Modbus Communication for Circuit Breakers

Compact NSX, Compact NS and Masterpact NT/NW Circuit Breakers Quick Start Guide

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

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

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

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

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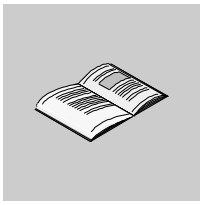

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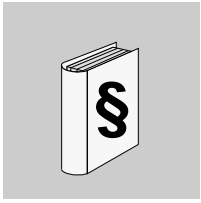
Safety Information



Important Information

NOTICE

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

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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

CAUTION

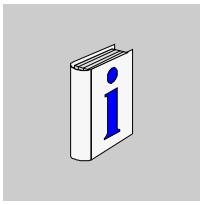
CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage.

PLEASE NOTE

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

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

About the Book



At a Glance

Document Scope

This quick start guide is designed to show users the advantages of implementing an information system on their electrical installation using the data available in the circuit breakers. It explains broadly how to implement this information system right from connecting the circuit breakers to the communication bus through to selecting the data relevant to the user.

Validity Note

This document is valid for Compact NSX, Compact NS and Masterpact NT/NW circuit breakers communicating using the Modbus protocol.

Related Documents

Title of Documentation	Reference Number
Modbus Compact NSX - User manual	LV434106
Installation and setup manual for the Modbus Communication option for Masterpact Micrologic	5100512864AA
Masterpact and Compact NS Modbus - User manual	COMBT32EN

You can download these technical publications and other technical information from our website at www.schneider-electric.com.

User Comments

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Collecting Data About the Installation

1

What's in this Chapter?

This chapter contains the following topics:

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Presentation	10
Advantage of Data Collection	11
Data Collection and Transmission Equipment	12

Presentation

Introduction

The main function of a circuit breaker is to protect the installation. The circuit breaker is designed to trip in the event of an electrical fault, thus isolating the faulty circuit. Nowadays it is also used as a metering and communication tool to promote energy efficiency and:

- Reduce energy costs
- Optimize energy quality
- Improve continuity of service

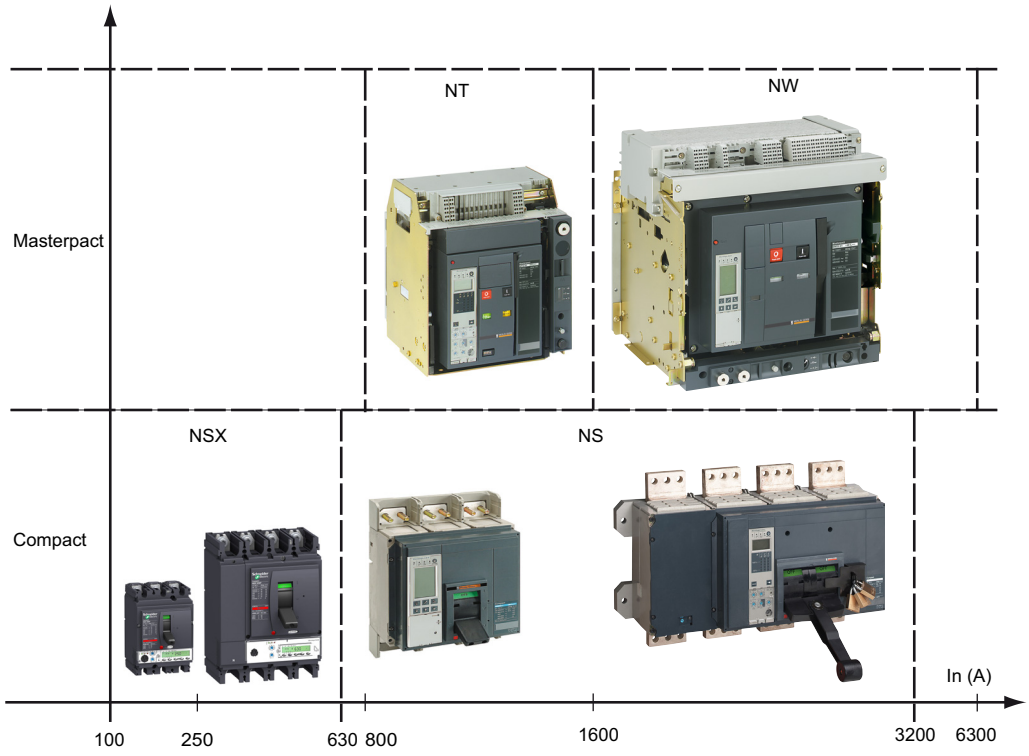
The circuit breaker concentrates all the measurements and states required to monitor the electrical installation:

- Circuit breaker status and control for managing the circuit breaker
- Energy metering for optimizing and distributing the costs
- Energy quality metering and maintenance data for reducing operating costs and improving continuity of service

All this data is displayed locally on the circuit breaker and/or remotely on a remote screen. This data can be made available and used via a communication network on a PC or PLC.

The Circuit Breaker Offer

Schneider Electric's low voltage circuit-breaker offer consists of the following circuit breakers:



Available Data

The metering data required to monitor the electrical installation depends on the type of Micrologic trip unit selected:

Circuit Breaker	**Compact NSX**		**Compact NS/Masterpact**		
Type of Micrologic	**A**	**E**	**A**	**P**	**H**
Current	√	√	√	√	√
Energy, voltage, frequency, power, power factor		√		√	√
Energy quality: total harmonic distortion		√			√

Advantage of Data Collection

Introduction

Keeping energy costs down and providing continuity of service for an installation are key factors in ensuring a company remains competitive. To achieve these objectives, the user needs to know certain information about the installation, such as consumption, energy quality, circuit breaker states, and alarms. All this data is available in Compact and Masterpact circuit breakers equipped with Micrologic trip units and is accessible remotely.

Managing the Electrical Installation

To manage the electrical installation efficiently, it is necessary to:
- Collect data
- Transmit this data to the supervision system
- Make use of the data by means of supervisory software

The metering and communication functions in Compact and Masterpact circuit breakers enable data to be collected and sent.

Making Use of Collected Data

Data can be used to:
- Reduce energy costs due to improved awareness of consumption habits
- Optimize energy quality in order to make the installation more reliable and optimize operating costs
- Improve continuity of service to make maximum use of the installation's capacities

Reducing Energy Costs

The data can be used to save energy, thanks to the sub-metering function.

