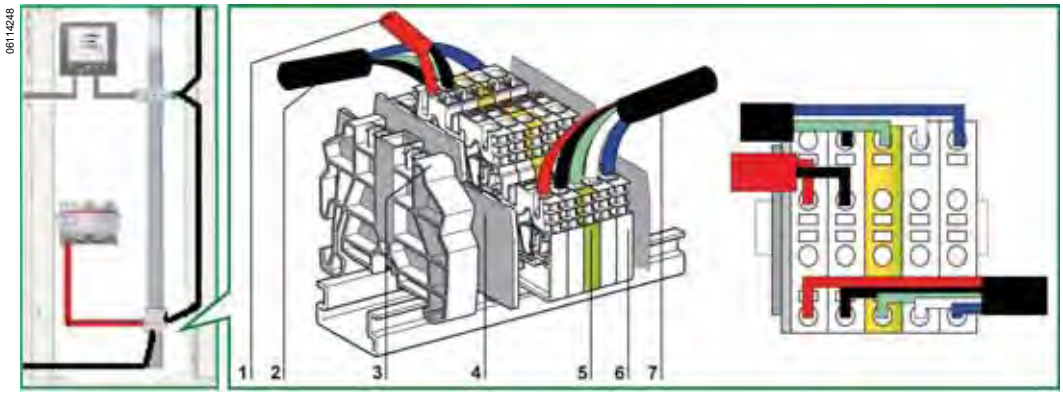
For the derivation terminal block part numbers, see “Part Numbers for the Derivation Terminal Block” on page 42.

t is possible to create derivation terminal blocks using pluggable terminal blocks to make it easier to transport the switchboard. For more information, refer to “Pluggable Terminal Block” on page 59.

Figure 29 shows the derivation terminal block on the incomer of the third cubicle in detail:

ENGLISH

Figure 29: Derivation Terminal Block on the Incomer of the Third Cubicle

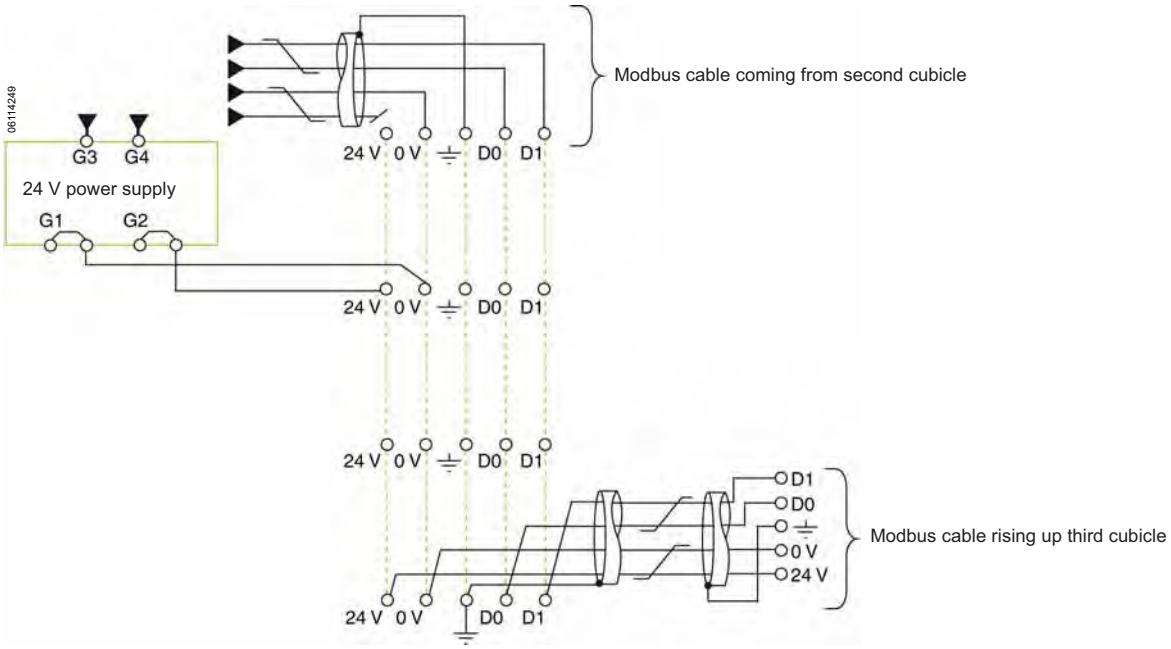


1. 24 Vdc power supply
2. Modbus cable coming from the second cubicle
3. Snap-in plastic end stop
4. End cover
5. Protective ground terminal block
6. Spring terminal block
7. Modbus cable rising up the third cubicle

Modbus Cable Connection

- The Modbus cable from the Modbus master ensures continuity of the Modbus signal (D0, D1, and 0 Connection V). The 24 V 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 Modbus cable running to the second cubicle ensures continuity of the Modbus signal (D0, D1, and 0 V) and the 24 Vdc power supply for the second cubicle.
- The Modbus cable running to the third cubicle ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected since the power supply is connected separately for the third cubicle.

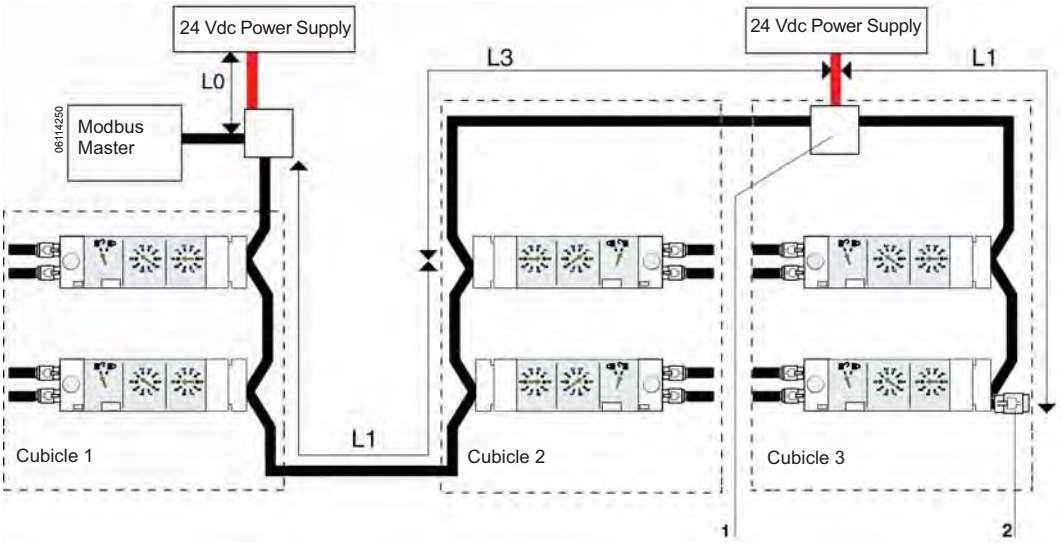
Figure 30: Wiring Diagram of Derivation Terminal Block on the Incomer of the Third Cubicle



Modbus Cable Lengths for Several Power Supply Segments

Figure 31 shows the Modbus cable lengths in detail for a daisy-chained distributed Modbus architecture with several power supply segments:

Figure 31: Modbus Cable Lengths for Several Power Supply Segments



1. Derivation terminal block on the cubicle incomer
2. Modbus line termination

Modbus cable L3 ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected since the power supply is connected separately on the derivation terminal block on the cubicle incomer.

The table below 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 “Connection to the Modbus Interface Module” on page 26.

24 Vdc Rating	L0 (in 18 AWG [0.75 mm^2] wires)	L1	Sum of all L1s (for all power supply segments)	Sum of the L1s and L3s (total length)
1 A	5 m	45 m	105 m	500 m
3 A	3 m	15 m	35 m	500 m

NOTE: The maximum number of power supply segments is three segments for a single Modbus network, with a maximum rating of 3 A for each power supply segment (see “Segmented Power Supply” on page 24).

Derivated Distributed Modbus Architecture

In the distributed Modbus architecture, the Modbus interface modules are distributed as close as possible to their IMU ULP modules and linked by the Modbus cable.

For a derivated distributed Modbus architecture, the main segment of the Modbus cable has a derivation terminal block on the incomer of each cubicle and the Modbus interface modules are connected on a derivation cable.

Figure 32 shows an example of a derivated distributed Modbus architecture with IMUs consisting of a PowerPact H-, J- or L-frame circuit breaker, an FDM121, and a Modbus interface module:

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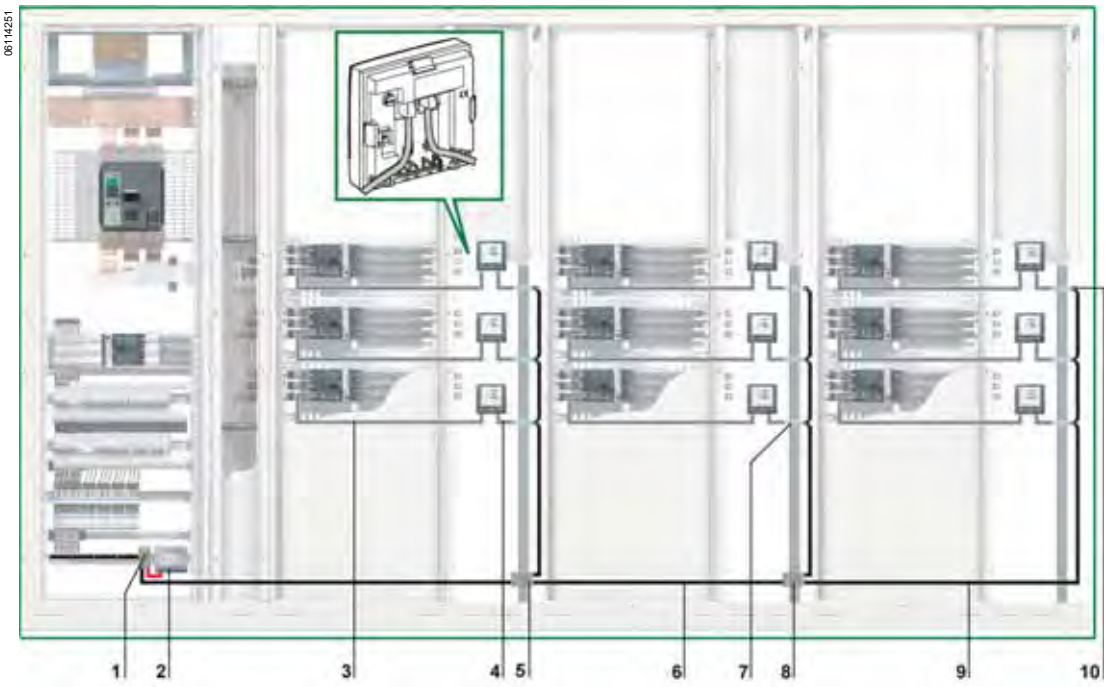
Figure 32: Derivated Distributed Modbus Architecture



1. Derivation terminal block on the switchboard incomer
2. 24 Vdc power supply
3. NSX cord
4. ULP cable
5. Derivation terminal block on the cubicle incomer
6. Modbus cable running to the second cubicle
7. Modbus interface module
8. Derivation terminal block on the cubicle incomer
9. Modbus cable running to the third cubicle
10. Modbus line termination

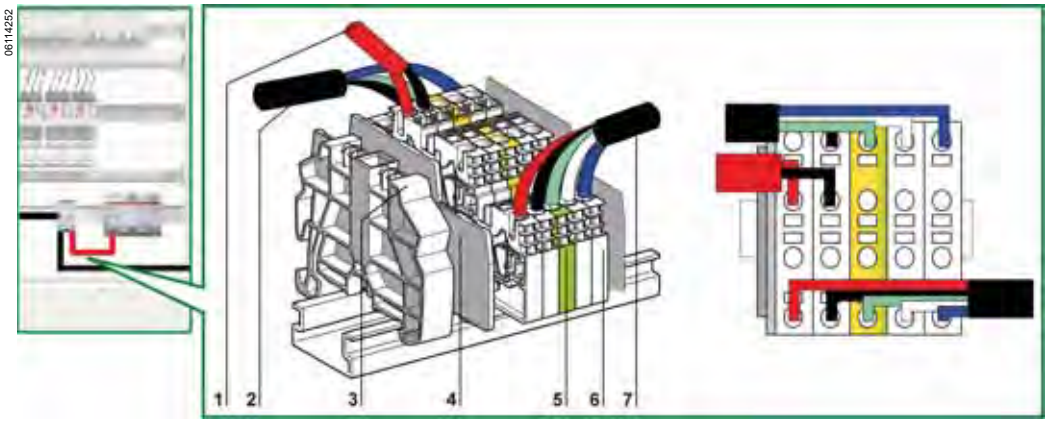
For a distributed Modbus architecture, the Modbus interface module 5-pin connector can be used to connect the upstream Modbus cable and the downstream Modbus cable in the same screw terminal.

Derivation Terminal Block on the Switchboard Incomer

The derivation terminal block on the switchboard incomer can be used to connect the Modbus cable and the power supply for all the IMUs.

The derivation 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.

Figure 33: Derivation Terminal Block on the Switchboard Incomer



1. 24 Vdc power supply
2. Modbus cable coming from the Modbus master
3. Snap-in plastic end stop 4
4. End cover
5. Protective ground terminal block
6. Spring terminal block
7. Modbus cable running to the first cubicle

Table 24: Part Numbers for the Derivation Terminal Block

Component	Nominal Cross-Section	Telemecanique Part Number
4-channel spring terminal block	14 AWG (2.5 mm^2)	AB1 RRNETV235U4 (gray)
Protective ground terminal block	14 AWG (2.5 mm^2)	AB1 RRNETP235U4 (green/yellow)
End cover	—	AB1 RRNACE244
Snap-in plastic end stop	—	AB1 AB8R35

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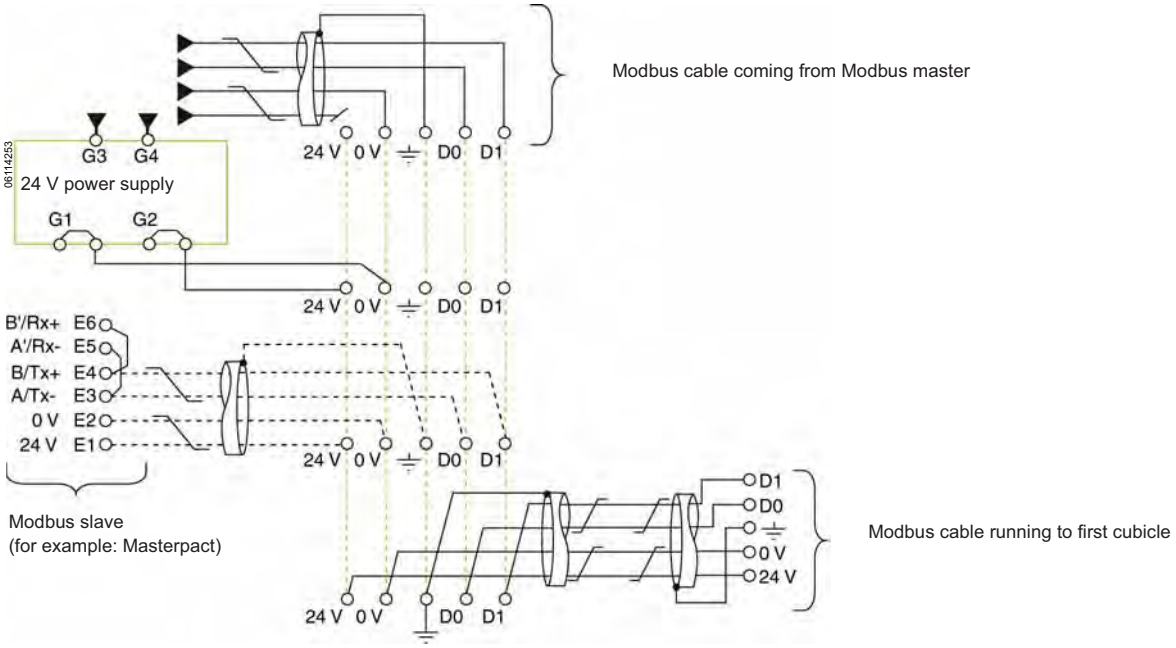
Modbus Cable Connection

- The Modbus cable coming from the Modbus master ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V 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 derivation terminal block can be used to connect another Modbus slave in the switchboard (a Masterpact circuit breaker, 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 Modbus interface module (same order of connection, same unsheathed length, and same stripped length). For more information, refer to “Connection to the Modbus Interface Module” on page 26.

Figure 34: Wiring Diagram of Derivation Terminal Block on the Switchboard Incomer



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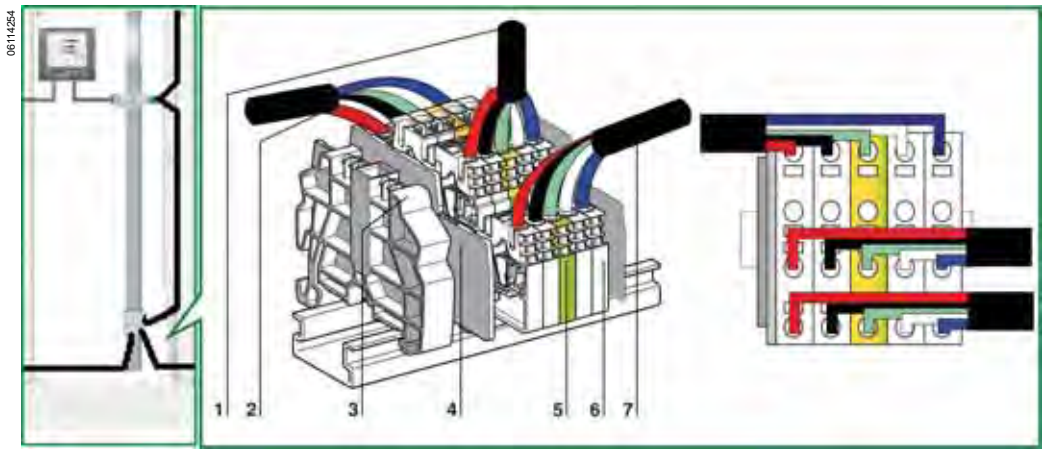
Derivation Terminal Block on the Cubicle Incomer

The derivation terminal block on the cubicle incomer distributes the Modbus signal and the 24 Vdc power supply to the cubicles in the switchboard.

The derivation 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.

For the derivation terminal block part numbers, see “Part Numbers for the Derivation Terminal Block” on page 42.

