Modbus™ Communications System for MicroLogic™ A, P, and H Trip Units

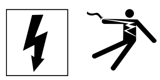
Instruction Bulletin

0613IB1201 R09/21
09/2021

Retain for future use.

Hazard Categories and Special Symbols

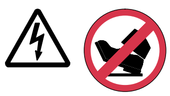
Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information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



The addition of either 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.

ANSI

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.



IEC

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

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

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

NOTICE
NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

NOTE: Provides additional information to clarify or simplify a procedure.

WARNING: This product can expose you to chemicals including DINP, which is known to the State of California to cause cancer, and DIDP which is known to the State of California to cause birth defects or other reproductive harm. For more information go to: www.P65Warnings.ca.gov.

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.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

Table of Contents

List of Tables

About the Book

At a Glance

The aim of this document is to provide users, installers, and maintenance personnel with the technical information needed to operate the Modbus protocol on the four ranges of circuit breakers and switches:

- PowerPacT™ P-frame 250–1200 A
- PowerPacT R-Frame 600–3000 A
- MasterPacT™ NT 250–1200 A (800 A in ANSI and 1600 A in UL489)
- MasterPacT NW 260–6000 A

Validity Note

This document is valid for MasterPacT NT/NW and PowerPacT P/R circuit breakers with a BCM circuit breaker communications module connected with four-wire Modbus to a RS485 serial network.

See Introduction on the next page for two-wire Modbus and Smart System™ communication systems.

Related Documents

Title of Documentation Reference Number	Reference Number
MasterPacT NT Circuit Breakers and Switches - User Guide	0613IB1209 (EN, ES, FR)
MasterPacT NW Circuit Breakers and Switches - User Guide	0613IB1204 (EN, ES, FR)
PowerPacT P-Frame - Installation Guide	48049-148 (EN, ES, FR)
PowerPacT Drawout P-Frame - Installation Guide	48049-336 (EN, ES, FR)
PowerPacT R-Frame - Installation Guide	48049-243 (EN, ES, FR)
MicroLogic A Trip Units - User Guide 48049-136	48049-136 (EN, ES, FR)
MicroLogic P Trip Units - User Guide	Guide 48049-137 (EN, ES, FR)
MicroLogic H Trip Units - User Guide	48049-330 (EN, ES, FR)
MasterPacT NT/NW, ComPacT NS, PowerPacT P- and R-Frame Communication Option - Installation Manual	EAV36080 (EN, ES, FR)
ULP (Universal Logic Plug) System - User Guide	48940-329 (EN, ES, FR)
MasterPacT NT/NW and PowerPacT™ P- and R-Frame Modbus Communications Guide	0613IB1313
ULP (Universal Logic Plug) User Guide	0602IB1503

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

Section 1— MicroLogic Communication System

Introduction

This instruction bulletin is for four-wire Modbus systems installed before the introduction of two-wire Modbus and Smart System™ communications systems. For two-wire Modbus systems and Smart System with ULP systems, see 0613IB1313 for instructions.

The Modbus communication option makes it possible to remotely use all the functions of a MasterPacT, PowerPacT, or ComPacT circuit breaker, its MicroLogic trip unit, and all its options.

Remote operations are based on a secure communication architecture. The Modbus communication system may be used to interconnect the control units (A, P, or H) and a supervisor, and a PLC or Modbus primary. The connection uses an RS485 physical link and the Modbus-RTU protocol.

List of Abbreviations

BCM – Breaker Communication Module

CCM – Cradle Communication Module

HMI – Human Machine Interface (Control Pad)

LED – Light Emitting Diode

MM – Trip Unit Metering Module

PIF – Product Interface Module

PLC – Programmable Logic Controller

PM – Trip Unit Protection Module

RS485 – Specific Type of Communication System

RTU – Remote Terminal Unit

SMS – System Management Software

TCP / IP – Transmission Control Protocol / Internet Protocol

Communication System Parameters

MicroLogic trip units use a system consisting of:

- four-wire Modbus.
- RTU, RS485 network.
- primary / secondary (MicroLogic trip units are always secondarys).
- any Modbus software (not proprietary).
- daisy chain using Belden® shielded / twisted cable (8723 recommended).
- Customer Engineering Tool (EcoStruxure Power Commission) Download EcoStruxure Power Commission from the Schneider Electric website: www.schneider-electric.com.

Communication System Components

Circuit breakers that have MicroLogic trip units are PowerPacT, ComPacT, and MasterPacT.