By measuring the circuit breakers' energy consumption, the user can:
- Identify the heaviest consumers
- Distribute the costs
- Raise users' awareness of costs

Optimizing Energy Quality

Energy quality has a direct impact on operating costs:
- Direct costs: Excessive energy consumption due to increased losses
- Indirect costs:
  - Loss of production: Process malfunctions, nuisance tripping
  - Equipment costs: Reduction in the life of electrical equipment, reduced efficiency, oversizing

By using the data available in the circuit breakers, users can assess an installation's energy quality, identify the causes of non-quality and check the effectiveness of any corrective solutions employed.

The following two measurements are key to monitoring energy quality:
- The power factor, which reflects the reactive energy
- The total harmonic distortion

Improving Continuity of Service

Electricity is vital for a site's activity. Analysis tools can be used on the data in order to increase familiarity with the electrical installation and improve its reliability.

Data Collection and Transmission Equipment

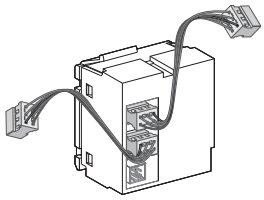
Metering Data

The metering data available in the circuit breakers depends on the type of Micrologic trip unit selected *(see page 10)*.

Data on the Circuit Breaker Status (OF, SD and SDE Contacts) and Circuit Breaker Control

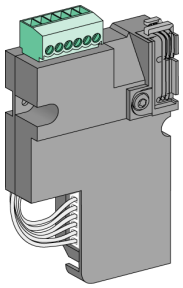
On Compact NSX circuit breakers, the BSCM module (Breaker Status & Control Module) is used to determine the circuit breaker status remotely and to control it.

The illustration below shows a BSCM module.



On Compact NS/Masterpact circuit breakers, the Modbus communication interface module (BCM) is used to determine the circuit breaker status remotely and to control it.

The illustration below shows a BCM module.



The following circuit breaker status data is available when the BSCM module (Compact NSX) or the BCM module (Compact NS/Masterpact) is present:

- Open/closed position (OF contact)
- Trip position (SD contact)
- Fault trip position (SDE contact)

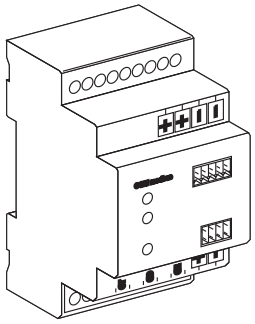
On Compact NSX circuit breakers, the communicating motor mechanism is used to control the circuit breaker remotely. On Compact NS/Masterpact circuit breakers, the MX or XF communicating releases are used to control the circuit breaker remotely.

The following circuit breaker controls are then available:

- Open
- Close
- Reset

Status Data on the Withdrawable Circuit Breaker Positions (CE, CD, CT)

The Compact NS/Masterpact withdrawable circuit breakers communicate the circuit breaker position by means of a chassis communication module (CCM) shown below:



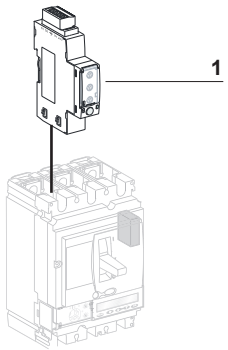
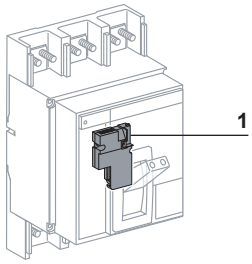
The circuit breaker positions are:
- Plugged in (CE contact)
- Withdrawn (CD contact)
- Test (CT contact)

The chassis communication module (CCM) is connected to the circuit breaker Modbus communication interface module (BCM).

Circuit Breaker Communication

Compact NSX circuit breakers communicate by means of the Modbus communication interface module external to the circuit breaker.

Masterpact circuit breakers communicate by means of the Modbus communication module (BCM) inside the circuit breaker.

Compact NSX Circuit Breaker	Compact NS/Masterpact Circuit Breaker
	
1 Modbus communication interface module	**1** Modbus communication module (BCM)

Installing the Communication Hardware

2

What's in this Chapter?

This chapter contains the following topics:

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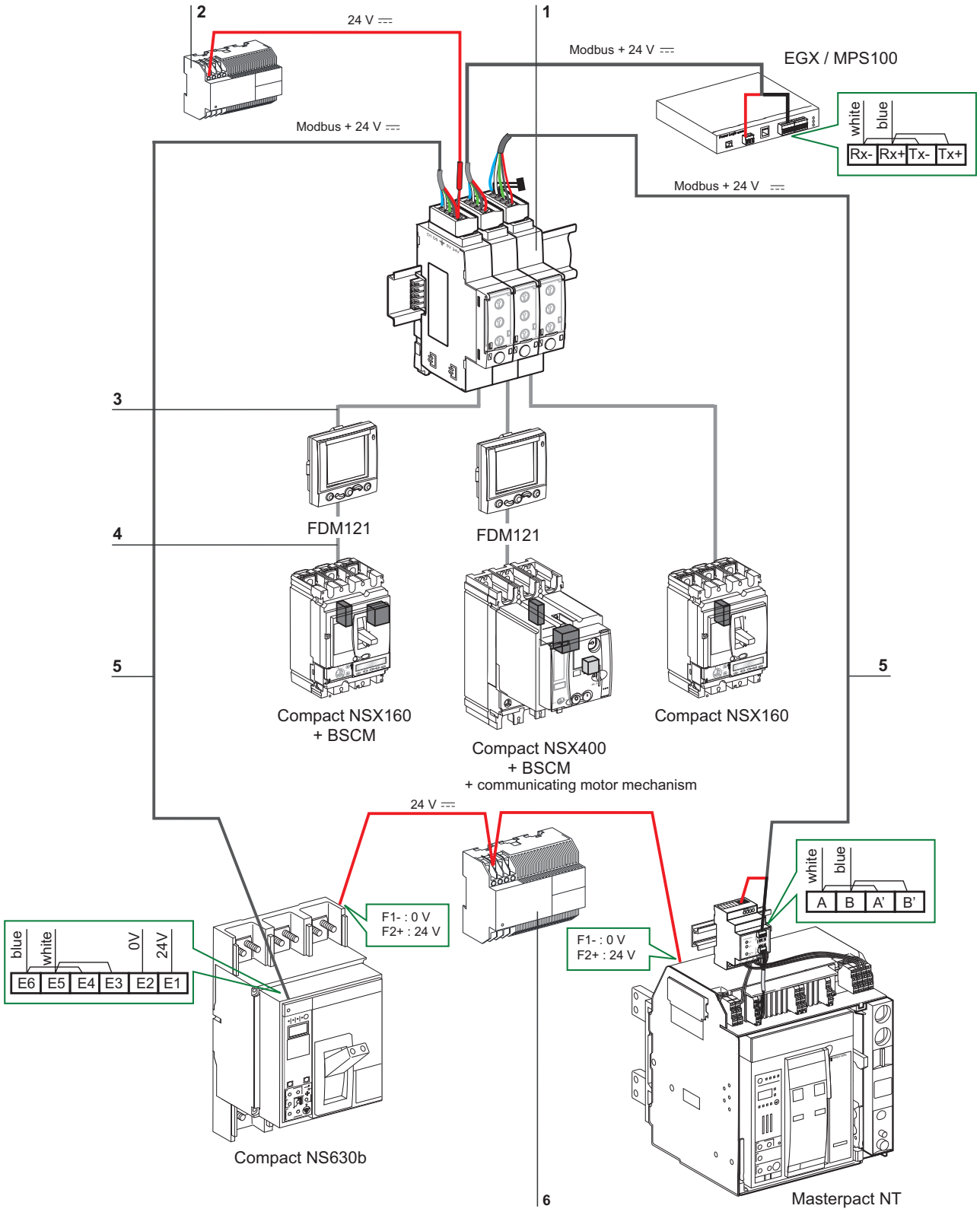
Communication Connections