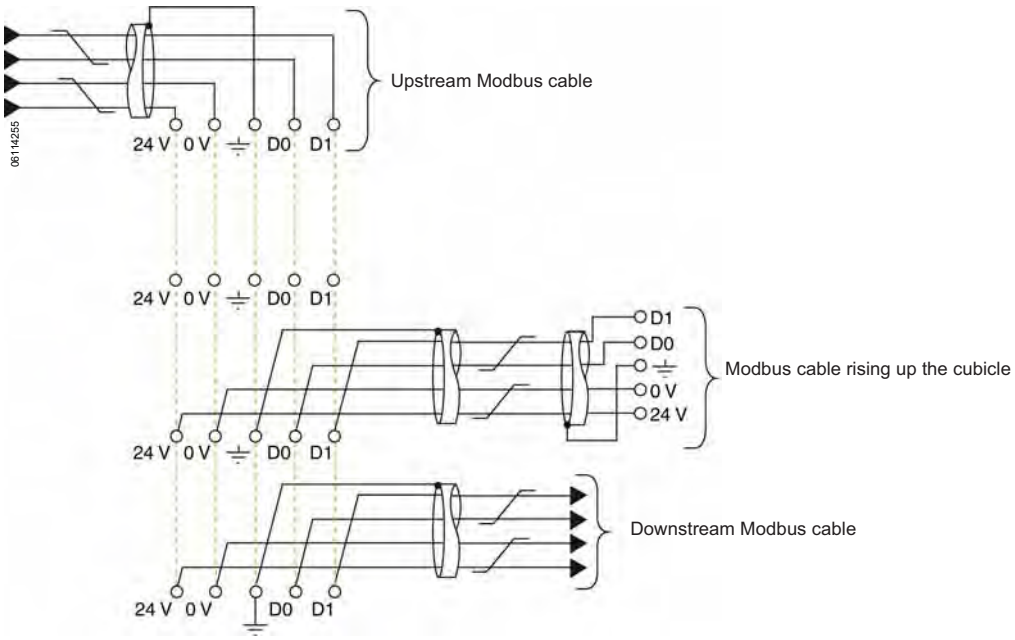
Figure 35: Derivation Terminal Block on the Cubicle Incomer



1. Modbus cable rising up in the cubicle
2. Upstream Modbus cable
3. Snap-in plastic end stop
4. End cover
5. Protective earth terminal block
6. Spring terminal block
7. Downstream Modbus cable

It is possible to create derivation terminal blocks using pluggable terminal blocks to make it easier to transport the switchboard. For more information, refer to “Pluggable Terminal Block” on page 59.

Figure 36: Wiring Diagram of Derivation Terminal Block on the Cubicle Incomer



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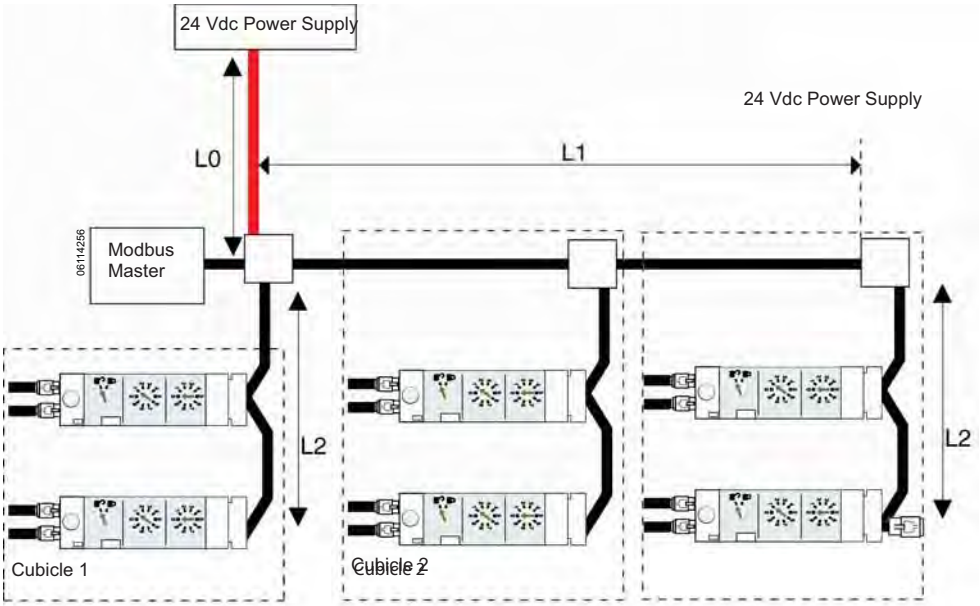
Modbus Cable Lengths for a Single Power Supply Segment

Figure 37 shows the Modbus cable lengths in detail for a derivated distributed Modbus architecture with a single power supply segment:

Figure 37: Modbus Cable Lengths for a Derivated Distributed Modbus Architecture with a Single Power Supply Segment



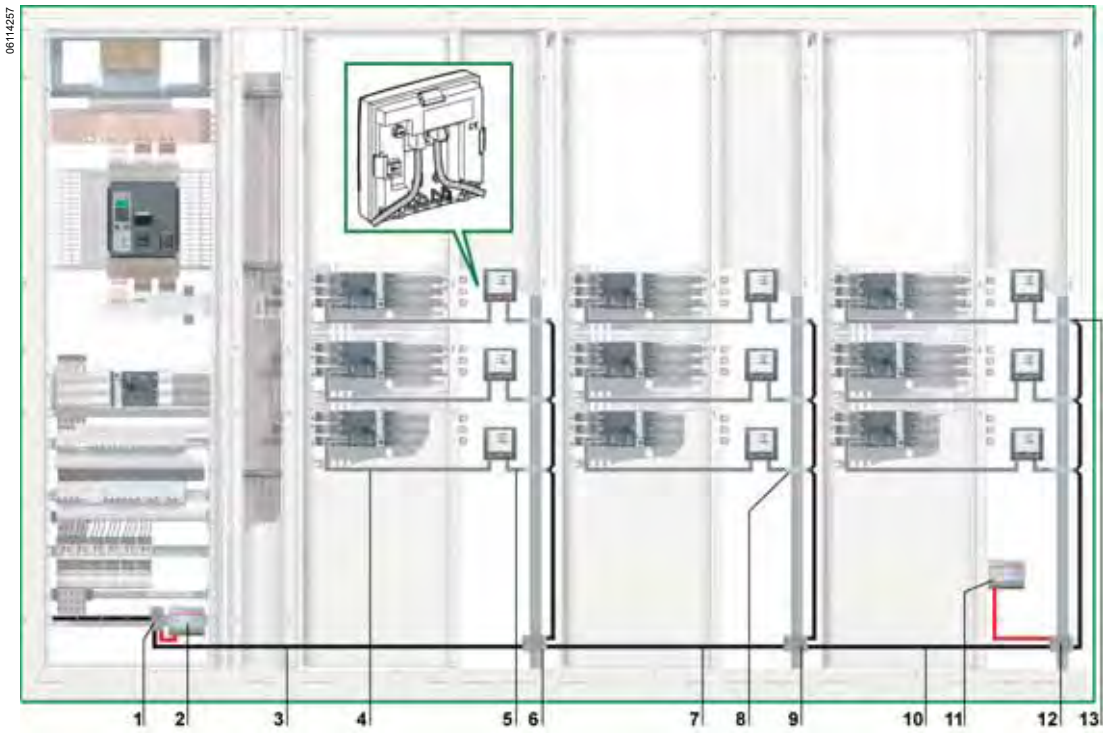
The table below summarizes the maximum Modbus cable lengths for the daisy-chained distributed Modbus architecture with a single power supply segment. The Modbus cable under consideration is described in “Connection to the Modbus Interface Module” on page 26.

24 Vdc Rating	L0 (in 18 AWG [0.75 mm^2] wires)	L1	L2	Sum of the L2s (for all derivations)
1 A	5 m	45 m	10 m	40 m
3 A	3 m	15 m	5 m	40 m

Case of Several Power Supply Segments

When more than one 24 Vdc power supply is needed (see “Segmented Power Supply” on page 24), then several power supply segments are used along the Modbus cable.

Figure 38: Derivated Distributed Modbus Architecture with Two Power Supply Segments



1. Derivation terminal block on the switchboard incomer
2. 24 Vdc power supply
3. Modbus cable running to the first cubicle
4. NSX cord
5. ULP cable
6. Derivation terminal block on the incomer of the first cubicle
7. Modbus cable running to the second cubicle
8. Modbus interface module
9. Derivation terminal block on the incomer of the second cubicle
10. Modbus cable running to the third cubicle
11. Insertion of a new 24 Vdc power supply unit
12. Derivation terminal block on the incomer of the third cubicle
13. Modbus line termination

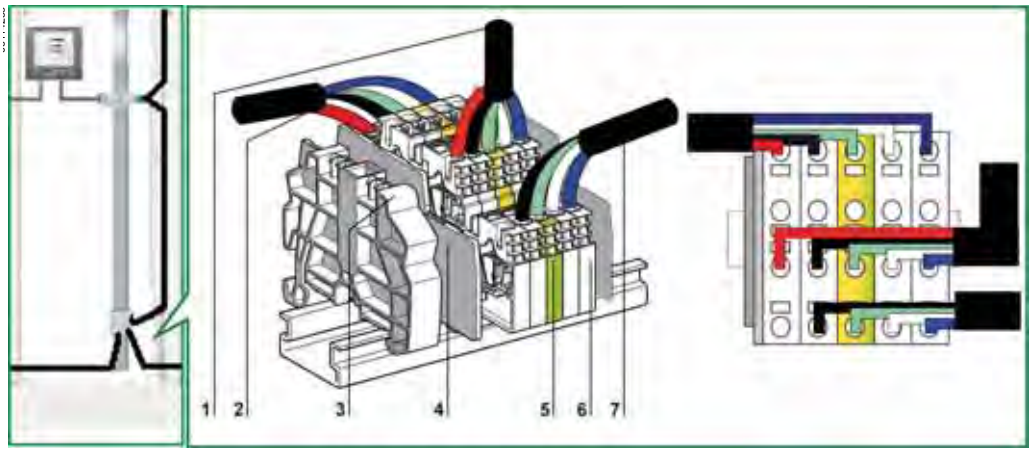
Derivation Terminal Block on the Incomer of the Second Cubicle

The derivation 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 derivation terminal block part numbers, see “Part Numbers for the Derivation Terminal Block” on page 42.

Figure 39 shows the derivation terminal block on the incomer of the second cubicle in detail:

Figure 39: Derivation Terminal Block on the Incomer of the Second Cubicle



1. Modbus cable rising up the second cubicle
2. Modbus cable coming from the first cubicle
3. Snap-in plastic end stop
4. End cover
5. Protective ground terminal block
6. Spring terminal block
7. Modbus cable running to the third cubicle

1

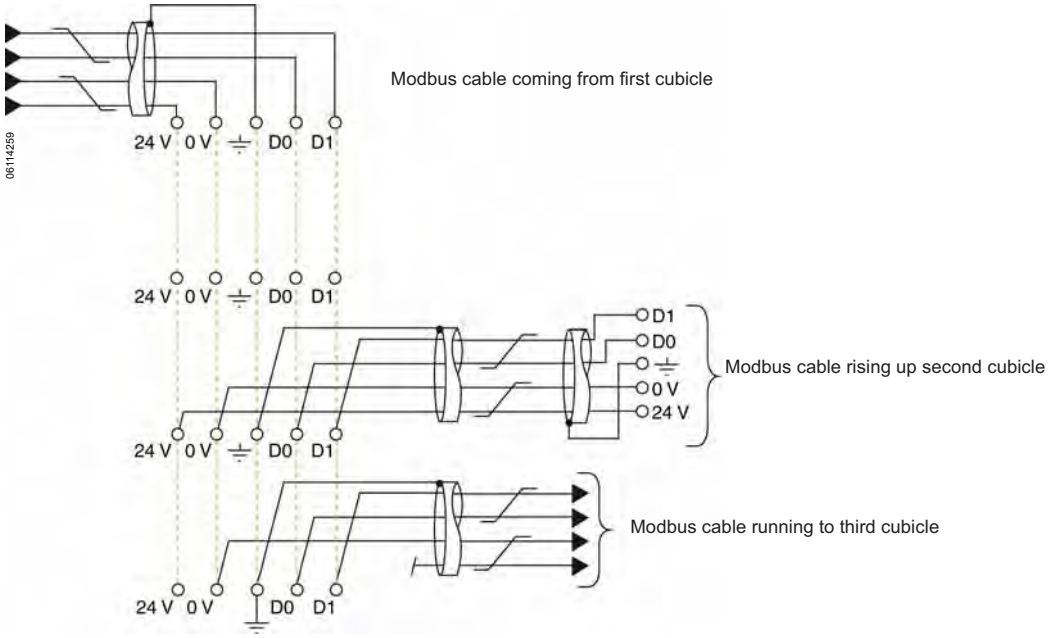
It is possible to create derivation terminal blocks using pluggable terminal blocks to make it easier to transport the switchboard.

For more information, refer to “Pluggable Terminal Block” on page 59.

Modbus Cable Connection

- The Modbus cable coming from the derivation terminal block on the incomer of the first cubicle ensures continuity of the Modbus signal (D0, D1, and 0 V) and the 24 Vdc power supply for the cubicle.
- The Modbus cable running to the third cubicle ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected since the power supply for the third cubicle is connected separately.

Figure 40: Wiring Diagram for the Derivation Terminal Block on the Incomer of the Second Cubicle



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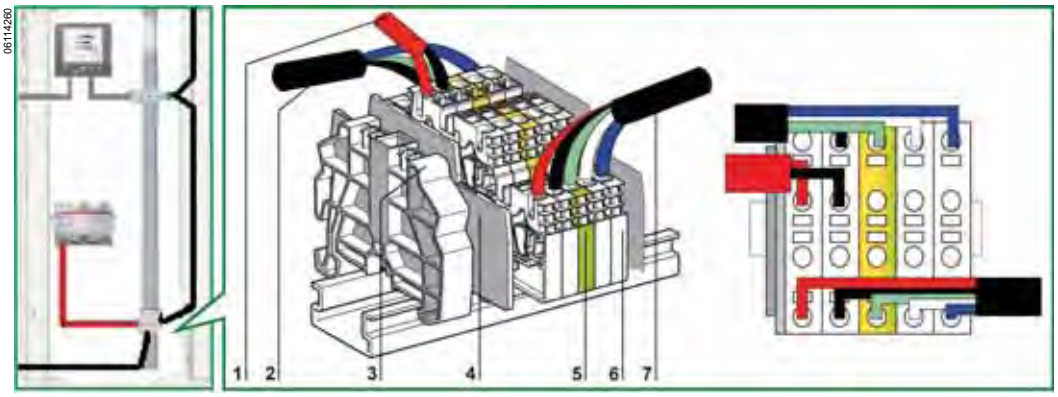
Derivation Terminal Block on the Incomer of the Third Cubicle

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

The derivation 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.

Figure 41: Derivation Terminal Block on the Incomer of the Third Cubicle



1. 24 Vdc power supply
2. Modbus cable coming from the derivation terminal block on the incomer of the second cubicle
3. Snap-in plastic end stop
4. End cover
5. Protective ground terminal block
6. Spring terminal block
7. Modbus cable rising up the third cubicle

It is possible to create derivation terminal blocks using pluggable terminal blocks to make it easier to transport the switchboard. For more information, refer to “Pluggable Terminal Block” on page 59.

Modbus Cable Connection

- The Modbus cable coming from the derivation terminal block on the incomer of the second cubicle ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected since the power supply for the third cubicle is connected separately.
- The Modbus cable rising up the third cubicle ensures continuity of the Modbus signal (D0, D1, and 0 V) and the 24 Vdc power supply for the third cubicle.

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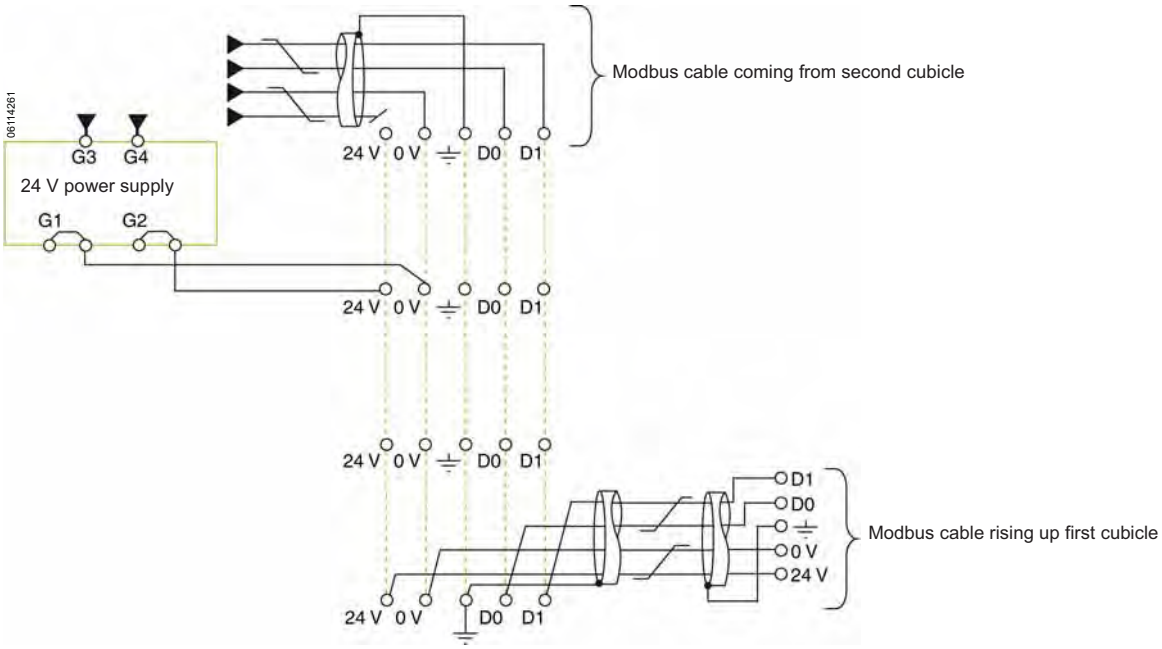
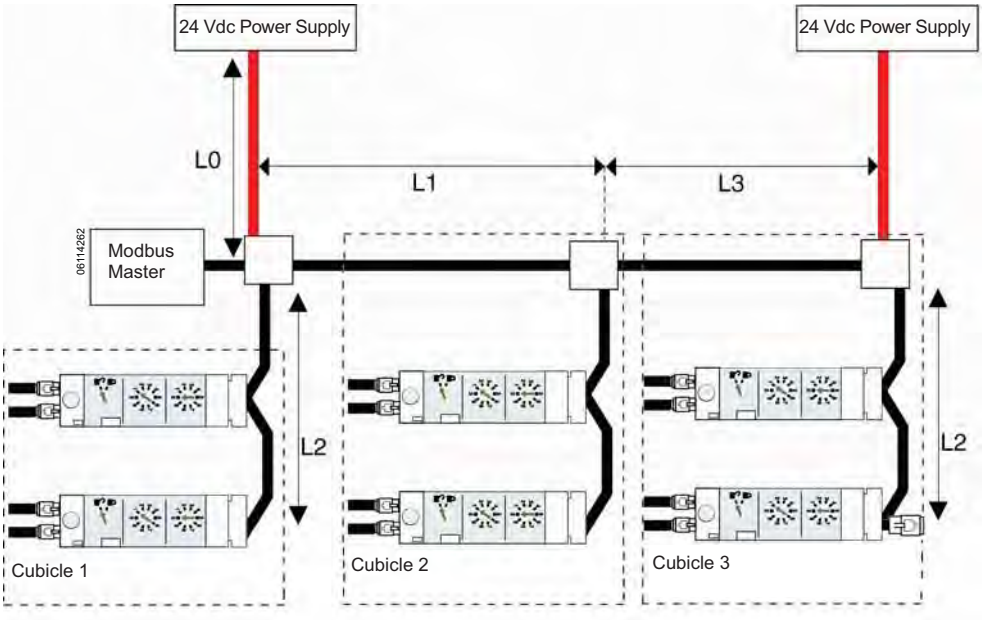
Figure 42: Wiring Diagram for the Derivation Terminal Block on the Incomer of the Third Cubicle



Modbus Cable Lengths for Several Power Supply Segments

Figure 43 shows the Modbus cable lengths in detail for a derivated distributed Modbus architecture with several power supply segments:

Figure 43: Modbus Cable Lengths for a Derivated Distributed Modbus Architecture with Several Power Supply Segments



Modbus cable L3 ensures continuity of the Modbus signal (D0, D1, and 0 V). The 24 V wire is not connected since the power supply is connected separately on the derivation terminal block on the incomer of the third cubicle.