The communication system consists of:

- MicroLogic trip units (A, P, or H models are capable of communication).
- Breaker Communication Module (BCM).
- Communication switches that report circuit breaker status (open, closed, tripped, ready to close) into the BCM.
- 24 Vdc control power.
- Daisy chain four-wire Modbus network.
- Drawout circuit breakers also have cradle communication module (CCM).
- Communicating shunt trip and shunt close coils.
- Ethernet gateway or circuit monitor to allow Modbus TCP / IP communication.

MicroLogic A Trip Units

MicroLogic A trip units require:

- Control power rated 50 mA at 24 Vdc.
- Control power source to the trip unit must be isolated from the 24 Vdc control power to the BCM.
- The positive or negative output of the power supply must not be earth grounded.
- The DC output of the 24 Vdc power supply must also be isolated from its input. See External 24 Vdc Control Power Supply Characteristics on page 13.
- MicroLogic A trip units control power connections to F1 (-) and F2 (+).
- See the trip unit manual and the MasterPacT NT/NW Universal Power Circuit Breakers catalog for specific information about the trip unit and other components.

MicroLogic P and H Trip Units

MicroLogic P or H trip units require:

- Control power rated 100 mA at 24 Vdc.
- Control power source to the trip unit must be isolated from the 24 Vdc control power to the BCM.
- The positive or negative output of the power supply must not be earth grounded.
- The DC output of the 24 Vdc power supply must also be isolated from its input. See External 24 Vdc Control Power Supply Characteristics on page 13.
- P and H trip units control power connections to F1 (-) and F2 (+).
- See the trip unit manual and the MasterPacT NT/NW Universal Power Circuit Breakers catalog for specific information about the trip unit and other components.

Breaker Communication Module (BCM)

The BCM requires:

- Control power rated 50 mA at 24 Vdc.
- Control power source to the trip unit must be isolated from the 24 Vdc control power to the BCM.
- The positive or negative output of the power supply must not be earth grounded.
- The DC output of the 24 Vdc power supply must also be isolated from its input. See External 24 Vdc Control Power Supply Characteristics on page 13.
- The BCM control power connections to E1 (+) and E2 (-).

Communication Switches

- Report circuit breaker status into BCM. Switches are actuated by the circuit breaker mechanism to indicate open, closed, tripped, and ready to close status.
- Switches are installed in the circuit breaker mechanism and connected by wiring into the BCM.
- See BCM instructions for each circuit breaker type for instructions and mounting information.

24 Vdc Control Power

- The 24 Vdc (E1, E2) power supply for the BCM **must** be separate from the 24 Vdc power supply module for the MicroLogic trip units (F1-, F2+).
- The separate power supplies provide isolation between the trip unit and the communication system. The positive or negative output of the power supply must not be earth grounded. The DC output of the 24 Vdc power supply must also be isolated from its input. Specifications are in the table below:

Table 1 – External 24 Vdc Control Power Supply Characteristics

Rated output current	1 A
Rated voltage	24 Vdc
Overall accuracy	± 5% Vn
Ripple	200 mV peak to peak
Noise	200 mV peak to peak
Voltage output variation limit	21.6 V < V_{out} < 26.3 V
Capacitive load	500 µF
Input / Output capacitive load	150 pF max

Daisy Chain Four-Wire Modbus Network

- Use 22 AWG Belden shielded / twisted cable (8723).
- Ground shield at one end of the chain only.
- Respect Standard Wiring Practices as explained on page 18.

Cradle Communication Module (CCM)

- Used with drawout construction.
- CCM requires 50 mA at 24 Vdc control power.
- Control power source can be the same as the one powering the BCM.
- Control power source must be isolated and ungrounded. See External 24 Vdc Control Power Supply Characteristics on page 13.
- Provides connections for daisy chain communication wires.
- Provides connections for 24 Vdc control power.
- Can be connected to cradle position switches to report circuit breaker position (connected, test, disconnected) in the cradle.
- Maintains communication parameters (address, baud rate, parity) for the cradle so when a spare circuit breaker is racked in, the communication parameters are automatically transferred.
- CCM can be replaced with the Input/Output (IO) Module plus a Modbus Interface Module (IFM) with firmware upgrade. See page 76 for information on converting to the IO and IFM modules.

Communicating Shunt Trip and Shunt Close Coils

- Allows opening and closing the circuit breaker through the communication network.
- Connected to BCM.
- Special three-wire shunt trip and close coils are required.

Ethernet Gateway or Circuit Monitor

- EGX100 and EGX300 ethernet gateways providing Modbus TCP / IP Communication.
- System wide communication.
- Web pages.
- Communication from any browser.