Overview

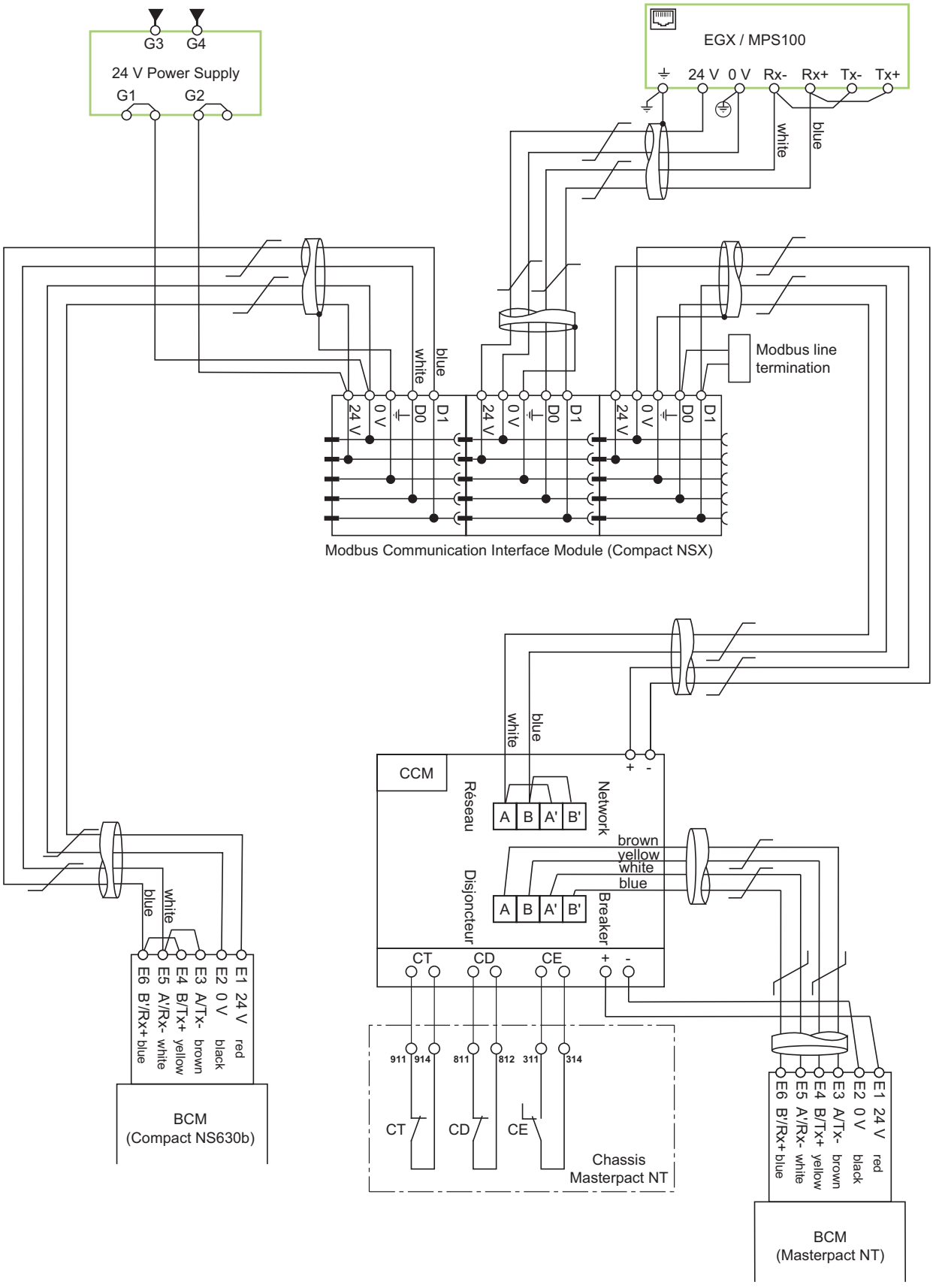
Connection of circuit breakers to the Modbus communication network:



1 Modbus communication interface module with stacking accessory (TRV00217)
2 24 VDC power supply for Micrologic trip units on Compact NSX and for communication modules
3 ULP cord
4 NSX Cord
5 Modbus cable + 24 VDC recommended: 50965 (Schneider Electric part number) or 7895A (Belden part number)
6 24 VDC power supply for Micrologic trip units on Compact NS/Masterpact

Detailed Diagram

Detailed connection of circuit breakers to the Modbus communication network:



24 VDC Power Supplies

Introduction

Two 24 VDC power supplies are needed:

- One 24 VDC power supply for the Compact NSX Micrologic trip units and all the communication modules
- One 24 VDC power supply for the Compact NS/Masterpact Micrologic trip units

Module Consumption

Compact NSX Micrologic and Communication Modules	Consumption (mA)
Compact NSX Micrologic	30
BSCM module (circuit breaker status)	9
Front display module FDM121	21
Compact NSX Modbus communication interface module	21
Compact NS/Masterpact breaker Modbus communication module (BCM)	30
Compact NS/Masterpact chassis Modbus communication module (CCM)	30