The table below summarizes the maximum Modbus cable lengths for the derivated distributed Modbus architecture with several power supply segments. The Modbus cable under consideration is described in “Connection to the Modbus Interface Module” on page 26.

24 Vdc Rating	L0 (in 18 AWG[0.75 mm^2] wires)	L1	L2	Sum of the L2s (for all derivations)	Sum of the L1s, L2s, and L3s (total length)
1 A	5 m	35 m	10 m	40 m	500 m
3 A	3 m	15 m	5 m	40 m	500 m

NOTE: The maximum number of power supply segments is three segments for a single installation, with a maximum rating of 3 A for each power supply segment (see “Segmented Power Supply” on page 24).

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Pluggable Terminal Block

The part numbers in Table 25 illustrate how to create a pluggable terminal block to make it easier to transport the switchboard.

Table 25: Part Numbers to Create a Pluggable Terminal Block

Component	Component	Nominal Cross-Section	Phoenix Contact Part Number
 06114264	Pluggable connector MSTB 2.5/5-STF-5.08	14 AWG (2.5 mm^2)	1778014
 06114265	Base unit on DIN rail UMSTBVK 2.5/5-GF-5.08	14 AWG (2.5 mm^2)	1787953
 06114266	Optional cable cover for pluggable connector KGG-MSTB 2.5/5	—	1803895

Figure 26 shows two examples of pluggable terminal blocks. The order of connection is the same as for the 5-pin connector on the Modbus interface module (D1, D0, shielding braid, 0 V, and 24 V):

Table 26: Pluggable Terminal Blocks

Pluggable Terminal Block	Pluggable Terminal Block Used as a Tee (Two Modbus cables on the fixed base and one Modbus cable on the pluggable connector)
 06114267	 1

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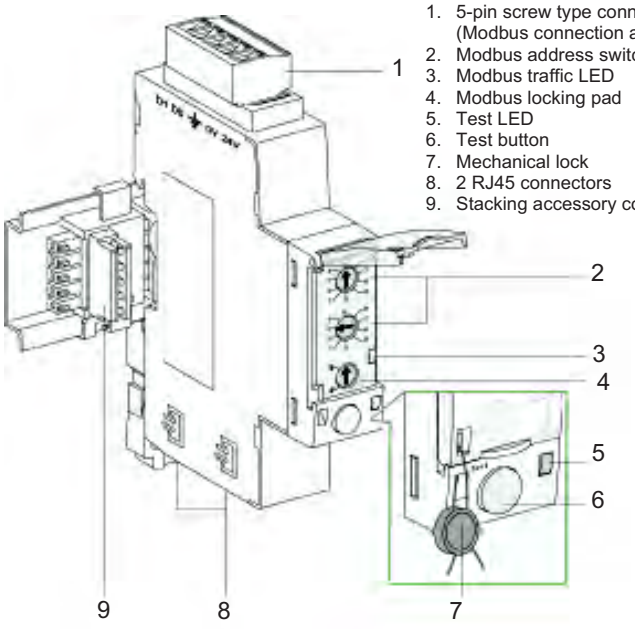
Section 3—Modbus™ Interface Module

Function

The Modbus interface module is a communication interface which allows intelligent modular units (IMUs) to communicate using the Modbus protocol. Each communicating IMU has its own Modbus interface module and a Modbus address chosen by the user.

Figure 44: Modbus Interface Module



Characteristics

Table 27: Modbus Interface Module Characteristics

Dimensions	0.71 x 2.83 x 3.78 in. (18 x 72 x 96 mm)
Operating temperature	-25 to +70°C
Power supply voltage	24 Vdc -20%/+10% (19.2–26.4 Vdc)
Consumption	Typical: 21 mA/24 Vdc at 20°C Maximum: 30 mA/19.2 Vdc at 60°C

Part Numbers

Table 28: Part Numbers

Product	Part Number
Modbus interface module	STRV00210
Stacking accessories (supplied in packs of 10)	TRV00217

Installing the Modbus Interface Module

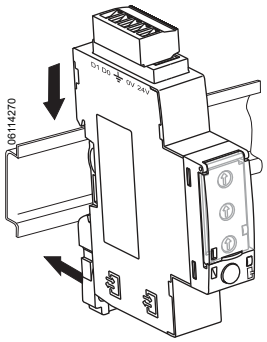
Mounting

There are two possible mounting configurations for the Modbus interface module:

- Direct mounting on the DIN rail
- Mounting on the stacking accessory mounted on a DIN rail

Direct Mounting on DIN Rail

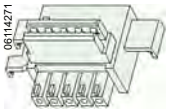
Figure 45: DIN Rail Mounting



Use direct mounting on a DIN rail in the case of distributed architectures (see “Daisy-Chained Distributed Modbus Architecture” on page 41 and “Derivated Distributed Modbus Architecture” on page 47).

Mounting on the Stacking Accessory

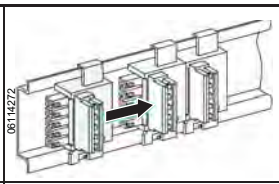
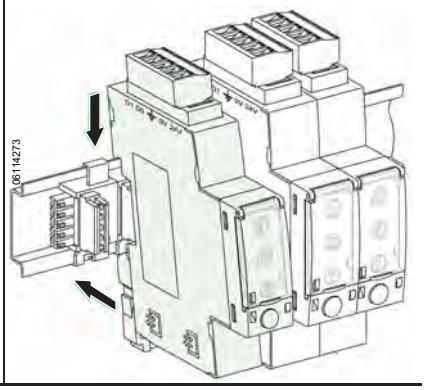
Figure 46: Stacking Accessory



Where there are several communicating intelligent modular interfaces (IMUs) in a switchboard column, the Modbus interface modules in the column can be grouped in blocks on the column incomer (see “Centralized Modbus Architecture” on page 32).

Use the stacking accessory for quick connection by simply snapping in the Modbus interface modules, thus providing the Modbus link and the 24 Vdc power supply between all the adjacent Modbus interface modules, without any additional wiring.

Table 29: Mounting the Modbus Interface Module on the Stacking Accessory

1. Clip the stacking accessories onto the DIN rail (one stacking accessory for each Modbus interface module) and snap them together:	
2. Mount the Modbus interface module on the DIN rail and snap it onto its stacking accessory:	

NOTE: Note: Do not clip more than 12 Modbus interface modules together with the stacking accessory.

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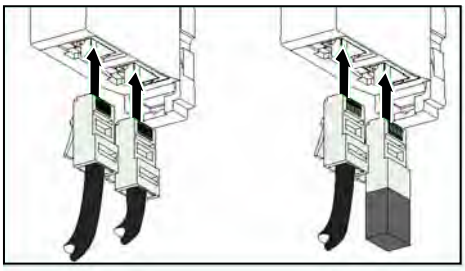
ULP Connection



Use the two ULP RJ45 connectors on the Modbus interface module to connect it to the other ULP modules on the IMU.

Both ULP connectors are identical and in parallel, allowing the IMU ULP modules to be connected in any order.

NOTE: When the second ULP connector is not used (Modbus interface module at the end of the ULP line), it must be closed with a ULP line termination.

5-Pin Connector (Modbus and 24 Vdc Power Supply)

The 5-pin connector is a screw connection block for powering the IMU and connecting it to the Modbus network. Connecting the Modbus cable to the 5-pin connector is described in “Connection to the Modbus Interface Module” on page 26.

Operation of the Modbus Interface Module

The user can configure the Modbus interface module directly on its front panel or with the RSU software.

Use the Modbus interface module to:

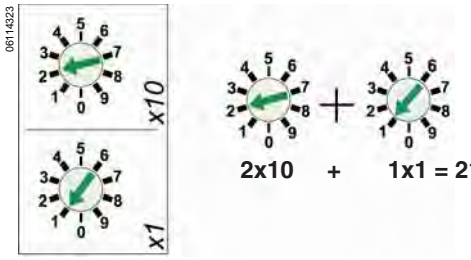
- Assign a Modbus address to the Modbus interface module and its associated intelligent modular unit (IMU)
- Enable/disable remote control commands
- Test the ULP connection

Modbus Address

The address switches assign a Modbus slave address to the Modbus interface module and its associated IMU.

The user defines the Modbus address in the range 1–99. The first address switch corresponds to the tens and the second address switch corresponds to the units.

Figure 47: Address Switch Configuration for Address 21



The Modbus interface module is factory-set with address 99.

Address 00 is reserved for Modbus broadcasting.

If the address switches are set to address 00, no Modbus communication is accepted by the Modbus interface module.

The user can modify the address at any time. The change of address takes effect 5 seconds after the modification.

Modbus Traffic LED

Table 30: Yellow Modbus Traffic LED

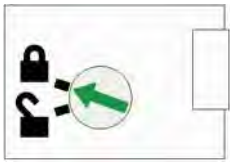
LED Status	Module Communication Activity
Blinking	Transmission/reception of a Modbus frame by the Modbus interface module
Steady ON	Address 00 assigned to the Modbus interface module

For more information about Modbus communication between the Modbus interface module and the PowerPact H-, J- or L-frame circuit breaker, refer to the *PowerPact H-, J- or L-Frame Circuit Breaker with Micrologic Trip Units—User Guide*.

Modbus Locking Pad

The Modbus locking pad on the front panel of the Modbus interface module enables or Pad disables remote control commands and modification of the IMU module parameters.

Table 31: Modbus Locking Pad

Locking Pad Status	Meaning
	Remote control commands and parameter modifications are enabled.
	Remote control commands and parameter modifications are disabled. In this case, the only remote control commands that are enabled are the get time and set time commands on the IMU ULP modules. For more information about these commands, refer to PowerPact H-, J- or L-Frame Circuit Breaker with Micrologic Trip Units—User Guide.

Test LED

The yellow test LED describes the connection between the ULP modules on the IMU:

Table 32: Yellow Test LED

LED Status M	Meaning
ON: 50 ms/OFF: 950 ms	Nominal operation (test button not pressed): The Modbus interface module is correctly connected to the IMU.
ON: 250 ms/OFF: 250 ms	Prohibited configuration: Two identical modules are detected in the same IMU. Two identical modules cannot form part of the same IMU.
ON: 500 ms/OFF: 500 ms	Degraded mode (EEPROM off)
ON: 1000 ms/OFF: 1000 ms	Test mode
Steady ON	The Modbus interface module is supplied with power but the ULP connection is not working.
Steady OFF	The Modbus interface module is not supplied with power.

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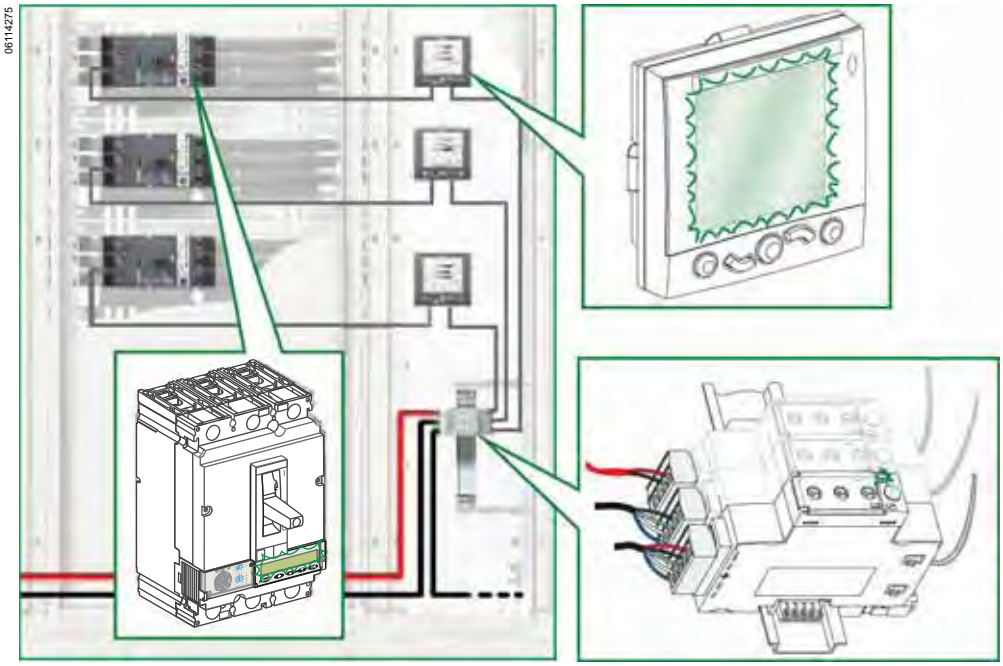
Test Button

Use the test button to check that there is a good connection between all the ULP modules connected to the Modbus interface module.

Figure 48 shows an IMU consisting of a Modbus interface module, a front display module (FDM121) and a PowerPact H-, J- or L-frame circuit breaker equipped with a Micrologic trip unit:

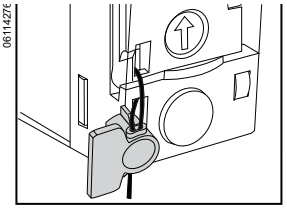
Figure 48: Test Button



Pressing the test button starts the ULP connection test for 15 seconds. In test mode, the test LED on the Modbus interface module and the backlighting on the FDM121 and Micrologic trip unit blink simultaneously in test mode (ON: 1000 ms/OFF: 1000 ms), which makes it easy to identify the IMU modules in the switchboard.

During the test, all the IMU module functions perform normally.

Mechanical Lock



The mechanical lock prevents access to the address switches and the locking pad on the Modbus interface module.

Configuration

Configure the Modbus interface module in one of two ways:

- Automatic configuration (Auto-Speed sensing On): When a Modbus master is communicating on the Modbus communication network, the Modbus interface module automatically detects the speed and parity of the Modbus connection (default configuration).
- Custom configuration: By deactivating the Auto-Speed sensing option in the RSU Modbus interface module configuration window, the user can customize the speed and parity of the Modbus connection.

Automatic Configuration

The user defines the Modbus address for the Modbus interface module with the two address switches. When the Modbus interface module 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 binary with one start bit, eight data bits, one stop bit in the case of even or odd parity and two stop bits if there is no parity.

Custom Configuration

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

The user can customize the communication parameters with the RSU (Remote Setting Utility) software described in “Remote Setting Utility (RSU) Software” on page 94.

Figure 49 shows configuration of the Modbus interface module with RSU when the Auto-Speed sensing function is deactivated:

Figure 49: Modbus Interface Module Configuration

- The supported speeds are: 4800, 9600, 19200, and 38400 baud
- The supported parities are: Even, odd, and no parity

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

For more information about the RSU software, refer to “Remote Setting Utility (RSU) Software” on page 94 and the RSU Online Help.

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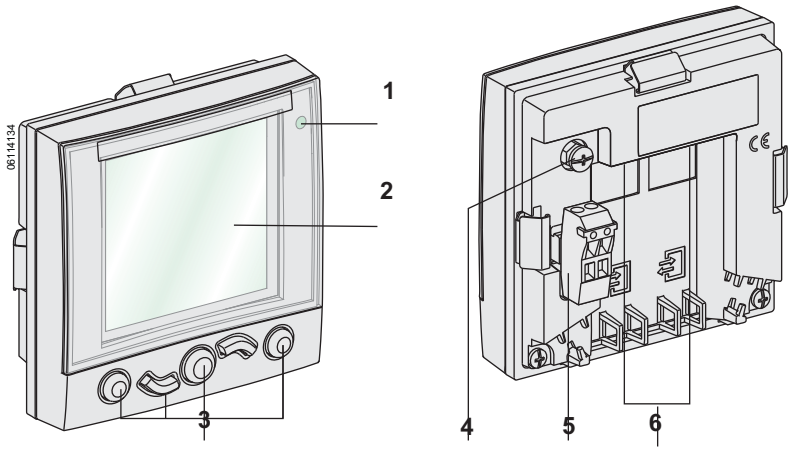
Section 4—Front Display Module (FDM121)

Function

The front display module (FDM121) displays the measurements, alarms, and operating assistance data from the intelligent modular unit (IMU).