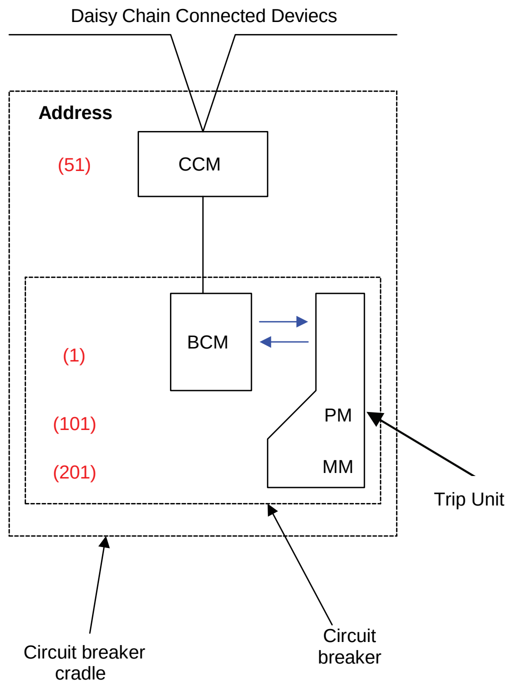
System Diagrams

MicroLogic Trip Unit, BCM and CCM

Drawout circuit breakers have four modules:

- BCM (Breaker Communication Module).
- Trip unit PM (Protection Module).
- Trip unit MM (Metering Module).
- CCM (Cradle Communication Module).

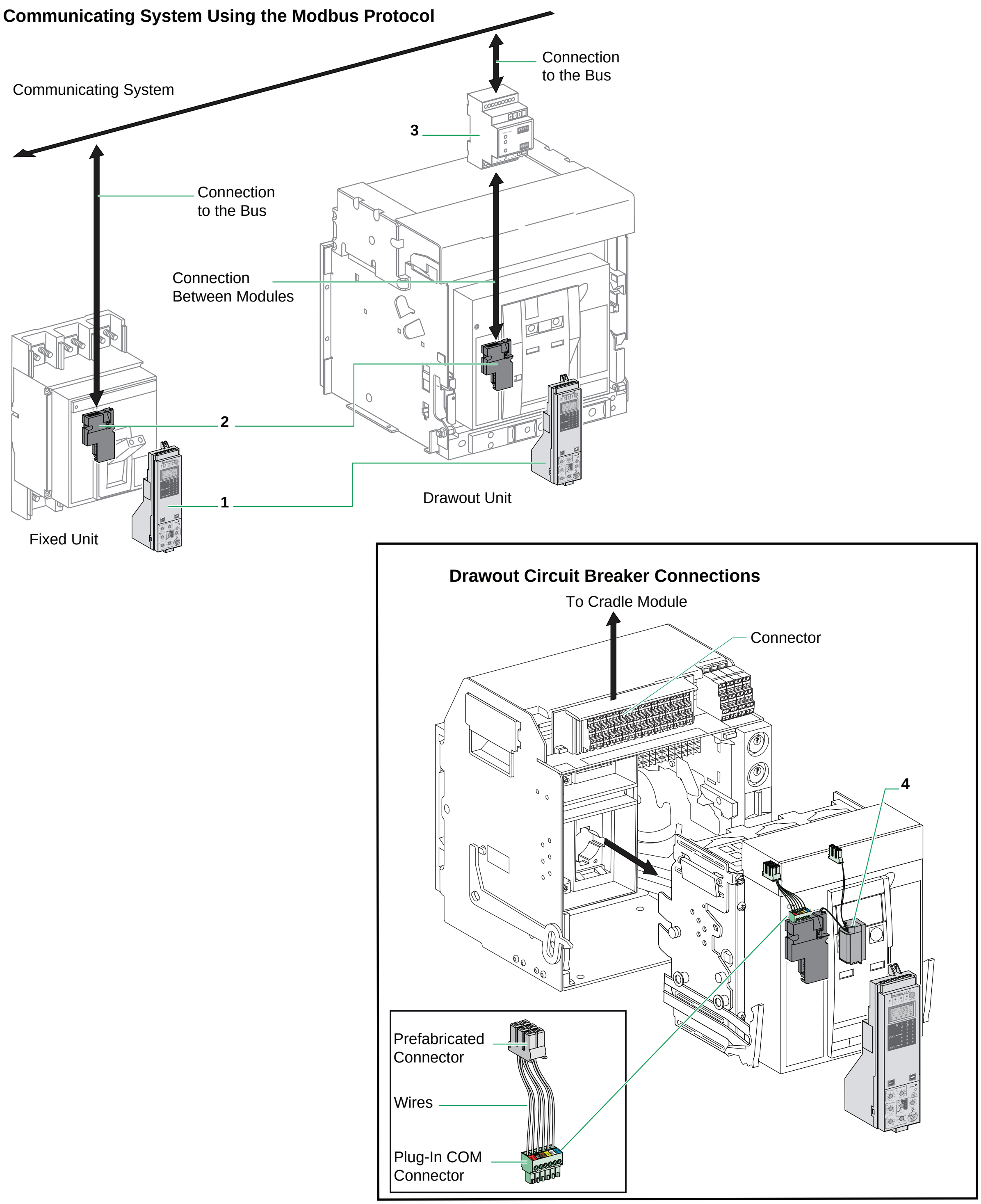
Figure 1 – MicroLogic Trip Unit, BCM and CCM