Compact NS/Masterpact Micrologic	Consumption (mA)
Compact NS/Masterpact Micrologic	100
M2C/M6C module	100

24 VDC Power Supply

Examples of power supplies available in the Schneider Electric catalog

Description	Rating	Part Number
24/30 VDC - 24 VDC - 1 A Primary overvoltage category IV Temperature: -25°C to +70°C	1 A	54440
48/60 VDC - 24 VDC - 1 A Primary overvoltage category IV Temperature: -25°C to +70°C	1 A	54441
100/125 VDC - 24 VDC - 1 A Primary overvoltage category IV Temperature: -25°C to +70°C	1 A	54442
110/130 VDC - 24 VDC - 1 A Primary overvoltage category IV Temperature: -25°C to +70°C	1 A	54443
200/240 VAC - 24 VDC - 1 A Primary overvoltage category IV Temperature: -25°C to +70°C	1 A	54444
380/415 VAC - 24 VDC - 1 A Primary overvoltage category IV Temperature: -25°C to +70°C	1 A	54445
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	ABL8RPS24030

Sizing the 24 VDC Power Supplies

Introduction

The calculated 24 VDC consumption required by circuit breakers for Modbus communication in the previous architecture *(see page 16)* is given below.

Calculated Consumption of Compact NSX Micrologic Units and Communication Modules

Compact NSX Circuit Breaker	Module	Consumption (mA)
Compact NSX160	Compact NSX Micrologic	30
	BSCM module (circuit breaker status)	9
	Front display module FDM121	21
	Modbus communication interface module	21
Compact NSX400	Compact NSX Micrologic	30
	BSCM module (circuit breaker status)	9
	Front display module FDM121	21
	Modbus communication interface module	21
Compact NSX160	Compact NSX Micrologic	30
	Modbus communication interface module	21
Total		**213**

Compact NS/Masterpact Circuit Breaker	Module	Consumption (mA)
Compact NS630b	Breaker communication module (BCM)	30
Masterpact NT	Breaker communication module (BCM)	30
	Chassis communication module (CCM)	30
Total		**90**

The total consumption of the circuit breaker communication modules is therefore:

213 + 90 = 303 mA

Calculated Consumption of Compact NS/Masterpact Micrologic Units

Breaker	Module	Consumption (mA)
Compact NS630b	Compact NS/Masterpact Micrologic	100
Masterpact NT	Compact NS/Masterpact Micrologic	100
Total		**200**

Choice of Power Supplies

- Since the power supply consumption for the Compact NSX Micrologic units and communication modules (303 mA) is less than 1 A, any power supply rated 1 A is suitable.
- Since the power supply consumption for the Compact NS/Masterpact (200 mA) Micrologic units is less than 1 A, any power supply rated 1 A is suitable *(see page 18)*.

Installing the Communication Software

3

What's in this Chapter?

This chapter contains the following topics:

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Communication Parameters

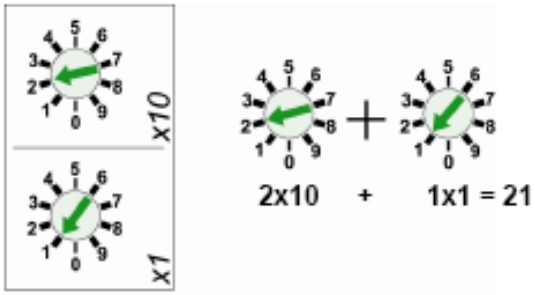
Parameters

Parameters	Compact NSX		Compact NS/Masterpact	
	Permitted Values	Default Value	Permitted Values	Default Value
Address	1...99	1	1...47	47
Baud rate	4800 Baud 9600 Baud 19200 Baud 38400 Baud	19200	4800 Baud 9600 Baud 19200 Baud 38400 Baud	19200
Parity	None (2 stop bits) Even (1 stop bit) Odd (1 stop bit)	Even	None (2 stop bits) Even (1 stop bit) Odd (1 stop bit)	Even

Configuring the Modbus Communication Interface Module with a Compact NSX

A Compact NSX circuit breaker's Modbus address is defined by means of 2 address switches located on the front face of the Modbus communication interface module.

Example of configuring Modbus address 21:



By default, the Modbus communication interface module automatically detects the communication parameters (baud rate and parity) when it is connected to the Modbus network (default configuration). The communication parameters can also be defined manually using the RSU (Remote Setting Utility) software.

Configuring the BCM with a Compact NS/Masterpact and Micrologic A

The Modbus address and communication parameters are defined using the keypad on the Micrologic A trip unit.

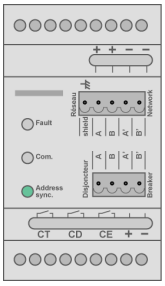
Step	Action	Micrologic A
1	Press the menu and ➔ keys simultaneously to access the communication option parameter settings. **ADXX** is displayed on the screen, where XX is the currently defined Modbus address.	
2	Press ➔ briefly to set the Modbus address between 1 and 47.	
3	Press ➔ for 3 s to confirm the Modbus address and then set the baud rate. **bXX.X** is displayed on the screen, where **XX.X** is the currently defined baud rate.	
4	Press ➔ briefly to set the communication speed to 19200 Baud (**b19.2**).	
5	Press ➔ for 3 s to confirm the communication speed and then set the parity. **P.X** is displayed on the screen, where **X** is the currently defined parity.	
6	Press ➔ briefly to set the parity to Even (**P.E**).	
7	Press ➔ for 3 s to confirm the parity and return to the metering menu.	

Configuring the BCM with a Compact NS/Masterpact and Micrologic P or H

The Modbus address and communication parameters are defined using the keypad on the Micrologic P or H trip unit.

Step	Action	Micrologic P or H
1	Press  to access the configuration menu.	
2	Select **Configure com** then **Parameter com.** to display the **Modbus Com** screen.	
3	Press the  and  keys to select the address setting then the  key to confirm.	
4	Press the  and  keys to define the address then the  key to confirm.	
5	Go back to step 3 to set the baud rate, then the parity.	

Configuring the CCM with a Compact NS/Masterpact

Step	Action	CCM
1	Configure the BCM as described above.	
2	Press the **Address sync** button.	
3	The chassis communication module (CCM) is automatically configured with: ● The same baud rate and parity as the breaker communication module (BCM) ● The address assigned to the breaker communication module + 50 The breaker (BCM) and chassis (CCM) communication modules are automatically connected to the rest of the network.	