Figure 50: Front Display Module



1. Alarm indicator LED
2. LCD screen
3. Navigation keys
4. Functional ground
5. 24 Vdc supply terminal block
6. ULP connectors

Characteristics

Table 33:

Dimensions	Without power supply terminal block: 3.78 x 3.78 x 1.30 in. (96 x 96 x 33.1 mm)
	With power supply terminal block: 3.78 x 3.78 x 1.70 in. (96 x 96 x 43.2 mm)
Display	28 x 128 pixels
Viewing Angle	Horizontal: +/- 30° Vertical: +/- 60°
Operating Temperature	-10 to +55°C (on the front panel)
Power Supply Voltage	24 Vdc -20%/+10% (19.2–26.4 Vdc)
Consumption Typical:	Typical: 21 mA/24 Vdc at 20°C Maximum: 30 mA/19.2 Vdc at 55°C

Part Numbers

Table 34: FDM121 Part Numbers

Product	Part Number
FDM121	STRV00121
Surface-mounting accessory	STRV00128

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Installing the FDM121

Mounting

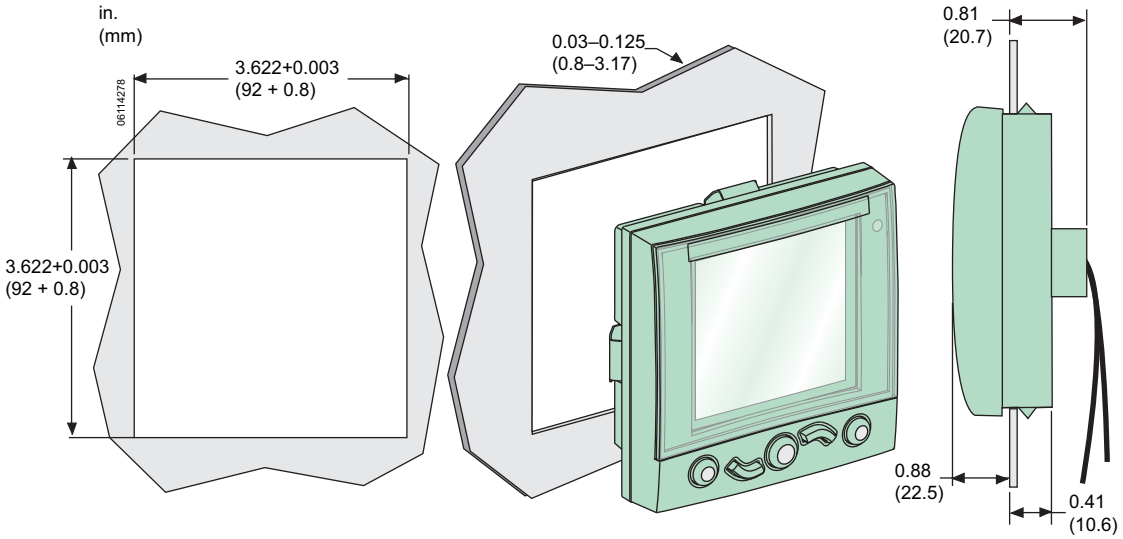
There are two possible mounting configurations for the FDM121:

- Mounting in a door cut-out with clip fixing
- Retrofit mounting through drill holes and fixing with a surface-mounting accessory

Door Cut-Out Mounting

Mount the FDM121 by cutting a standard 3.62 x 3.62 in. (92 x 92 mm) cut-out on the door and pushing through hole until secured by clips (Figure 51).

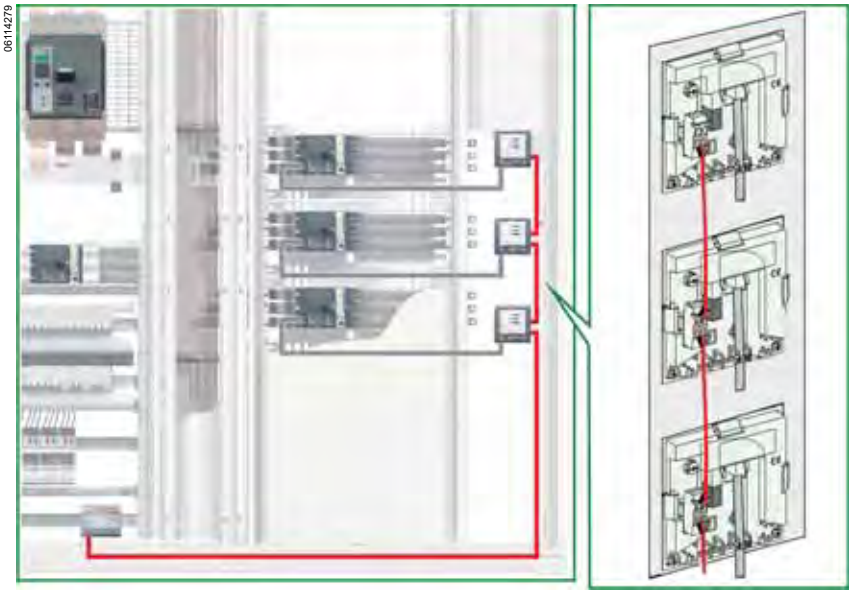
Figure 51: Front Display Module Installation



Door Cut-Out Mounting for Standalone Architecture

The FDM121 mounts in door cut-outs in the case of a standalone architecture (Figure 52). The FDM121 power supply terminal block powers the intelligent modular units (IMUs).

Figure 52: Door Cut-Out Mounting for Standalone Architecture



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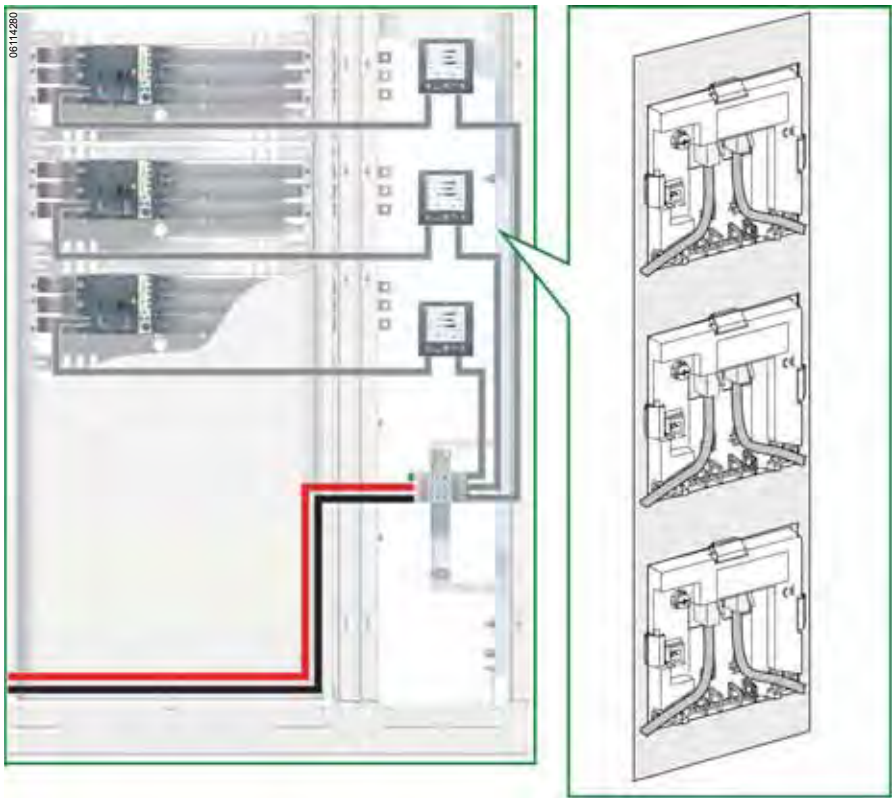
Door Cut-Out Mounting for Communicating Architecture

The FDM121 mounts in door cut-outs in the case of a centralized Modbus architecture (Figure 53). In this case, power the IMUs from the Modbus cable or by connecting a 24 Vdc power supply to the Modbus interface module. Remove the FDM121 power supply terminal block.

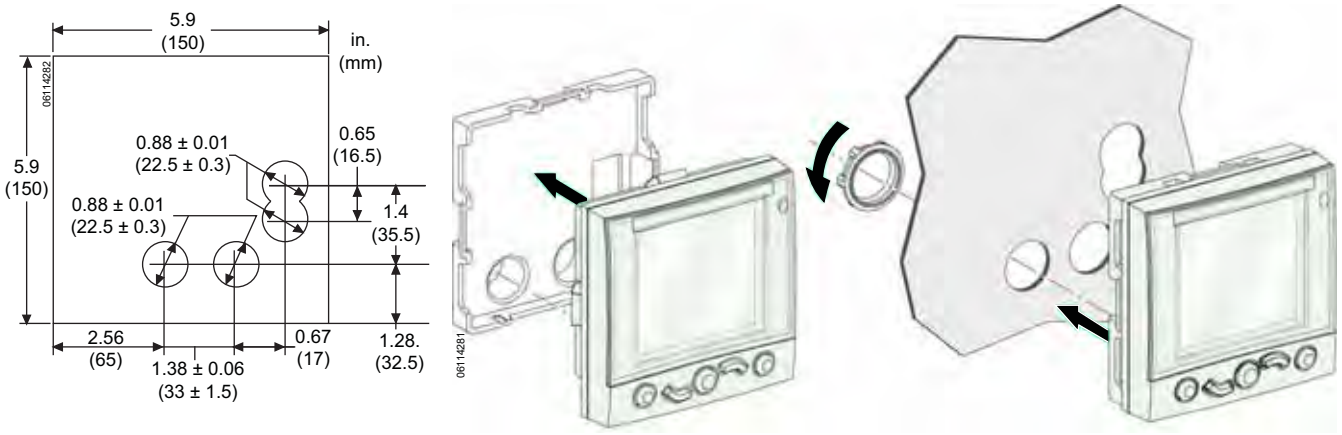
Figure 53: Mounting the FDM121 in Door Cut-Outs in a Centralized Modbus Architecture



Hole Mounting

Mount the FDM121 by drilling two holes 0.89 in. (22.5 mm) in diameter and securing using a surface-mounting accessory and a locking nut (Figure 54). If the FDM121 power supply terminal block is used to power the IMUs, a third cut-out made up of two drill holes 0.89 in. (22.5 mm) in diameter is needed.

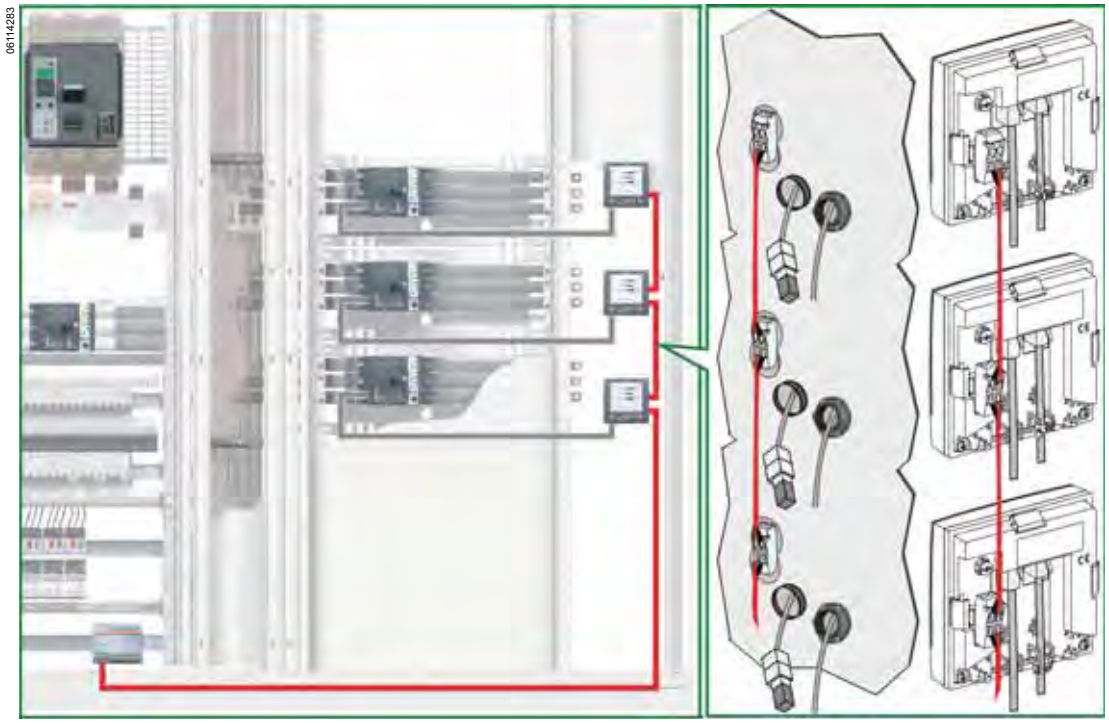
Figure 54: Drilling Dimensions



Hole Mounting for Standalone Architecture

The cut-out for the FDM121 power supply terminal block is necessary for retrofit mounting for standalone modular units, since they are powered by this terminal block.

Figure 55: Drill Hole Mounting for Standalone Architecture

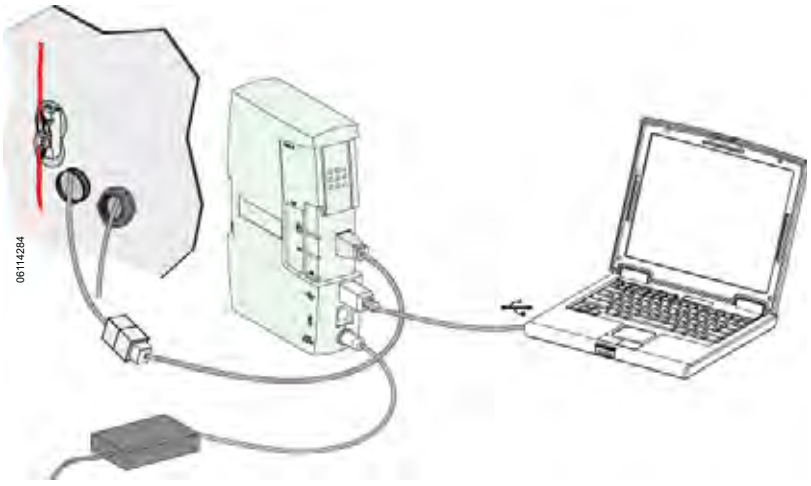


Hole Mounting and ULP Terminations

If mounting through drill holes on the door when the second ULP connector on the FDM121 is not being used (see previous figure), use a ULP cable and an RJ45 female/ female connector closed with a ULP line termination.

This makes it easier to access the ULP line termination, especially when connecting the UTA tester (see “UTA Tester ULP Connection” on page 86):

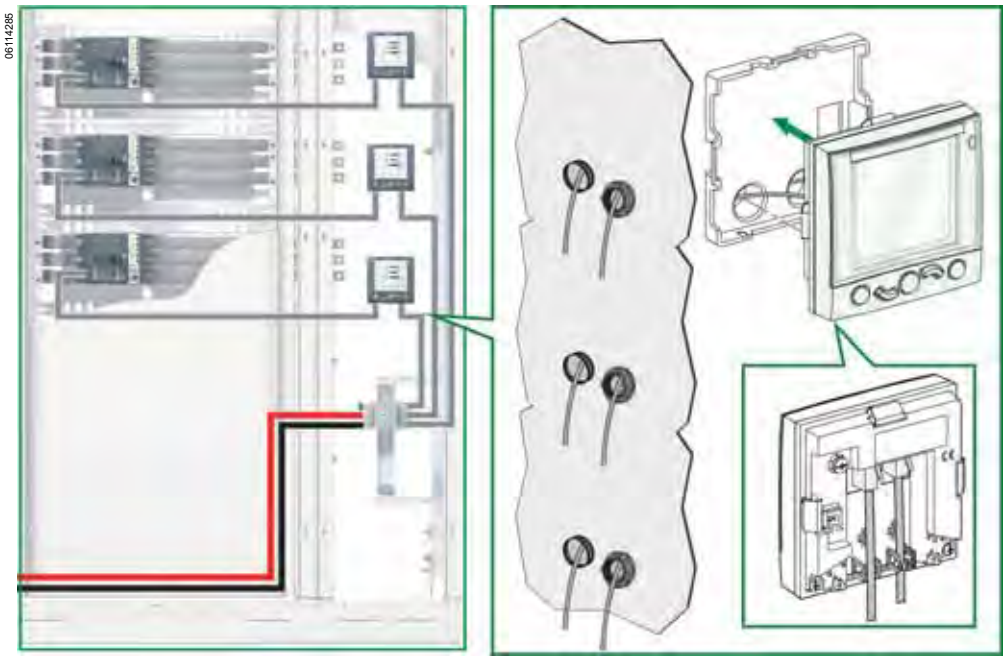
Figure 56: Drill Hole Mounting and ULP Termination



Hole Mounting for Communicating Architecture

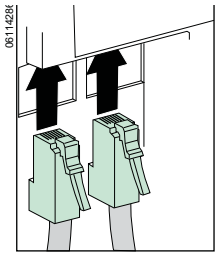
Figure 57 shows an example of mounting the FDM121 through drill holes in the case of a centralized Modbus architecture. In this case, the Modbus cable powers the IMUs. The FDM121 power supply terminal block can therefore be removed, and only two 0.89 in. (22.5 mm) diameter holes are needed.

Figure 57: Hole Mounting for Communicating Architecture



ULP Connection

Figure 58:



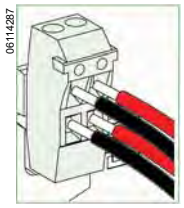
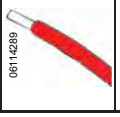
Use the two ULP RJ45 connectors on the FDM121 to connect it to the ULP modules on the IMU. Both ULP connectors are identical and in parallel, allowing the IMU ULP modules to be connected in any order.

NOTE: When the second ULP connector is not used (FDM121 at the end of the ULP line), it must be closed with a ULP line termination.

24 Vdc Power Supply

- Power the FDM121 either through the ULP cables or by direct connection of the power supply to the FDM121 power supply terminal block: For a communicating architecture, connect the 24 Vdc power supply to the 5-pin connector on the Modbus interface module. The Modbus interface module powers the other modules on the IMU and the ULP cables. The FDM121 power supply terminal block can be removed to reduce the dimensions.
- For a standalone architecture, the FDM121 power supply terminal block powers the IMUs.

Table 35: Power Supply Terminal Block Wires

Power Supply Terminal Block	Wire	Color	Description	Cross-Section	Stripped Length
 06114287	 06114288	Black	0 V	24–16 AWG (0.2–1.5 mm^2)	0.28 in. (7 mm)
	 06114289	Red	24 V	24–16 AWG (0.2–1.5 mm^2)	0.28 in. (7 mm)

The 24 Vdc supply terminal block has 2 points per terminal to simplify, if necessary, distribution of the power supply to other FDM121s in the switchboard (see “Door Cut-Out Mounting for Standalone Architecture” on page 67).

Functional Ground

In an environment with a high level of electromagnetic disturbance, connect the FDM121 functional ground to the local machine ground in the switchboard with a grounding strip.

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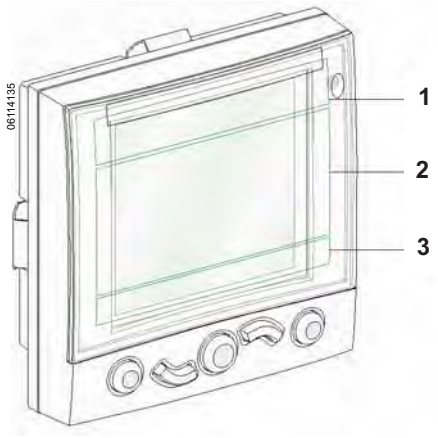
Operation of the FDM121

The screen displays the information to operate the ULP modules:

Figure 59: Screen Zones



1. Identification zone
2. Information zone
3. 3 Navigation zone

The display has three zones:

- The identification zone identifies the current screen (screen title) and notifies the user when an alarm trips.
- The information zone displays specific data on the screen (such as measurements, alarms, and settings).
- The navigation zone indicates which navigation options are available using the keys depending on the menu displayed.

Table 36: Example of the Display

Example	Description
06114291 V 2/10 1N 230 V 2N 232 V 3N 231 V ESC ▼ ▲	Identification zone The icon indicates that you are in the Metering menu. • The measurements displayed are voltages. • The V L-L V L-N submenu in the Metering menu consists of ten screens. The V screen displayed is number 2. Information zone • The voltage values V_{1N}, V_{2N}, and V_{3N} are displayed. Navigation zone • The navigation options for the V screen are displayed.

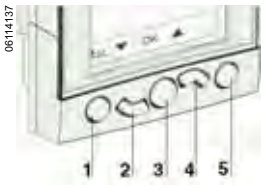
The FDM121 also has white backlighting:

- The backlighting comes on for 3 minutes each time a navigation key is pressed.
- The backlighting blinks every 250 ms when a prohibited ULP modular unit configuration is detected (for example, 2 identical modules being part of the same IMU).
- The backlighting blinks once a second when test mode is active (see “Test Button” on page 64).

Navigation Keys

The five navigation keys provide quick and intuitive navigation:

Figure 60: Navigation Keys



1. Escape
2. Down
3. Validation (OK)
4. Up
5. Context-sensitive key

The navigation zone indicates which navigation options are available using the keys depending on the menu displayed.

Table 37 lists the navigation options available from the five keys on the FDM121. When no icon is displayed in the zone corresponding to a key, this key is inactive for the menu displayed.

Table 37: Navigation Keys

Key		Definition	Icon	Description
	1	Escape key	**ESC**	Exits a menu or a submenu and returns to the previous menu
	2	Down key	▼	Used to point to the desired measurements or to go from one screen to the next
	3	Enter key	**OK**	Enters selection of a menu option
	4	Up key	▲	Used to point to the desired measurements or to go back to the previous screen
	5	Context-sensitive key		Displays measurements in Bar Graph mode
—	Keys are inactive for the icon displayed.		**Clear**	Clears an alarm: pop-up screen clears and LED goes off
—				Displays measurements in Dial Graph mode
—			**888**	Displays measurements in numeric mode

Alarm Indicator LED

The user can associate an alarm with any measurement or event in the intelligent modular unit (IMU).

Four priority levels are defined for the alarms:

- Level 0: No priority is assigned to the alarm
- Level 1: Low priority
- Level 2: Medium priority
- Level 3: High priority

Set the alarm parameters and assign priorities with the RSU software. For more information about alarm setup and priorities, refer to the RSU Online Help and the *Micrologic 5 and 6 Electronic Trip Units—User Guide*.

The orange alarm indicator LED alerts the user when an alarm trips in the IMU. It also indicates that one of the IMU ULP modules is in degraded mode or off.

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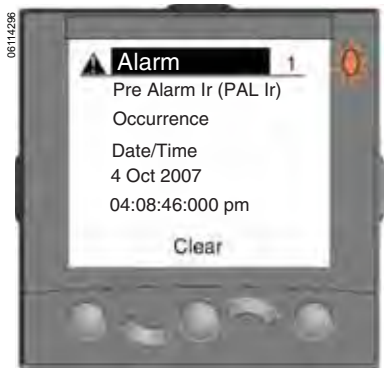
Table 38: Alarm Indicator LED

LED Status	Meaning
Steady OFF	Nominal operation (no alarm detected, no module degraded or off)
Blinking	• At least one pop-up screen is displayed. A pop-up screen is displayed in the following cases: — Occurrence of a level 3 alarm (high priority) — Occurrence of a trip The pop-up screen is cleared and the LED is extinguished by pressing the validation key (Clear). • An IMU module is off. The LED goes off after acknowledgment on the non-operational module or when the module concerned is no longer off.
Steady ON	• At least one level 2 alarm (medium priority) has tripped since the alarm history was last viewed. The LED goes off after the alarm history has been viewed. • An IMU module is in degraded mode. The FDM121 is in degraded mode if the EEPROM is off or the screen is faulty. The LED goes off after acknowledgment on the degraded module or when the module concerned is no longer degraded.

Example of an Alarm Pop-Up

Figure 61: Example of a Level 3 Alarm Pop-Up (High Priority)

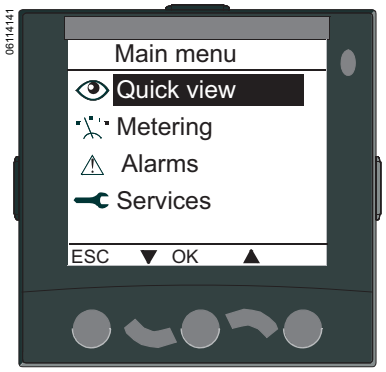


Pressing the validation key (Clear) clears the pop-up and returns to the screen displayed before the alarm occurred.

NOTE: Level 0 and level 1 alarms appear in the alarm history but are not signaled by the LED.

Main Menu

Figure 62:



The **Main** menu offers four menus for monitoring and using the ULP system intelligent functional units. The description and content of the menus is set for the PowerPact H-, J-, and L-frame circuit breakers.

Table 39: Menus

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 measurement values
Alarms	**Alarms Menu** The Alarms menu displays the alarm history of the last 40 alarms detected by the Micrologic trip unit.
Services	**Services Menu** The Services menu contains all the FDM121 display module set-up functions and the operating assistance information: • Reset (peak demand values, energy meters) • Set-up (display module) • Maintenance (operation counters, load profile) • Product version (identification of the intelligent functional unit modules) • Language (choice of language display)

Navigation within the **Main** menu is as follows:

- Use the ▼ and ▲ keys to select one of the four menus.
- Use the OK key to confirm the selection.
- The ESC key has no effect.

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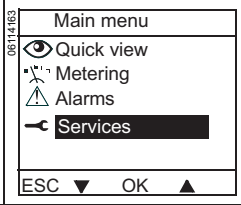
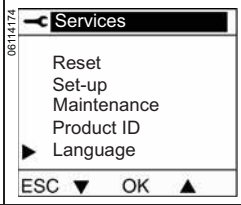
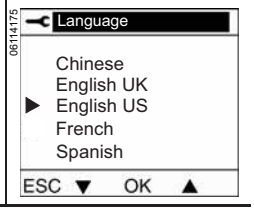
Choice of Language

Table 40: Procedure for Choosing the FDM121 Language

Action	Display
Select the Services menu in the main menu using the ▼ and ▲ keys. Pressing the OK key validates selection of the Services menu.	
The Services menu is displayed. Select the Language submenu using the ▼ and ▲ keys. Pressing the OK key validates selection of the Language submenu. Pressing the ESC key returns to the main menu.	
The Language submenu is displayed. Select the desired display language using the ▼ and ▲ keys. Pressing the OK key validates the language selection. Pressing the ESC key returns to the Services menu.	

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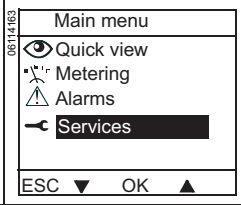
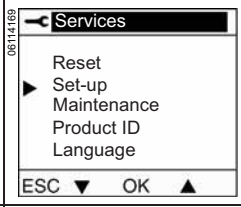
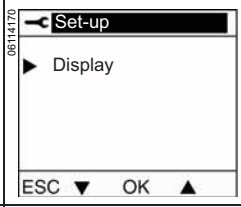
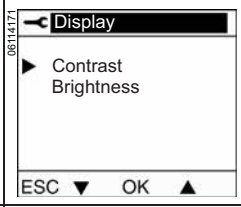
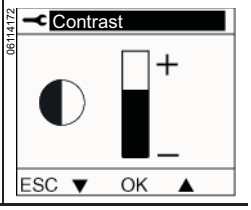
Setting the Contrast

Table 41: Setting the Contrast on the FDM121

Action	Display
Select the Services menu in the main menu using the ▼ and ▲ keys. Pressing the OK key validates selection of the Services menu.	
The Services menu is displayed. Select the Set-up submenu using the ▼ and ▲ keys. Pressing the OK key validates selection of the Set-up submenu. Pressing the ESC key returns to the main menu.	
The Set-up submenu is displayed. Pressing the OK key validates selection of the Display submenu. Pressing the ESC key returns to the Services menu.	
The Display submenu is displayed. Select the Contrast submenu using the ▼ and ▲ keys. Pressing the OK key validates selection of the Contrast submenu. Pressing the ESC key returns to the Set-up submenu.	
The Contrast submenu is displayed. Set the contrast using the ▼ and ▲ keys. Pressing the OK key validates the contrast setting. Pressing the ESC key returns to the Display submenu.	

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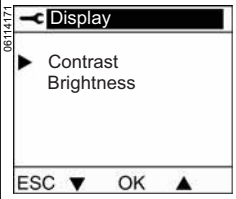
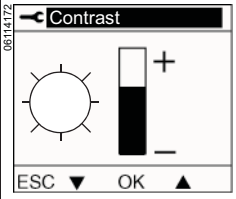
Setting the Brightness

The procedure for setting the brightness on the FDM121 is as follows:

Table 42: Setting the Brightness on the FDM121

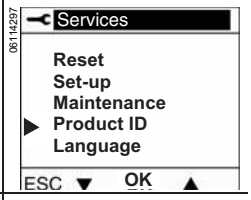
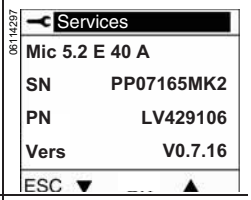
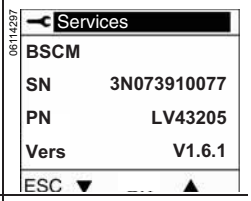
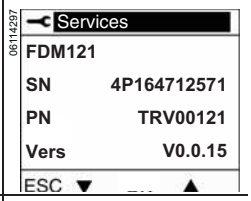
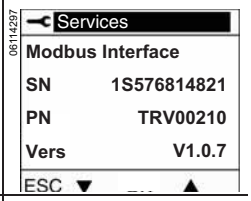
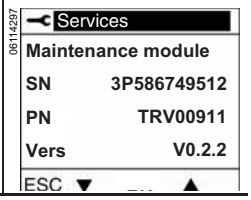
Action	Display
In the Display submenu, select the Brightness submenu using the ▼ and ▲ keys (see previous table for how to access the Display submenu). Pressing the OK key validates selection of the Brightness submenu. Pressing the ESC key returns to the Set-up submenu.	
The Brightness submenu is displayed. Set the brightness using the ▼ and ▲ keys. Pressing the OK key validates the brightness setting. Pressing the ESC key returns to the Display submenu.	

Product Version

The FDM121 identifies every module associated with an IMU: for each module, it displays the serial number, the part number, and the version.

Table 43 shows how to access the module versions for an IMU consisting of a PowerPact H-, J-, or L-frame circuit breaker equipped with a BSCM and a Micrologic 5.2 E trip unit, an FDM121, and a Modbus interface module. The UTA tester is connected to the test port on the Micrologic trip unit.

Table 43: Procedure for Accessing the Module Versions for an IMU

Action	Display
Select the Services menu in the main menu, then select the Product ID submenu using the ▼ and ▲ keys. Pressing the OK key validates selection of the Product ID submenu. Pressing the ESC key returns to the main menu.	
• Type of Micrologic trip unit • SN = Serial number • PN = Micrologic trip unit part number • Vers = Firmware version Pressing the ▼ key moves on to the BSCM version. Pressing the ESC key returns to the Services menu.	
• BSCM • SN = Serial number • PN = BSCM part number • Vers = Firmware version Pressing the ▼ key moves on to the FDM121 version. Pressing the ▲ key returns to the Micrologic trip unit version. Pressing the ESC key returns to the Services menu.	
• FDM121 • SN = Serial number • PN = FDM121 part number • Vers = Firmware version Pressing the ▼ key moves on to the Modbus interface module version. Pressing the ▲ key returns to the BSCM version. Pressing the ESC key returns to the Services menu. Product ID	
• Modbus interface module (IFM) • SN = Serial number • PN = Modbus interface module part number • Vers = Firmware version Pressing the ▼ key moves on to the UTA tester version. Pressing the ▲ key returns to the FDM121 version. Pressing the ESC key returns to the Services menu.	
• Maintenance module (UTA tester) • SN = Serial number • PN = UTA tester part number • Vers = Firmware version Pressing the ▼ key moves on to the Micrologic trip unit version. Pressing the ▲ key returns to the Modbus interface module version. Pressing the ESC key returns to the Services menu.	

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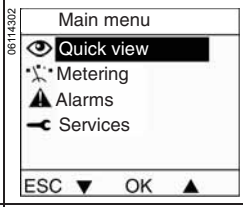
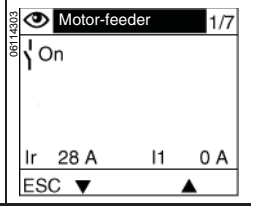
Intelligent Modular Unit (IMU) Name

For optimum use of the electrical equipment, use the RSU software to assign a name to the IMU relating to the function it is associated with (see “IMU Name and Location” on page 97).

Table 44: Procedure for Displaying the IMU Name

Action	Display
Select the Quick View menu in the main menu using the ▼ and ▲ keys. Pressing the OK key validates selection of the Quick View menu.	
Screen 1 in the Quick view menu displays the IMU name: Motor-feeder. The IMU name defined using RSU can consist of 45 characters maximum, but only the first 14 characters are visible on the FDM121.	

Settings Retained in the Event of a Power Failure

If its power supply fails, the FDM121 retains the following:

- Language setting
- Contrast setting
- Brightness setting

The FDM121 memory also retains the name of its associated IMU and the ID of the IMU modules.

However, all the metering information and the alarm history are lost.

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Section 5—UTA Tester

Function

Use the UTA tester to test and maintain the IMU ULP modules and their accessories.

Connection to the Intelligent Modular Unit (IMU)

The UTA tester connects to the IMU in one of two ways:

- Connection to the test port on the Micrologic trip unit, which allows connection on the front of the (IMU) switchboard.
- ULP connection, where the UTA tester connects to a ULP port on one of the IMU ULP modules.

Operating Modes

The UTA tester operates in one of two modes:

- In standalone mode (not connected to a computer), the UTA tester connects to the test port on the Micrologic trip unit and 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 tester can be used to:
  - — 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 PowerPact H-, J-, or L-frame circuit breaker (LTU)
  - — Check discrimination and the ZSI (Zone Selective Interlocking) function (LTU)
  - — Store all the operating data and maintenance tests in a file dedicated to each PowerPact H-, J-, or L-frame circuit breaker (LTU)
  - — Set the Modbus interface module communication parameters (RSU)
  - — Update the firmware in the IMU 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.

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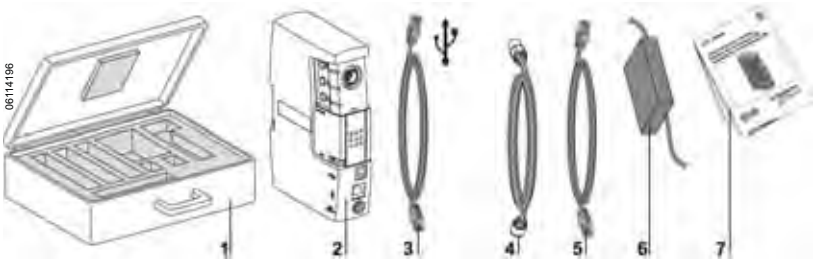
UTA Tester Kit

Figure 63: UTA Tester Kit

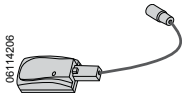


1. Case
2. UTA tester
3. USB cable for connection to the computer
4. Cable for connecting the UTA tester to the test port on the trip unit
5. ULP cable
6. 24 Vdc external power supply unit for the UTA tester
7. Instruction sheet

NOTE: To use the 24 Vdc external power supply unit to power the UTA tester, connect it to a 120/240 V power supply, overvoltage category II, in accordance with standard IEC 60664 for the protection of persons.

Bluetooth Connection

Figure 64:



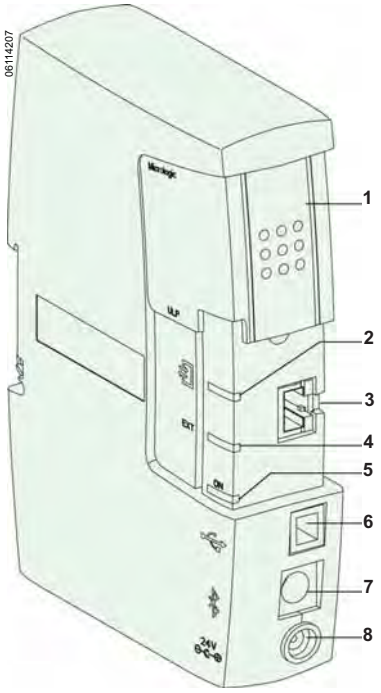
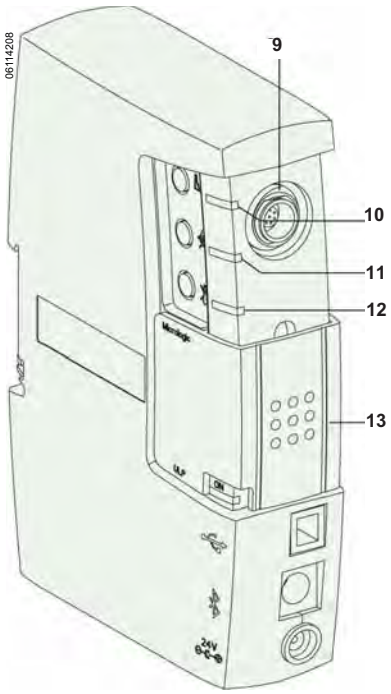
If desired, the user can order the optional Bluetooth connection SVW3A8114.