Modbus Registers

Table of Common Registers (Communication Profile)

The main information needed for remote supervision of a Compact NSX, Compact NS or Masterpact NT/NW circuit breaker is contained in the table of common registers starting at register 12000.

This compact table of 113 registers can be read with a single Modbus request.

It contains the following information:
- Circuit breaker status
- Trip unit protection status
- Real-time values of main measurements: current, voltage, power, energy, total harmonic distortion

The content of this table of registers is detailed in the List of Common Registers (Communication Profile) section.

Use of these common registers is highly recommended to optimize response times and simplify use of data.

NOTE: For Compact NS/Masterpact circuit breakers, the communication profile (table of common registers) must be activated by writing 1 in register 800.

Maintenance Data Registers

Maintenance data for a Compact NSX, Compact NS or Masterpact NT/NW circuit breaker is not available in the table of common registers.

This must be read by specific read requests according to the type of circuit breaker.

See registers 29851 onwards for Compact NSX.

See registers 9094 onwards for Compact NS/Masterpact.

Measurement Update Period

The update period for the common registers is:
- 1 second for the following measurements:
  - Voltage and voltage unbalance
  - Current and current unbalance
  - Active, reactive, apparent, and distortion power
  - Reactive power with harmonics
  - Power factor and fundamental power factor
  - Frequency
- 5 seconds for the following measurements:
  - Energy
  - Minimum and maximum real-time measurement values
  - Total harmonic distortion (THD)

Format des tableaux de registres

The register tables consist of the following columns:

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description

- **Register**: Number of the 16-bit register in decimal number format.
- **Address**: Address of the 16-bit register (one less than the register number).
- **R/W**: The register is either read-only (R), or read-write (R/W).
- **X**: Scale factor. Scale 10 means that the register contains the value multiplied by 10. The actual value is therefore the register value divided by 10.

  Example
  Register 12036 contains the network frequency. The unit is Hz and the scale factor is 10.
  If the register contains the value 502, this means that the network frequency is
  502/10 = 50.2 Hz.

- **Unit**: Unit in which the information is expressed.
- **Type**: Type of encoding data.
- **Range**: Permitted values for this register, usually a subset of what the format allows.
- **A/E**: Types of Micrologic Compact NSX trip unit for which the register is available.
  - Type A (ammeter): Current measurements
  - Type E (energy): Current, voltage, power and energy measurements
- **A/P/H**: Types of Masterpact NT/NW and Compact NS Micrologic trip unit for which the register is available.
  - Type A (ammeter): Current measurements
  - Type P (power): Current, voltage, power and energy measurements
  - Type H (harmonics): Current, voltage, power, energy and energy quality measurements
- **Description**: Provides information about the register and the restrictions applying to it.

Data Types

The following data types appear in the Modbus register tables:

Label	Description	Range
UINT	Unsigned 16-bit integer	0 to 65,535
INT	Signed 16-bit integer	-32,768 to +32,767
UDINT	Unsigned 32-bit integer	0 to 4,294,967,295
DINT	Signed 32-bit integer	-2,147,483,648 to +2,147,483,647
STRING	Text string	1 byte per character

Notes

- The **type** column indicates the number of registers to be read in order to obtain the variable. For example, UINT asks for one word to be read whereas DINT requires 2 words to be read.
- Reading from an undocumented address results in a Modbus exception.
- Variables stored in 2 words (energy, for example) are stored in big-endian, format, with the most significant word transmitted first, and the least significant word transmitted second.
- Digital values are given in decimal format. When there is an advantage in having the corresponding value in hexadecimal format, this is given as a constant in C language: 0xdddd. For example, the decimal value 123 is represented in hexadecimal format as 0x007B.
- Non-functioning and non-applicable values are represented by 32,768 (0x8000 or 0x8000000 for 32-bit values).
- Out-of-limit values are represented by 32,767 (0x7FFF, for 16-bit values only).
- For measurements which depend on presence of the neutral, value readout returns 32,768 (0x8000) if not applicable. For each table where this appears, an explanation is given in a footnote.

List of Common Registers (Communication Profile)

Data Validity

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description
12000	11999	R	1	-	UINT	-	A/E	A/P/H	Indicates the validity of each bit in the circuit breaker status register (12001).

Circuit Breaker Status Register

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Bit	Description
12001	12000	R	–	–	UINT	–	A/E	A/P/H	–	Circuit breaker status register
							A/E	A/P/H	0	OF status 0 = The circuit breaker is open 1 = The circuit breaker is closed
							A/E	A/P/H	1	SD trip indication ● For Compact NS and NSX: 0 = No tripping 1 = The circuit breaker has tripped due to an electrical fault or due to the release or because the **Push to trip** button has been pressed. ● For Masterpact: Always 0
							A/E	A/P/H	2	SDE fault trip indication 0 = No tripping 1 = The circuit breaker has tripped due to an electrical fault or during testing of the ground fault protection or the Vigi protection.
							–	A/P/H	3	CH loaded (only with Masterpact motor mechanism) 0 = Spring discharged 1 = Spring loaded
							–	–	4	Reserved
							–	A/P/H	5	PF ready to close 0 = Not ready to close 1 = Ready to close
							–	A/P/H	6	Distinction between Compact/Masterpact 0 = Compact 1 = Masterpact
							–	–	7...14	Reserved
							A/E	A/P/H	15	Data availability If this bit is at 1, the circuit breaker status is not available.
12002 12003	12001 12002	R	–	–	UINT	–	–	-	-	Reserved

Tripping Cause

The tripping cause register provides information about the cause of the trip for the basic protection functions. When a bit is at 1 in the register, it indicates that a trip has occurred and has not been acknowledged.