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

Connection Type

Table 45 describes the two types of connection for the UTA tester, depending on the position of the sliding mechanical cap:

Table 45: Connection Types for the UTA Tester

ULP Connection	Connection to the Test Port on the Micrologic Trip Unit
	
1. Sliding mechanical cap in ULP position 2. ULP communication LED 3. ULP RJ45 connector 4. LED indicating that the 24 Vdc external power supply is not connected 5. ON LED 6. USB connector 7. Bluetooth adapter connector 8. 24 Vdc external power supply unit input	9. Connection socket for special cable connecting UTA tester to test port on Micrologic trip unit 10. Electrical push to trip test button and LED indicator 11. Inhibit ground fault protection button and LED indicator 12. Inhibit thermal memory button and LED indicator 13. Sliding mechanical cap in test position

Characteristics

Table 46: UTA Tester Characteristics

Dimensions	4.41 x 6.46 x 1.65 in. (112 x 164 x 42 mm
Operating Temperature	-10 to +55°C
Power Supply Voltage	24 Vdc -20%/+10% (19.2–26.4 Vdc)
Consumption	• Without Bluetooth option: 60 mA/24 Vdc at 20°C • With Bluetooth option: 100 mA/24 Vdc at 20°C

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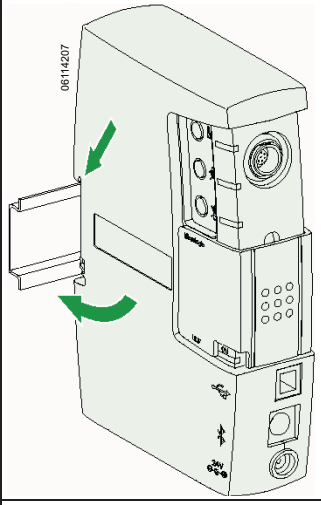
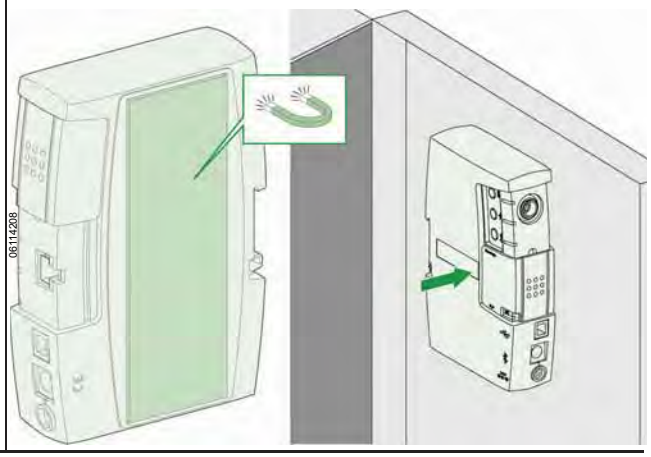
Part Numbers

Table 47: UTA Tester Kit Part Numbers

Product	Description	Part Number
UTA tester kit	Case, UTA tester, external power supply unit, and associated cables	STRV00910
UTA tester	—	STRV00911
24 Vdc power supply for UTA tester	—	TRV00915
Micrologic test cable	Cable for connecting the UTA tester to the test port on the Micrologic trip unit	TRV00917
Bluetooth option	Bluetooth module for connection to the UTA tester	SVW3A8114
RSU software	Remote Setting Utility	LV4ST100
LTU software	Local Test Utility	LV4ST121

Mounting

Table 48: Mounting Configuration

Mounting Configuration	Installation
Mounting on DIN Rail	
Mounting Magnetically	

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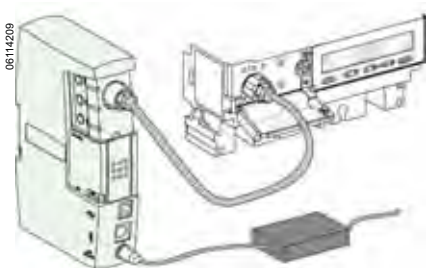
Connection to the Test Port on the Micrologic Trip Unit

Connect the UTA tester to the test port on the Micrologic trip unit using the test cable supplied in the UTA tester kit.

Place the UTA tester sliding mechanical cap in the Micrologic position.

Connection in Standalone Mode

Figure 65:



In standalone mode, the UTA tester is not connected to a computer. The UTA tester is connected to the test port on the Micrologic trip unit and is powered by the 24 Vdc external power supply unit provided in the UTA tester kit.

In standalone mode, the UTA tester can be used to perform the PowerPact H-, J-, or L-frame circuit breaker tripping tests and the inhibit ground fault protection and thermal memory tests. For more information about these three functions, refer to “Test Functions” on page 88.

Connection to a computer

The UTA tester connected to a computer can carry out the complete range of checks, tests, and adjustments on the IMU ULP modules, using the RSU and LTU software.

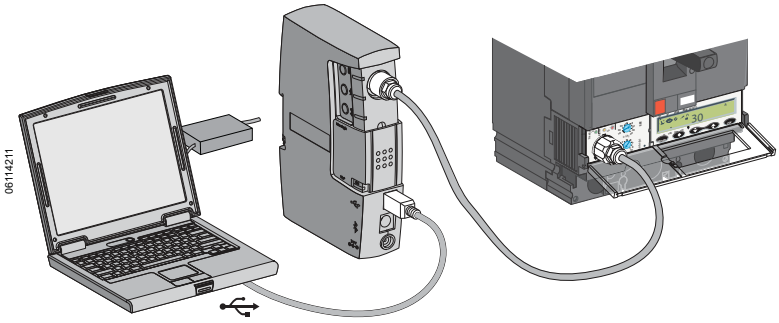
There are two possible configurations for connecting the UTA tester to a computer:

- Using the USB port
- Using the Bluetooth option

USB Connection

Figure 66 shows the UTA tester USB connection to the test port on a Micrologic trip unit. The UTA tester is powered through the USB port:

Figure 66: USB Connection Between UTA Tester and Micrologic Trip Unit



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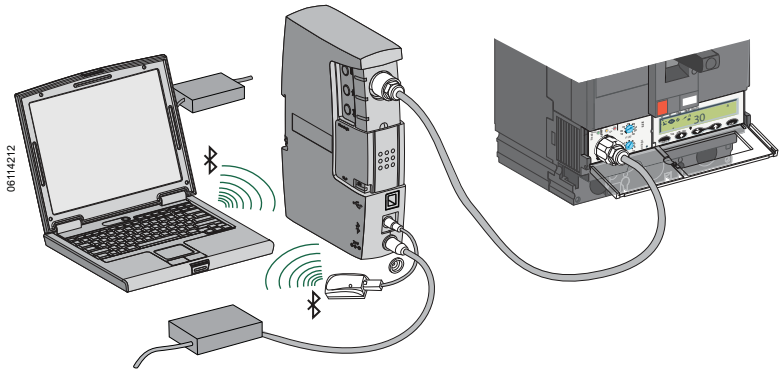
Bluetooth Connection

Figure 67 shows the UTA tester Bluetooth connection to the test port on a Micrologic trip unit. The UTA tester is powered by the 24 Vdc external power supply unit provided in the UTA tester kit:

Figure 67: Bluetooth Connection Between UTA Tester and Micrologic Trip Unit



UTA Tester ULP Connection

> **⚠ WARNING**
>
> **HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**
>
> Do not connect the switchboard's internal Modbus network 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 tester ULP to the IMU using the ULP cable provided in the UTA tester kit. Place the UTA tester sliding mechanical cap in the ULP position.

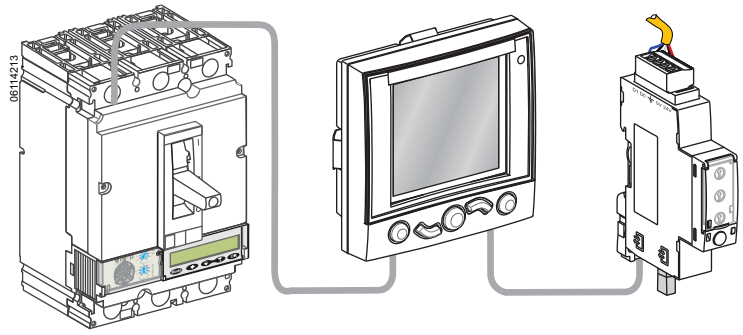
When the UTA tester ULP is connected to a communicating IMU over Modbus, it is important that the Modbus connection rules are followed.

For more information, refer to "Connection to the Modbus Master" on page 27.

Example of ULP Connection

The example shows an IMU consisting of a Modbus interface module, a PowerPact H-, J-, or L-frame circuit breaker and an FDM121. The UTA tester ULP is connected to an unused ULP connector on an IMU module:

Figure 68: A ULP Connection



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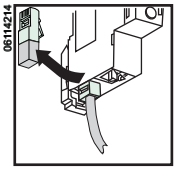
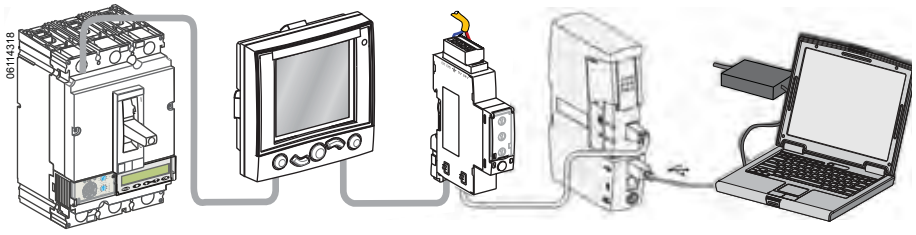
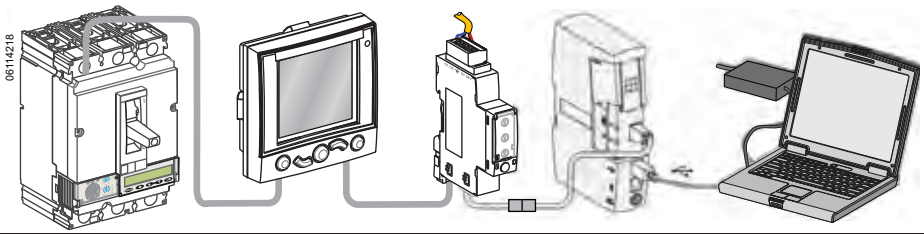
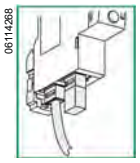
ULP Connection Procedure

Table 49: Procedure for Connecting the UTA Tester ULP to the IMU

Step	
1. Disconnect the ULP line termination from the Modbus interface module:	
2. Connect the UTA tester to the Modbus interface module using the ULP cable supplied in the UTA tester kit:	
If the ULP cable is too short, use an RJ45 female/female connector and a second ULP cable:	
3. Use the RSU software to set the parameters or update the firmware.	—
4. When the parameter-setting or firmware update operations have been completed, close the ULP connector on the Modbus interface module using the ULP line termination:	

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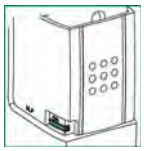
Using the UTA Tester Connected to the Test Port on the Micrologic Trip Unit

Standalone Mode

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

ON LED

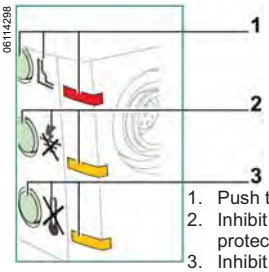
The green ON LED indicates that the UTA tester is supplied with power and operating correctly.



Test Functions

Carry out the tests using the three test buttons. Each button has a pictogram and an LED.

Table 50 describes the functions possible with the UTA tester connected in standalone mode to the test port on the Micrologic trip unit.



1. Push to trip
2. Inhibit ground fault protection
3. Inhibit thermal memory

Table 50: Test Functions in Standalone Mode

Function	Test Button Description	LED			
		Color	Function	Status	Meaning
Push to Trip	Press the push to trip button to trip the PowerPact H-, J-, or L-frame circuit breaker.	Red	Shows execution of the electronic trip test:	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	Press the inhibit ground fault protection button to inhibit ground fault protection and the thermal memory for 15 minutes.	Orange	Shows execution of the inhibit ground fault protection test:	ON for 15 min. 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.
				Blinking for 3 s	The ground fault protection function is not available while the Micrologic trip unit is in test mode.
Inhibit Thermal Memory	Press the inhibit thermal memory button to inhibit the thermal memory for 15 minutes.	Orange	Shows execution of the inhibit thermal memory test	ON for 15 min. 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.

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Connection to a computer

In addition to the test functions described above, the UTA tester connected to a computer 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, using the RSU and LTU software:

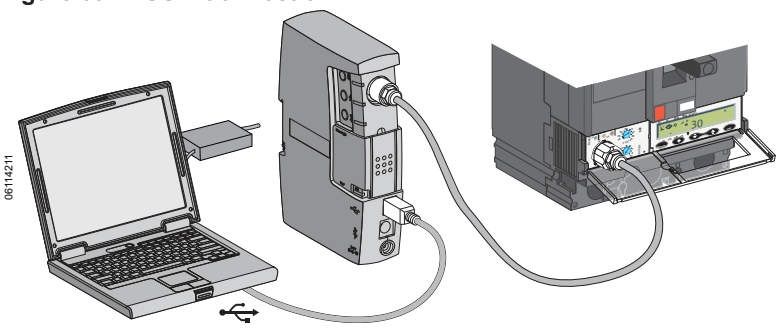
- Use the LTU software to test the protection functions (such as short time, long time, and instantaneous), simulate the Micrologic trip unit alarms, display the currents, and test the ZSI function.
- Use the RSU software to check and configure the protection, metering, and alarm parameters. It can also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

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

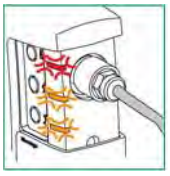
USB Connection

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

Figure 69: USB Connection



NOTE: If the USB port cannot supply power to the UTA tester (because the computer has a low battery), the three test LEDs blink.

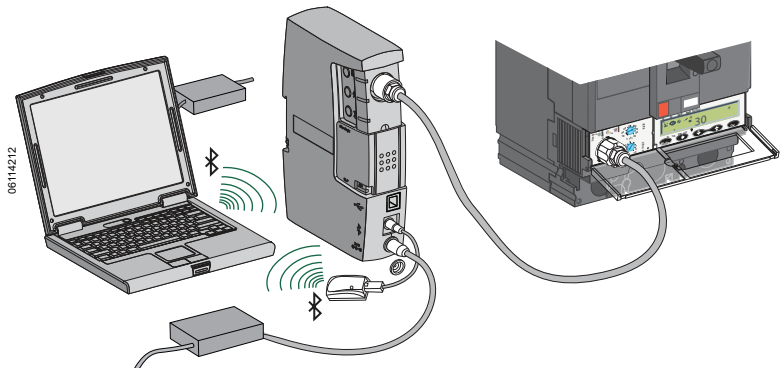


In this case, power the UTA tester with the 24 Vdc external power supply unit provided in the UTA tester kit. Connect the 24 Vdc external power supply unit to a 110/ 230 V power supply, overvoltage category II, in accordance with standard IEC 60664 for the protection of persons.

Bluetooth Connection

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

Figure 70: Bluetooth Connection



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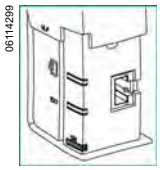
Using the UTA Tester Connected to the ULP System

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

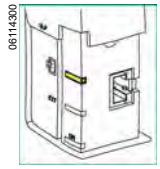
The LTU software only works with a connection to the test port on the Micrologic trip unit.

ON LED



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

ULP LED



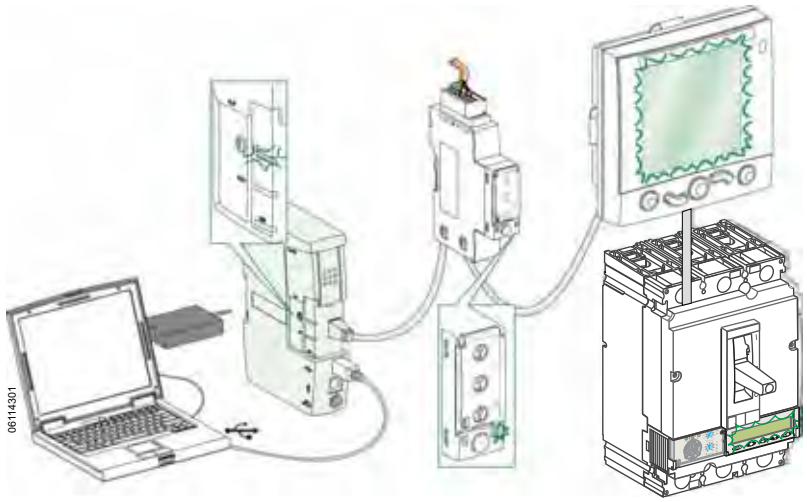
The yellow ULP LED describes the connection between the IMU ULP modules and the UTA tester.

Table 51: LED Status

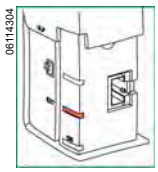
LED Status	Meaning
ON: 50 ms/OFF950 ms	Nominal operation: The UTA tester is supplied with power and the ULP connection is operating correctly.
ON: 250 ms/OFF	Prohibited configuration: Two identical modules are connected to the UTA tester in a daisy chain.
ON: 500 ms/OFF	Degraded mode (EEPROM off, faulty button)
ON: 1000 ms/OFF	Test mode
Steady ON	The UTA tester is supplied with power but the ULP connection is not functioning.
Steady OFF	The UTA tester is not supplied with power.