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Bit	Description
12004	12003	R	–	–	UINT	–	A/E	A/P/H	–	Tripping cause for the basic protection functions
							A/E	A/P/H	0	Long time protection Ir
							A/E	A/P/H	1	Short time protection Isd
							A/E	A/P/H	2	Instantaneous protection Ii
							A/E	A/P/H	3	Ground fault protection Ig
							A/E	A/P/H	4	Earth leakage protection (Vigi module) IΔn
							A/E	A/P/H	5	Integrated instantaneous protection
							A/E	–	6	Internal failure (STOP)
							–	A	6	Other protections
							–	P/H	6	Internal failure (temperature)
							–	P/H	7	Internal failure (overvoltage)
							–	P/H	8	Other protection (see register 12005)
							A/E	–	9	Instantaneous with earth leakage protection (Vigi module) on the trip unit
							E	–	10	Unbalance motor protection
							E	–	11	Jam motor protection
							E	–	12	Underload motor protection
							E	–	13	Long start motor protection
							A/E	–	14	Reflex tripping protection
							A/E	A/P/H	15	If this bit is at 1, bits 0 to 14 are not valid.
12005	12004	R	–	–	UINT	–	–	P/H	–	Tripping causes for the advanced protection functions
12006 12007	12005 12006	R	–	–	UINT	–	–	–	–	Reserved

Overrun of the Protection Setpoints

The alarm setpoint registers provide information about overrun of the standard and advanced protection setpoints. A bit is at 1 once a setpoint overrun has occurred, even if the time-out has not expired.

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Bit	Description
12008	12007	R	–	–	UINT	–	A/E	P/H	–	Overrun of the standard protection setpoints
							A/E	P/H	0	Long time protection pick-up
							–	–	1...14	Reserved
							A/E	P/H	15	If this bit is at 1, bits 0 to 14 are not valid.
12009	12008	R	–	–	UINT	–	–	P/H	–	Overrun of the advanced protection setpoints
							–	P/H	0	Current unbalance
							–	P/H	1	Maximum current on phase 1
							–	P/H	2	Maximum current on phase 2
							–	P/H	3	Maximum current on phase 3
							–	P/H	4	Maximum current on the neutral
							–	P/H	5	Minimum voltage
							–	P/H	6	Maximum voltage
							–	P/H	7	Voltage unbalance
							–	P/H	8	Maximum power
							–	P/H	9	Reverse power
							–	P/H	10	Minimum frequency
							–	P/H	11	Maximum frequency
							–	P/H	12	Phase rotation
							–	P/H	13	Load shedding based on the current
							–	P/H	14	Load shedding based on the power
							–	P/H	15	If this bit is at 1, bits 0 to 14 are not valid.
12010	12009	R	–	–	UINT	–	–	P/H	–	Continuation of the previous register
							–	P/H	0	Ground fault alarm
							–	P/H	1	Earth leakage alarm (Vigi module)
							–	–	2...14	Reserved
							–	P/H	15	If this bit is at 1, bits 0 to 14 are not valid.

Alarms

The alarm register provides information about the pre-alarms and the user-defined alarms. A bit is set to 1 once an alarm is active.

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Bit	Description
12011	12010	R	–	–	UINT	–	A/E	–	–	Pre-alarm register
							A/E	–	0	Long time protection time pre-alarm (PAL Ir)
							A/E	–	1	Earth leakage protection pre-alarm (Vigi module) (PAL IΔn)
							A/E	–	2	Ground fault protection pre-alarm (PAL Ig)
							–	–	3...14	Reserved
							A/E	–	15	If this bit is at 1, bits 0 to 14 are not valid.
12012	12011	R	–	–	UINT	–	A/E	–	–	Register of user-defined alarms
							A/E	–	0	User-defined alarm 201
							A/E	–	1	User-defined alarm 202
							A/E	–	2	User-defined alarm 203
							A/E	–	3	User-defined alarm 204
							A/E	–	4	User-defined alarm 205
							A/E	–	5	User-defined alarm 206
							A/E	–	6	User-defined alarm 207
							A/E	–	7	User-defined alarm 208
							A/E	–	8	User-defined alarm 209
							A/E	–	9	User-defined alarm 210
							–	–	10...14	Reserved
							A/E	–	15	If this bit is at 1, bits 0 to 14 are not valid.
12013... 12015	12012... 12014	R	–	–	UINT	–	–	–	–	Reserved

Currents

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description
12016	12015	R	1	A	UINT	0...20xIn	A/E	A/P/H	Rms current on phase 1: I1
12017	12016	R	1	A	UINT	0...20xIn	A/E	A/P/H	Rms current on phase 2: I2
12018	12017	R	1	A	UINT	0...20xIn	A/E	A/P/H	Rms current on phase 3: I3
12019	12018	R	1	A	UINT	0...20xIn	A/E	A/P/H	Rms current on the neutral: IN (1)
12020	12019	R	1	A	UINT	0...20xIn	A/E	A/P/H	Maximum of I1, I2, I3, and IN
12021	12020	R	1	(2)	UINT	–	A/E	A/P/H	Ground fault current Ig. The range depends on the nominal current In.
12022	12021	R	1	(3)	UINT	–	A/E	A/P/H	Ground leakage current IΔn. The range depends on the nominal current In.

(1) Value cannot be accessed for motor applications and in cases of 3-pole circuit breakers without external neutral current transformer (ENCT).

(2) This value is only available:

- For Masterpact NT/NW and Compact NS Micrologic 6.0 trip units, expressed in amps
- For Compact NSX Micrologic 6.2 and 6.3 trip units, expressed as %Ig

(3) This value is only available:

- For Masterpact NT/NW and Compact NS Micrologic 7.0 trip units, expressed in milliamps
- For Compact NSX Micrologic 7.2 and 7.3 trip units, expressed as %IΔn

Maximum Current Values

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description
12023	12022	R	1	A	UINT	0...20xIn	A/E	A/P/H	Maximum rms current on phase 1: I1
12024	12023	R	1	A	UINT	0...20xIn	A/E	A/P/H	Maximum rms current on phase 2: I2
12025	12024	R	1	A	UINT	0...20xIn	A/E	A/P/H	Maximum rms current on phase 3: I3
12026	12025	R	1	A	UINT	0...20xIn	A/E	A/P/H	Maximum rms current on the neutral: IN (1)
12027	12026	R	1	A	UINT	0...20xIn	A/E	A/P/H	Maximum rms current out of the 4 previous registers
12028	12027	R	1	(2)	UINT	–	A/E	A/P/H	Maximum ground fault current Ig. The range depends on the current In.
12029	12028	R	1	(3)	UINT	–	A/E	A/P/H	Maximum ground leakage current I∆n. The range depends on the nominal current In.

(1) Value cannot be accessed for motor applications and in cases of 3-pole circuit breakers without external neutral current transformer (ENCT).
(2) This value is only available:
- For Masterpact NT/NW and Compact NS Micrologic 6.0 trip units, expressed in amps
- For Compact NSX Micrologic 6.2 and 6.3 trip units, expressed as %Ig

(3) This value is only available:
- For Masterpact NT/NW and Compact NS Micrologic 7.0 trip units, expressed in milliamps
- For Compact NSX Micrologic 7.2 and 7.3 trip units, expressed as %I∆n

Voltages

Register = 0 if the voltage < 25 V.

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description
12030	12029	R	1	V	UINT	0...850	E	P/H	Rms phase-to-phase voltage V12
12031	12030	R	1	V	UINT	0...850	E	P/H	Rms phase-to-phase voltage V23
12032	12031	R	1	V	UINT	0...850	E	P/H	Rms phase-to-phase voltage V31
12033	12032	R	1	V	UINT	0...850	E	P/H	Rms phase-to-neutral voltage V1N (1)
12034	12033	R	1	V	UINT	0...850	E	P/H	Rms phase-to-neutral voltage V2N (1)
12035	12034	R	1	V	UINT	0...850	E	P/H	Rms phase-to-neutral voltage V3N (1)

(1) Value cannot be accessed for motor applications and in cases of 3-pole circuit breakers without external neutral voltage transformer (ENVT).

Frequency

When the software cannot calculate the frequency, it returns Not available = 32,768 (0x8000).

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description
12036	12035	R	10	Hz	UINT	150...4400	E	P/H	Network frequency: F
12037	12036	R	10	Hz	UINT	150...4400	E	P/H	Network frequency maximum

Power

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description
12038	12037	R	(3)	kW	UINT	-10000...+10000	E	P/H	Active power on phase 1: P1 (1) (2)
12039	12038	R	(3)	kW	UINT	-10000...+10000	E	P/H	Active power on phase 2: P2 (1) (2)
12040	12039	R	(3)	kW	UINT	-10000...+10000	E	P/H	Active power on phase 3: P3 (1) (2)
12041	12040	R	(3)	kW	UINT	-30000...+30000	E	P/H	Total active power: Ptot (2)
12042	12041	R	(3)	kVAR	UINT	-10000...+10000	E	P/H	Reactive power on phase 1: Q1 (1) (2)
12043	12042	R	(3)	kVAR	UINT	-10000...+10000	E	P/H	Reactive power on phase 2: Q2(1) (2)
12044	12043	R	(3)	kVAR	UINT	-10000...+10000	E	P/H	Reactive power on phase 3: Q3(1) (2)
12045	12044	R	(3)	kVAR	UINT	-30000...+30000	E	P/H	Total reactive power: Qtot (2)
12046	12045	R	(3)	kVA	UINT	0...10000	E	P/H	Apparent power on phase 1: S1 (1)
12047	12046	R	(3)	kVA	UINT	0...10000	E	P/H	Apparent power on phase 2: S2 (1)
12048	12047	R	(3)	kVA	UINT	0...10000	E	P/H	Apparent power on phase 3: S3 (1)
12049	12048	R	(3)	kVA	UINT	0...30000	E	P/H	Total apparent power: Stot

(1) Value cannot be accessed for motor applications and in cases of 3-pole circuit breakers without external neutral current transformer (ENCT).
(2) The sign for the active and reactive power depends on the Micrologic configuration.
(3) The scale factor depends on the type of Micrologic trip unit:
- The scale factor is 10 for Compact NSX Micrologic 5.2, 5.3, 6.2, 6.3, 7.2 or 7.3 trip units.
- The scale factor is 1 for Masterpact NT/NW and Compact NS Micrologic 5.0, 6.0 or 7.0 trip units.

Energy

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description
12050 12051	12049 12050	R	1	kWh	DINT	-1 999 999 999 ...+1 999 999 999	E	P/H	Active energy: Ep
12052 12053	12051 12052	R	1	kVARh	DINT	-1 999 999 999 ...+1 999 999 999	E	P/H	Reactive energy: Eq
12054 12055	12053 12054	R	1	kWh	UDINT	0...1 999 999 999	E	P/H	Active energy counted positively: EpIn
12056 12057	12055 12056	R	1	kWh	UDINT	0...1 999 999 999	E	P/H	Active energy counted negatively: EpOut
12058 12059	12057 12058	R	1	kVARh	UDINT	0...1 999 999 999	E	P/H	Reactive energy counted positively: EqIn
12060 12061	12059 12060	R	1	kVARh	UDINT	0...1 999 999 999	E	P/H	Reactive energy counted negatively: EqOut
12062 12063	12061 12062	R	1	kVAh	UDINT	0...1 999 999 999	E	P/H	Total apparent energy: Es
12064 12065	12063 12064	R	1	kWh	UDINT	0...1 999 999 999	E	–	Active energy counted positively (non-resettable): EpIn
12066 12067	12065 12066	R	1	kWh	UINT	0...1 999 999 999	E	–	Active energy counted negatively (non-resettable): EpOut
12068... 12079	12067... 12078	–	–	–	–	–	–	–	Reserved

Current Demand Values

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description
12080	12079	R	1	A	UINT	0...20xIn	E	P/H	Current demand value on phase 1: I1 Dmd
12081	12080	R	1	A	UINT	0...20xIn	E	P/H	Current demand value on phase 2: I2 Dmd
12082	12081	R	1	A	UINT	0...20xIn	E	P/H	Current demand value on phase 3: I3 Dmd
12083	12082	R	1	A	UINT	0...20xIn	E	P/H	Current demand value on the neutral: IN Dmd (1)

(1) Value cannot be accessed for motor applications and in cases of 3-pole circuit breakers without external neutral current transformer (ENCT).

Power Demand Values

When the window is fixed type, this value is updated at the end of the window. For the sliding type, the value is updated every 15 seconds.

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description
12084	12083	R	(1)	kW	UINT	-30000...+30000	E	P/H	Demand value of the total active power: Ptot Dmd
12085	12084	R	(1)	kVAR	UINT	-30000...+30000	E	P/H	Demand value of the total reactive power: Qtot Dmd
12086	12085	R	(1)	kVA	UINT	0...30000	E	P/H	Demand value of the total apparent power: Stot Dmd
12087... 12089	12086... 12088	–	–	–	–	–	–	–	Reserved

(1) The scale factor depends on the type of Micrologic trip unit:
- The scale factor is 10 for Compact NSX Micrologic 5.2, 5.3, 6.2, 6.3, 7.2 or 7.3 trip units.
- The scale factor is 1 for Masterpact NT/NW and Compact NS Micrologic 5.0, 6.0 or 7.0 trip units.

Maximum Voltage Values

Register = 0 if the voltage < 25 V.