Figure 71 shows an IMU in test mode. The backlighting on the FDM121 and the Micrologic trip unit, the test LED on the Modbus interface module and the ULP LED on the UTA tester blink simultaneously in test mode (ON: 1000 ms/OFF: 1000 ms):

Figure 71: IMU in Test Mode



External Power Supply LED

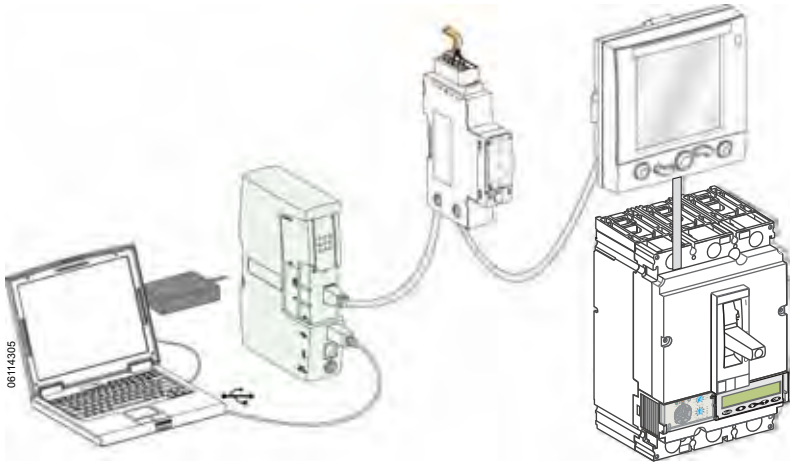


The orange external power supply LED lights up when the UTA tester does not have enough power (for example, with USB connection on a computer running on low battery). In this case it is necessary to use the external power supply unit provided in the UTA tester kit. The LED goes off when the external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

USB Connection

For a USB connection, the UTA tester is powered through the USB port:

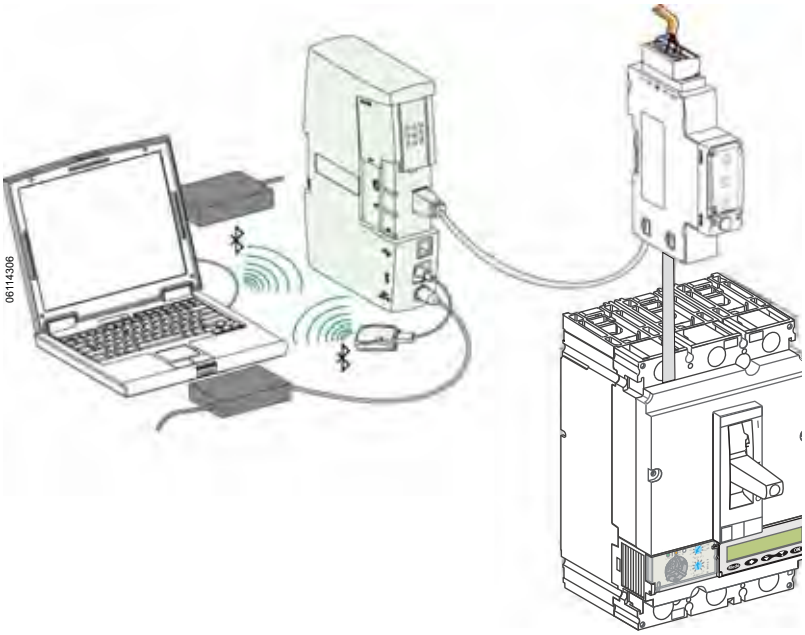
Figure 72: USB Connection



Bluetooth Connection

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

Figure 73: Bluetooth Connection



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Use Summary

Table 52: Summary of Connection and Power Supply Procedures

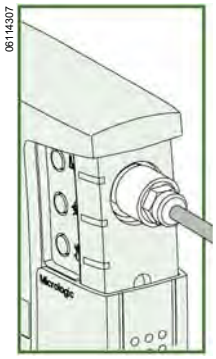
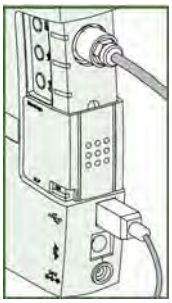
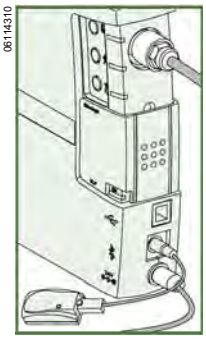
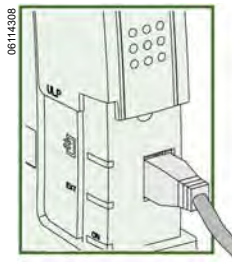
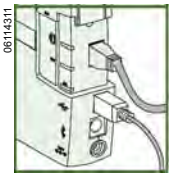
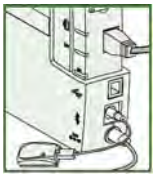
Connection to the Intelligent Modular Unit	Connection to the Computer	Associated Functions
Connection to the test port on the Micrologic trip unit 	No connection to the computer	• The UTA tester is in standalone mode. • The UTA tester is powered by its 24 Vdc external power supply unit. • The user can test PowerPact H-, J- or L-frame circuit breaker tripping, thermal memory inhibition, and ground fault protection inhibition.
	USB connection 	• The UTA tester 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 UTA tester 24 Vdc external power supply unit. • The standalone mode functions are available. • The user can test PowerPact H-, J-, or L-frame 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 tester is powered by its 24 Vdc external power supply unit. • The standalone mode functions are available. • The user can test PowerPact H-, J-, or L-frame 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 tester 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 UTA tester 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.
	Bluetooth connection 	• The UTA tester 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.

Table 53: ULP Module Power Supplies

Connection	Power Supply
If the UTA tester is connected to an IMU powered by the switchboard, the USB port or the 24 Vdc external power supply unit (in the case of a Bluetooth connection).	Only power the UTA tester.
If the UTA tester is connected to an IMU without a power supply.	Use the UTA tester 24 Vdc external power supply unit to power all the IMU modules.
If the UTA tester is connected to a ULP module without a power supply.	The USB port is usually capable of supplying power to the UTA tester and the ULP module. If not, use the UTA tester 24 Vdc external power supply unit.

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Section 6—Remote Setting Utility (RSU) Software

Function

The RSU (Remote Setting Utility) software is a Micrologic program designed for:

- Verification and configuration of the protection parameters
- Verification and configuration of the metering parameters
- Verification and configuration of the alarm parameters
- Verification and configuration of the SDx module outputs
- Verification and configuration of the BSCM parameters
- Verification and configuration of the Modbus interface module communication parameters
- Modification of passwords
- Editing and saving configurations
- Displaying trip curves
- Updating the firmware in the intelligent modular unit (IMU) modules
- Updating the FDM121 languages
- Resetting passwords associated with the IMU

Selection

Use the selection window for selecting the Micrologic trip unit using the RSU software:

Figure 74: RSU Window for Selecting the Micrologic Trip Unit Using the RSU Software

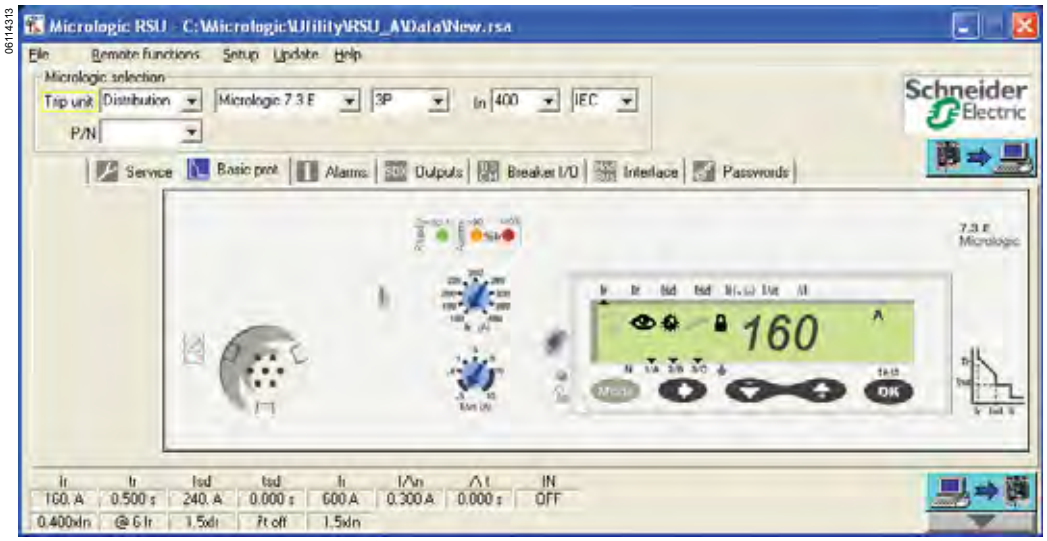

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Table 54: The RSU Software Tabs

Tab	Description	Functions
Service	Metering	Configuring the metering functions (Micrologic E)
Basic prot	Basic Protection	Setting the Protection Functions
Alarms.	Alarm	Configuring pre-alarms and the ten user-defined alarms
SDx Outputs	SDx Outputs	Assignment of the two SDx outputs
Passwords	Passwords	Configuring four password levels BSCM Module Option
BSCM Breaker I/O	BSCM Module Option	• Counters for OF operations and actions on SD and SDE faults • Alarm threshold associated with the OF counter • Communicating electrical motor operator: Close command counter • Communicating electrical motor operator: Configuring the motor reset command • Communicating electrical motor operator: Alarm threshold associated with the close command counter
Mod Bus Interface	Modbus Interface Option	• Reading Modbus addresses • Communication functions setup

RSU in Offline Mode

In offline mode, the RSU software does not communicate with the IMU ULP modules.

Table 55: Offline IMU Adjustments

Adjustment	Description
Define the protection settings.	The settings are configured on a screen that looks like the front panel of the Micrologic trip unit. The use of dials and navigation using the keypad keys simulate all the options available on the Micrologic trip unit screen.
Save and duplicate the protection settings	Each configuration created can be saved for use at a later date. It can be duplicated and used as a basis for programming another circuit breaker.

RSU in Online Mode

In online mode, the RSU software communicates with the IMU ULP modules.

Table 56: Online IMU Adjustments

Adjustment	Description
Display the existing settings.	The RSU software displays the Micrologic trip unit with access to all its settings.
Display the corresponding protection curves.	The RSU software displays the protection curve corresponding to the defined settings. It is possible to superimpose a second curve for a discrimination study.
Modify settings:	• By setting the protection parameters online directly on the screen • By loading the settings prepared in offline mode
Program alarms.	The user can program up to 12 alarms associated with measurements or events: • Two alarms are predefined and activated automatically: Overload (I_r) for the Micrologic 5 trip unit, overload (I_r) and ground fault (I_g) for the Micrologic 6 trip unit • The user can choose up to ten alarms from a list of 90, in association with thresholds, priorities, and time delays
Update the firmware in the IMU modules:	• Modbus interface module firmware update • FDM121 firmware update • Micrologic trip unit firmware update • UTA tester firmware update
Languages	Update the FDM121 languages
Passwords	Reset passwords to their factory-set values

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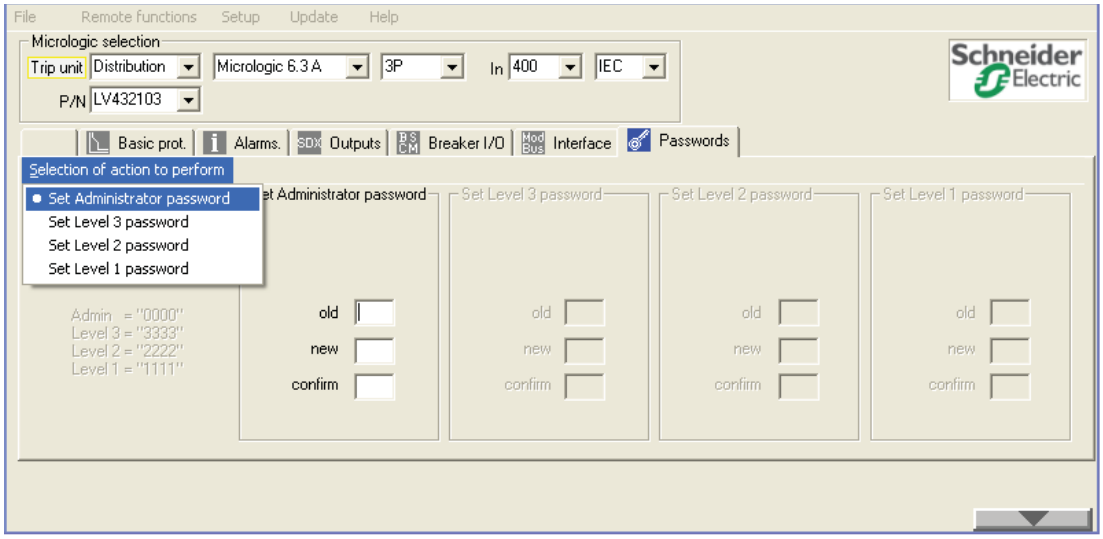
Security

There are three possible security levels for the settings.

Table 57: Security Levels

Security Level	Description
1. Locking the Modbus interface module	When the Modbus locking pad is in the locked position, write operations are prohibited.
2. Maximum limit	The position of the dials on the Micrologic trip unit defines the maximum settings that are possible using the communication option.
3. Passwords	Common by default, passwords can be set individually for each PowerPact H-, J-, or L-frame circuit breaker. Four password levels are available with RSU: • Levels 1, 2, and 3 are available for operators. The factory-set passwords are 1111 for level 1, 2222 for level 2 and 3333 for level 3. • Level 4 is reserved for the administrator. The factory-set level 4 password is 0000. Figure 75 shows the window for entering passwords in RSU:

Figure 75: RSU Window for Entering Passwords Using the RSU Software



Any manual intervention on the Micrologic trip unit and on the Modbus interface module takes priority over settings made with RSU.

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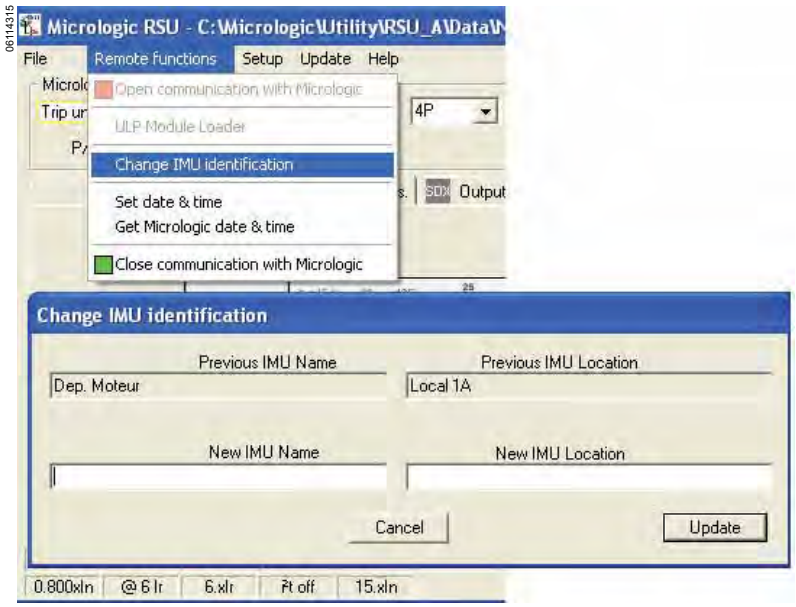
RSU and the Intelligent Modular Unit (IMU)

IMU Name and Location

When RSU is in online mode, use it to assign a name and location to the IMU

Figure 76: Using the RSU to Assign the IMU Name and Location



The FDM121 displays the first 14 characters of the IMU name.

The FDM121 does not display the IMU location. View the IMU location using RSU or the Modbus command “Read IMU name and location”.

For more information about the IMU name and location, refer to the RSU Online Help and the *Modbus Communication—User Guide*.

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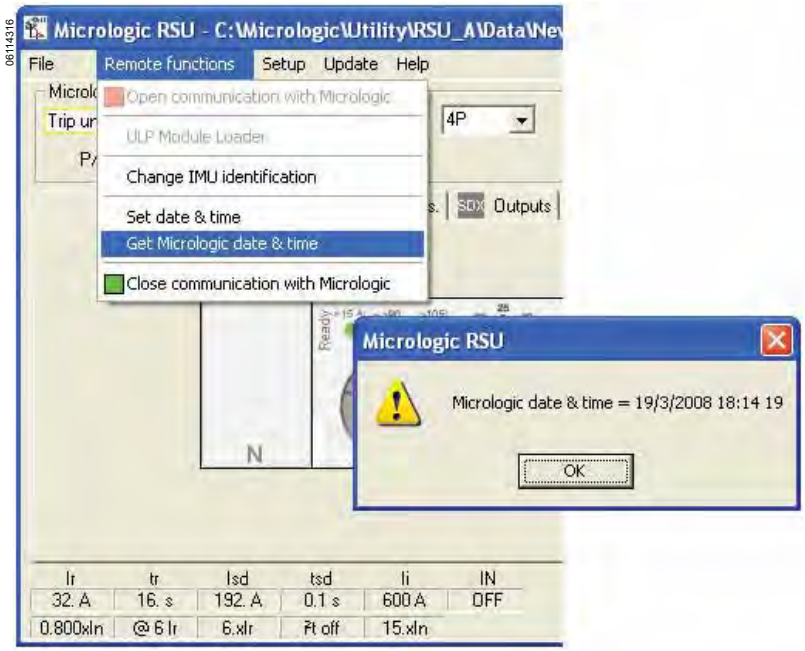
Setting the Time on the ULP Modules

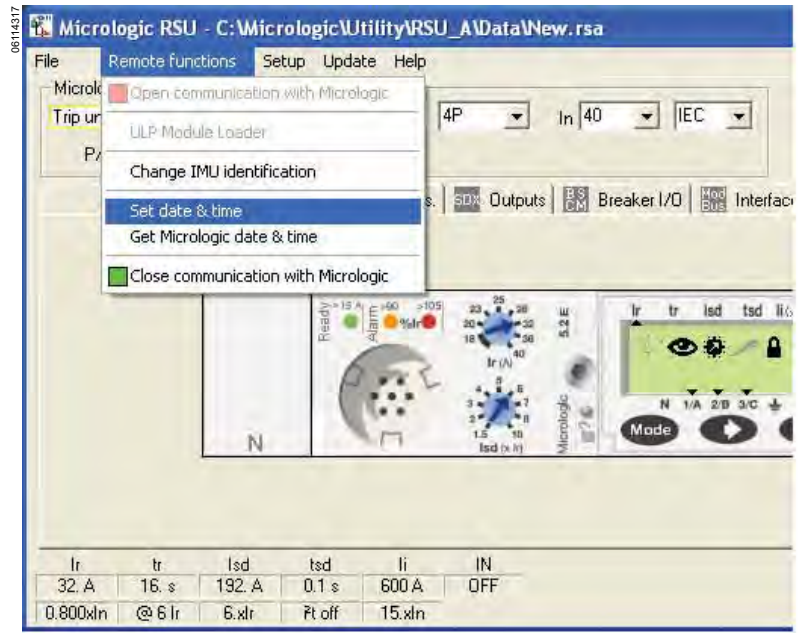
When RSU is in online mode, use it to read the time on the IMU ULP modules:

Figure 77: Using the RSU to Read the IMU Time



RSU can also be used to set the time on the IMU ULP modules. A particular reason for setting the time is if the IMU power supply fails.