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description
12090	12089	R	1	V	UINT	0...850	E	P/H	Maximum rms phase-to-phase voltage V12
12091	12090	R	1	V	UINT	0...850	E	P/H	Maximum rms phase-to-phase voltage V23
12092	12091	R	1	V	UINT	0...850	E	P/H	Maximum rms phase-to-phase voltage V31
12093	12092	R	1	V	UINT	0...850	E	P/H	Maximum rms phase-to-neutral voltage V1N (1)
12094	12093	R	1	V	UINT	0...850	E	P/H	Maximum rms phase-to-neutral voltage V2N (1)
12095	12094	R	1	V	UINT	0...850	E	P/H	Maximum rms phase-to-neutral voltage V3N (1)

(1) Value cannot be accessed for motor applications and in cases of 3-pole circuit breakers without external neutral voltage transformer (ENVT).

Power Factor

The sign for the fundamental power factor (cosφ) depends on the Micrologic configuration.

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description
12096	12095	R	(2)	-	INT	(2)	E	P/H	Power factor on phase 1: PF1 (1)
12097	12096	R	(2)	-	INT	(2)	E	P/H	Power factor on phase 2: PF2 (1)
12098	12097	R	(2)	-	INT	(2)	E	P/H	Power factor on phase 3: PF3 (1)
12099	12098	R	(2)	-	INT	(2)	E	P/H	Total power factor: PF
12100	12099	R	(2)	-	INT	(2)	E	H	Fundamental power factor on phase 1: cosφ1 (1)
12101	12100	R	(2)	-	INT	(2)	E	H	Fundamental power factor on phase 2: cosφ2 (1)
12102	12101	R	(2)	-	INT	(2)	E	H	Fundamental power factor on phase 3: cosφ3 (1)
12103	12102	R	(2)	-	INT	(2)	E	H	Total fundamental power factor: cosφ

(1) Value cannot be accessed for motor applications and in cases of 3-pole circuit breakers without external neutral voltage transformer (ENVT).
(2) The scale factor and range depend on the type of Micrologic trip unit:
- The scale factor is 100 and the range is -100...+100 for Compact NSX Micrologic 5.2, 5.3, 6.2, 6.3, 7.2 or 7.3 trip units.
- The scale factor is 1000 and the range is -1000...+1000 for Masterpact NT/NW and Compact NS Micrologic 5.0, 6.0 or 7.0 trip units.

Total Harmonic Distortion (THD)

Register	Address	R/W	X	Unit	Type	Range	A/E	A/P/H	Description
12104	12103	R	10	%	UINT	0...32766	E	H	Total harmonic distortion of V12 compared to the fundamental
12105	12104	R	10	%	UINT	0...32766	E	H	Total harmonic distortion of V23 compared to the fundamental
12106	12105	R	10	%	UINT	0...32766	E	H	Total harmonic distortion of V21 compared to the fundamental
12107	12106	R	10	%	UINT	0...32766	E	H	Total harmonic distortion of V1N compared to the fundamental
12108	12109	R	10	%	UINT	0...32766	E	H	Total harmonic distortion of V2N compared to the fundamental
12109	12108	R	10	%	UINT	0...32766	E	H	Total harmonic distortion of V3N compared to the fundamental
12110	12109	R	10	%	UINT	0...32766	E	H	Total harmonic distortion of I1 compared to the fundamental
12111	12110	R	10	%	UINT	0...32766	E	H	Total harmonic distortion of I2 compared to the fundamental
12112	12111	R	10	%	UINT	0...32766	E	H	Total harmonic distortion of I3 compared to the fundamental
(1) Value cannot be accessed for motor applications and in cases of 3-pole circuit breakers without external neutral voltage transformer (ENVT).									

Readout Examples

Readout Example of a Modbus Register

The table below shows how to read the rms current on phase 1 (I1) in register 12016.

- The address of register 12016 equals 12016 - 1 = 12015 = 0x2EEF.
- The Modbus address of the Modbus slave is 47 = 0x2F.

Request from the Master		**Response from the Slave**	
Field name	**Example**	**Field name**	**Example**
Modbus slave address	0x2F	Modbus slave address	0x2F
Function code	0x03	Function code	0x03
Address of word to be read (MSB)	0x2E	Data length in bytes	0x02
Address of word to be read (LSB)	0xEF	Register value (MSB)	0x02
Number of registers (MSB)	0x00	Register value (LSB)	0x2B
Number of registers (LSB)	0x01	MSB CRC	0xXX
MSB CRC	0xXX	LSB CRC	0xXX
LSB CRC	0xXX	–	–

The content of register 12016 (address 12015) is 0x022B = 555.

The rms current on phase 1 (I1) is thus 555 A.

Readout Example of the Table of Common Registers

The table below shows how to read the table of common registers. This table starts at register 12000 and consists of 113 registers.

- The address of register 12000 equals 12000-1 = 11999 = 0x2EDF.
- The table length is 113 registers = 0x71.
- The number of bytes is 113x2 = 226 bytes = 0xE2.
- The Modbus address of the slave is 47 = 0x2F.

Request from the Master		**Response from the Slave**	
Field name	**Example**	**Field name**	**Example**
Modbus slave address	0x2F	Modbus slave address	0x2F
Function code	0x03	Function code	0x03
Address of word to be read (MSB)	0x2E	Data length in bytes	0xE2
Address of word to be read (LSB)	0xDF	Value of register 12000 (MSB)	0xXX
Number of registers (MSB)	0x00	Value of register 12000 (LSB)	0xXX
Number of registers (LSB)	0x71	Value of register 12001 (MSB)	0xXX
MSB CRC	0xXX	Value of register 12001 (LSB)	0xXX
LSB CRC	0xXX	–	0xXX
		–	0xXX
		Value of register 12112 (MSB)	0xXX
		Value of register 12112 (LSB)	0xXX
		MSB CRC	0xXX
		LSB CRC	0xXX

Communication Test

Introduction

We recommend you use the RCU (Remote Control Utility) to test communication on the various circuit breakers. You can download the RCU software from our website at www.schneider-electric.com.

Presentation of the RCU Software

The RCU (Remote Control Utility) is simple SCADA software designed for:
- Compact NSX circuit breakers
- Masterpact circuit breakers
- Power Meters

The RCU software allows users to monitor and control their equipment and helps installers to check and validate newly installed equipment.

Depending on which device the RCU software is connected to, it allows the user to:
- Display the I, U, E, THD measurements
- Display the date and time
- Display the device identification and maintenance data
- Control the device (for circuit breakers only)
- Save the P, FP, E measurements every 5 minutes