Figure 78: Using the RSU to Set the IMU Time



For more information about the IMU ULP module get time and set time functions, refer to the RSU Online Help and the *Modbus Communication—User Guide*.

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Appendix A—ULP System for PowerPact H-, J- and L-Frame Circuit Breakers

Summary of Connection Rules

Table 58: Summary of Rules

Connection	Daisy-chaining of ULP cables and ULP line termination at the end of the ULP line
Maximum length	• 65.6 ft (20 m) in total for the IMU • 32.8 ft (10 m) between two ULP modules • 39.4 ft (12 m) for the fixed part in the case of an installation with a withdrawable drawer
Voltage range supported	24 Vdc -20% (19.2 Vdc) to 24 Vdc +10% (26.4 Vdc)
Maximum consumption per IMU	300 mA (see “ULP Module Consumption” on page 23)

ULP Cable Characteristics

The common characteristics of ULP cables are as follows:

- Shielded cable with four twisted pairs, 26 AWG (0.15 mm^2) 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 “Composition of the Modbus Cable” on page 25)
- Insulation voltage of the outer sheath: 300 V[1]
- Bending radius: 1.97 in. (50 mm)[1]

Modbus Cable Characteristics

When a Modbus cable other than Merlin Gerin 50965 is used, it must have the following characteristics:

- Shielded cable with 2 twisted pairs:
  - — One communication pair for the RS485 signal, with typical impedance of 120 Ω and minimum cross-section 24 AWG (0.25 mm^2). 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: 22 AWG (0.32 mm^2) minimum for a 24 Vdc power supply rated 1 A, and 20 AWG (0.5 mm^2) 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 Modbus interface module’s 5-pin connector)
- Nominal insulation voltage of the outer sheath: 300 V minimum[1]

Connection Rules

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

Table 59: 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	22 AWG (0.34 mm^2)	Belden ref. 3084A [1]	External diameter limited to 0.28 in. (7 mm) for ease of wiring
Large installation: all topologies	3 A	18 AWG (0.75 mm^2)	Belden ref. 7895A[1]	Recommended cable with shielding drain wire and 0.38 in. (9.6 mm) diameter

[1] 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.

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Modbus Cable Lengths

Table 60: Rules for Modbus Cable Length

Condition	Rule
The maximum permitted length for the Modbus network (for the trunk cable, excluding derivations)	1640 ft (500 m) at 38400 baud and 3281 ft (1000 m) at 19200 baud.
The Modbus cable connecting the Modbus interface modules in the ULP system incorporates both the Modbus communication network and the 24 Vdc power supply.	• 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 V (2 V on +24 V wire and 2 Von 0 V wire). A minimum supply voltage of 24 V -20% (19.2 V) is thus obtained on the last Modbus interface module, with a 24 V power supply regulated at: — +/- 3% (23.3 V–24.7 V) for 3 A power supplies —+/-5% (22.8 V–25.2 V) for 1 A power supplies
Because of the stresses caused by a drop in the supply voltage, more restrictive limitations are imposed:	• For optimum quality of Modbus communication, the voltage on the 0 V terminal on each Modbus interface module (Modbus common) must not vary by more than +/-4 V 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.

Table 61: Modbus Cable Lengths

Description	24 Vdc Rating	Cross-Section of Power Supply Pair	L0 (in 18 AWG [0.75 mm^2] wires)	L1	Sum of all L1s (for all power supply segments)	Sum of the L1s and L3s (total length)
Maximum Modbus cable lengths for a centralized Modbus architecture (see "Centralized Modbus Architecture" on page 32) depending on the cross-section of the Modbus cable power supply pair:	1A	22 AWG (0.34 mm^2)	16.4 ft (5 m)	98 ft (30 m)	246 ft (75 m)	1640 ft (500 m)
		20 AWG (0.5 mm^2)	16.4 ft (5 m)	148 ft (45 m)	344 ft (105 m)	1640 ft (500 m)
	3A	22 AWG (0.34 mm^2)	Cross-section incompatible with current > 1 A			
		20 AWG (0.5 mm^2)	9.8 ft (3 m)	49 ft (15 m)	115 ft (35 m)	1640 ft (500 m)
		18 AWG (0.75 mm^2)	9.8 ft (3 m)	82 ft (25 m)	197 ft (60 m)	1640 ft (500 m)
		17 AWG (1mm^2)	9.8 ft (3 m)	98 ft (30 m)	230 ft (70 m)	1640 ft (500 m)
		16 AWG (1.5 mm^2)	9.8 ft (3 m)	164 ft (50 m)	394 ft (120 m)	1640 ft (500 m)
Maximum Modbus cable lengths for a daisy-chained distributed Modbus architecture (see "Daisy-Chained Distributed Modbus Architecture" on page 41) depending on the cross-section of the Modbus cable power supply pair	1A	22 AWG (0.34 mm^2)	16.4 ft (5 m)	98 ft (30 m)	246 ft (75 m)	1640 ft (500 m)
		20 AWG (0.5 mm^2)	16.4 ft (5 m)	148 ft (45 m)	344 ft (105 m)	1640 ft (500 m)
	3A	22 AWG (0.34 mm^2)	Cross-section incompatible with current > 1 A			
		20 AWG (0.5 mm^2)	9.8 ft (3 m)	49 ft (15 m)	115 ft (35 m)	1640 ft (500 m)
		18 AWG (0.75 mm^2)	9.8 ft (3 m)	82 ft (25 m)	197 ft (60 m)	1640 ft (500 m)
		17 AWG (1mm^2)	9.8 ft (3 m)	98 ft (30 m)	230 ft (70 m)	1640 ft (500 m)
		16 AWG (1.5 mm^2)	9.8 ft (3 m)	164 ft (50 m)	394 ft (120 m)	1640 ft (500 m)

Table 62: Modbus Cable Lengths for Derivated Distribution Modbus Architecture

Description	24 Vdc Rating	Cross-Section of Power Supply Pair	L0 (in 18 AWG [0.75 mm^2] wires)	L1	L2	Sum of all L2s (for all power supply segments)	Sum of the L1s, L2s and L3s (total length)
Maximum Modbus cable lengths for a derivated distributed Modbus architecture (see "Derivated Distributed Modbus Architecture" on page 47) depending on the cross-section of the Modbus cable power supply pair	1A	22 AWG (0.34 mm^2)	16.4 ft (5 m)	66 ft (20 m)	33 ft (10 m)	131 ft (40 m)	1640 ft (500 m)
		20 AWG (0.5 mm^2)	16.4 ft (5 m)	115 ft (35 m)	33 ft (10 m)	131 ft (40 m)	1640 ft (500 m)
	3A	22 AWG (0.34 mm^2)	Cross-section incompatible with current > 1 A				
		20 AWG (0.5 mm^2)	9.8 ft (3 m)	33 ft (10 m)	16.4 ft (5 m)	131 ft (40 m)	1640 ft (500 m)
		18 AWG (0.75 mm^2)	9.8 ft (3 m)	49 ft (15 m)	33 ft (10 m)	131 ft (40 m)	1640 ft (500 m)
		17 AWG (1mm^2)	9.8 ft (3 m)	66 ft (20 m)	33 ft (10 m)	131 ft (40 m)	1640 ft (500 m)
		18 AWG (0.75 mm^2)	9.8 ft (3 m)	131 ft (40 m)	33 ft (10 m)	131 ft (40 m)	1640 ft (500 m)

Isolated Modbus Repeater Module

Isolated Modbus Repeater Module Characteristics

Since Modbus interface modules (part number STRV00210) are not isolated, an isolated Modbus Repeater Module needs to inserted between the Modbus network inside the switchboard and the Modbus network outside the switchboard. The Isolated Modbus Repeater Module must conform to the characteristics shown in Figure 79.

Table 63: Isolated Modbus Repeater Module Connection Rules

Description	Connection Rule
Each isolated Modbus segment must include a polarization at one point, and a Modbus line termination at each end:	On the segment outside the switchboard: • The line polarization and a termination are integrated in the Modbus master. • A Modbus line termination (part number VW3A8306DRC) must be connected at the other end, on the last Isolated Modbus Repeater Module.
	On the segment inside the switchboard: • The polarization and a Modbus line termination must be integrated in the Isolated Modbus Repeater Module. • A Modbus line termination must be connected at the other end, on the last Modbus interface module or other Modbus slave.
L is the length of the Modbus trunk cable (excluding derivations):	Lmax = 1640 ft (500 m) at 38400 baud
	Lmax = 3281 ft (1000 m) at 19200 baud

Connection of the Isolated Modbus Repeater Module to the Modbus networks inside and outside the switchboard is shown in detail in “Isolated Modbus Repeater Module Characteristics” on page 101.

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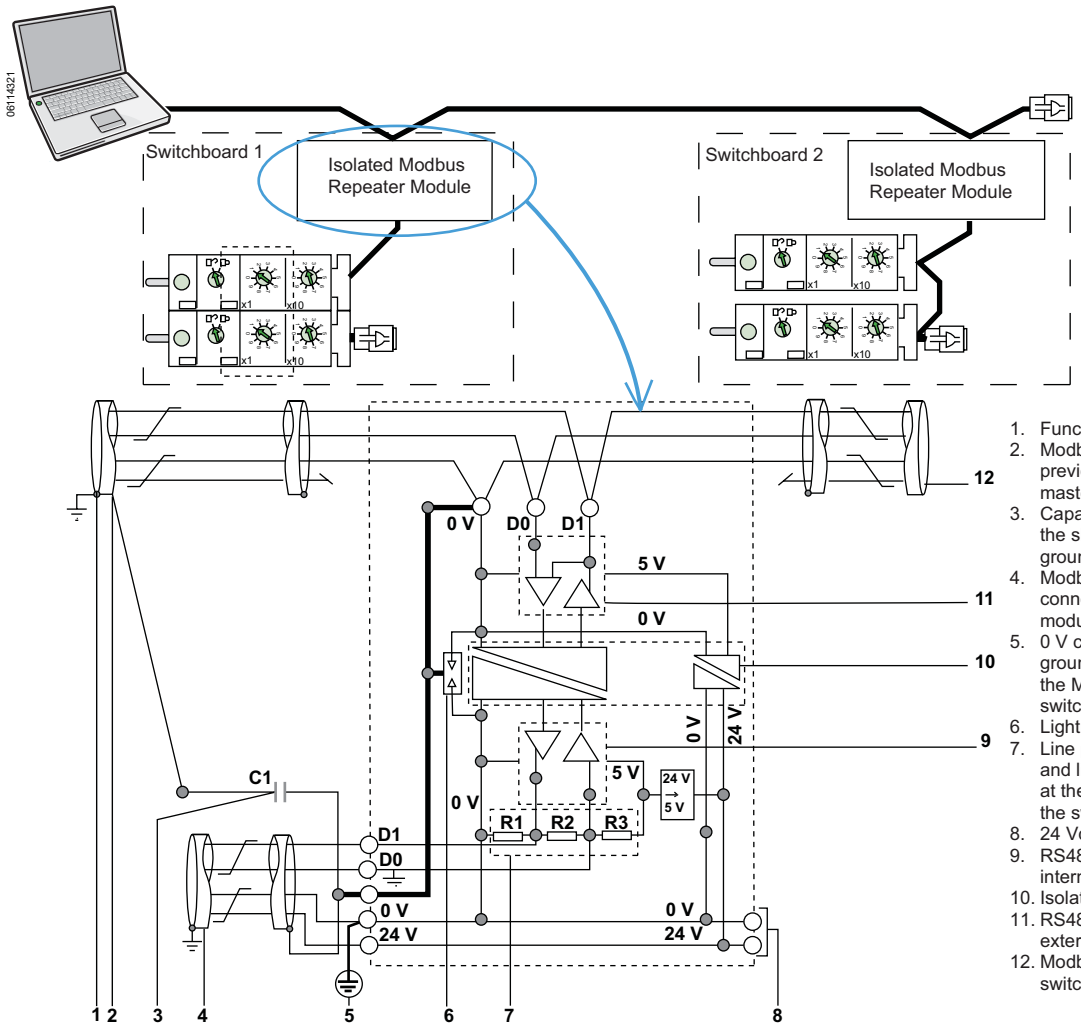
Figure 79: Isolated Modbus Repeater Module Characteristics



1. Functional ground connection
2. Modbus cable coming from the previous switchboard or the Modbus master
3. Capacitor (C1 = 2.2–22 nF) between the shielding and the local machine ground
4. Modbus cable inside the switchboard, connected to the Modbus interface modules
5. 0 V connection to the protective ground, at a single point at the top of the Modbus cable inside the switchboard
6. Lightning surge protector
7. Line polarization (R1 = 390–680 Ω) and line termination (R2 = 120–220 Ω) at the top of the Modbus cable inside the switchboard
8. 24 Vdc power supply input
9. RS485 transmitter-receiver at the internal Modbus network end
10. Isolation barrier > 2 kV
11. RS485 transmitter-receiver at the external Modbus network end
12. Modbus cable running to the next switchboard

Connection Rules

The rules below must also be followed:

- The shielding on the Modbus cable coming from the previous switchboard or the Modbus master must be connected to the local machine ground via a capacitor C1 (2.2–22 nF) in order to avoid current loops between remote grounds. Select a capacitor with a voltage rating greater than the ground potential difference.
- The shielding on the Modbus cable running to the next switchboard is connected to the local machine ground. It should be isolated at the incoming point to the next switchboard in order to avoid current loops between remote grounds.

ULP System Part Numbers

Table 64: Part Numbers for ULP System Components for PowerPact H-, J- and L-Frame Circuit Breakers

Product	Description	Part Number
PowerPact H-, J- or L-frame circuit breaker	—	See PowerPact H-, J- or L-frame Circuit Breaker Catalog
NSX Cord	L = 4.27 ft (1.3 m)	S434201
	L = 9.84 ft (3.0 m)	S434202
	L = 14.7 ft (4.5 m)	S434304
NSX Cord > 480 Vac	L = 4.27 ft (1.3 m), V > 480 Vac	S434204
	L = 9.84 ft (3.0 m), V > 480 Vac	S434303
	L = 14.7 ft (4.5 m), V > 480 Vac	S434305
BSCM only	—	S434205
NSX Cord plus BSCM	L = 4.27 ft (1.3 m)	S434201BS
	L = 9.84 ft (3.0 m)	S434202BS
	L = 14.7 ft (4.5 m)	S434304BS
NSX Cord > 480 Vac plus BSCM	L = 4.27 ft (1.3 m), V > 480 Vac	S434204BS
	L = 9.84 ft (3.0 m), V > 480 Vac	S434303BS
	L = 14.7 ft (4.5 m), V > 480 Vac	S434305BS
Micrologic trip unit	—	See PowerPact H-, J- or L-frame Circuit Breaker Catalog
Front Display Module FDM121	—	STRV00121
Surface-mounting accessory	—	TRV00128
Modbus Interface Module	—	STRV00210
Stacking accessory	10 stacking accessories TRV00217	TRV00217
UTA Tester kit	UTA tester, 24 Vdc external power supply unit and associated cables	STRV00910
UTA Tester	—	STRV00911
UTA Tester power supply unit	—	TRV00915
Micrologic test cable	—	TRV00917
Bluetooth option	—	SVW3A8114
RSU software	—	LV4ST100
LTU software	—	LV4ST121
ULP cable	L = 0.98 ft (0.3 m);10 cables	TRV00803
	L = 1.97 ft (0.6 m); 10 cables	TRV00806
	L = 3.28 ft (1 m); 5 cables	TRV00810
	L = 6.56 ft (2 m); 5 cables	TRV00820
	L = 9.84 ft (3 m); 5 cables	TRV00830
	L = 16.4 ft (5 m); 1 cable	TRV00850
RJ45 female/female connector	10 RJ45 female/female connectors	TRV00870
ULP line termination	10 ULP line terminations	TRV00880
Modbus line termination	Telemecanique: 2 Modbus line terminations with impedance of 120 Ω +1nF	VW3A8306DRC
24 Vdc power supply	Merlin Gerin: 24/30 Vdc-24 Vdc-1 A -overvoltage category IV	685823
	Merlin Gerin: 48/60 Vdc-24 Vdc-1 A - overvoltage category IV	685824
	Merlin Gerin: 100/125 Vdc-24 Vdc-1 A - overvoltage category IV	685825
	Merlin Gerin: 110/130 Vac-24 Vdc-1 A - overvoltage category IV	685826
	Merlin Gerin: 200/240 Vac-24 Vdc-1 A - overvoltage category IV	685827
	Merlin Gerin: 380/415 Vac-24 Vdc-1 A - overvoltage category IV	685829
	Telemecanique: 100/500 Vac-24 Vdc- 3 A - overvoltage category II	ABL8RPS24030
Modbus cable	Belden: 0.28 in. (7 mm) diameter shielded cable with 2 twisted pairs	3084A
	Belden: 0.38 in. (9.6 mm) diameter (recommended) shielded cable with 2 twisted pairs	7895A
	Merlin Gerin: cable with 2 twisted pairs without shielding drain wire	50965

Table 64: Part Numbers for ULP System Components for PowerPact H-, J- and L-Frame Circuit Breakers

Product	Description	Part Number
Derivation terminal block	Telemecanique: 4-channel spring terminal block (gray)	AB1 RRNETV235U4
	Telemecanique: 4-channel protective earth terminal block (green/yellow)	AB1 RRNETP235U4
	Telemecanique: End cover	AB1 RRNACE244
	Snap-in 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 cover for pluggable connector KGG-MSTB 2.5/5	1803895
Ethernet gateway	EGX100	EGX100
	EGX300	EGX300
ZSI Wire Harness H/J	ZSI OUT only	S434300
ZSI Wire Harness L	ZSI IN and ZSI OUT	S434301
ENVT Wire Harness		S434302

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