BCM to Daisy Chain

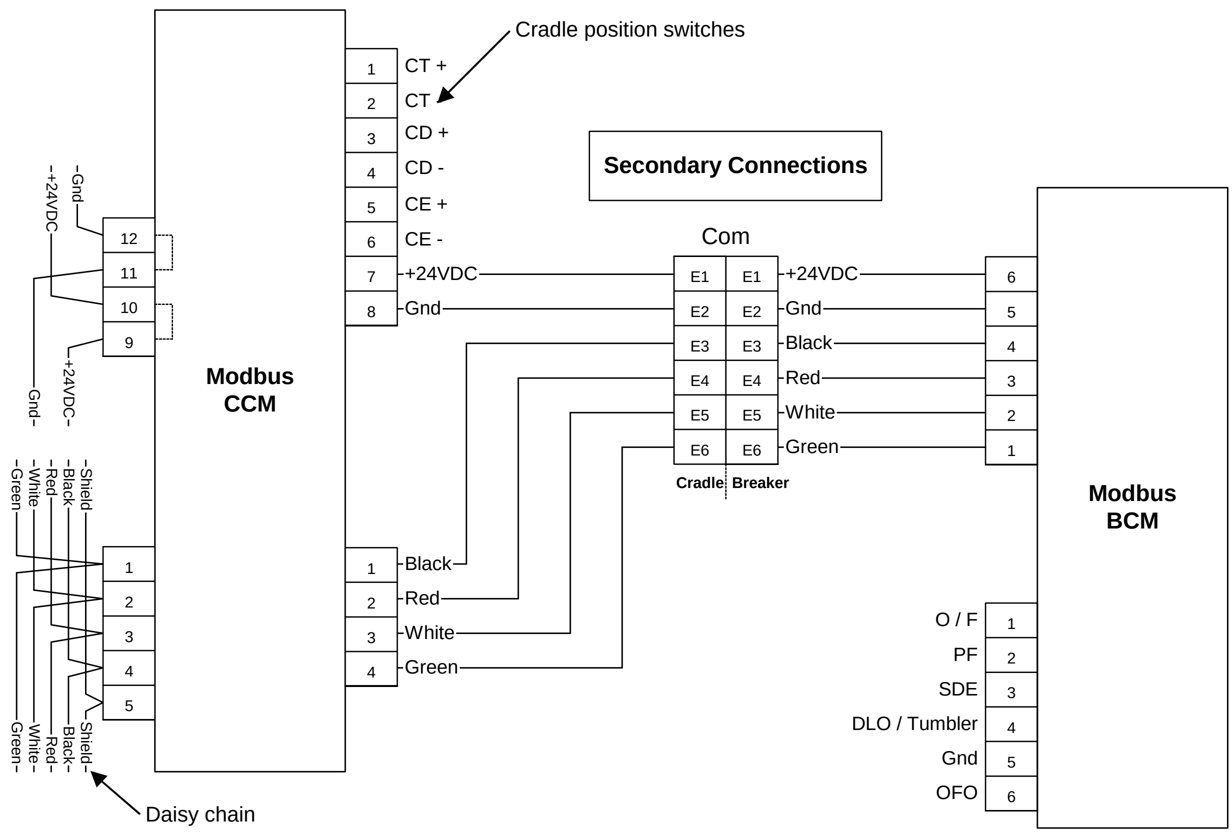
1. Trip unit
2. BCM
3. CCM
4. Communicating shunt trip or shunt close coil

Figure 2: MicroLogic Trip Unit, BCM, CCM and Communicating Shunt Trip or Shunt Close Co8il



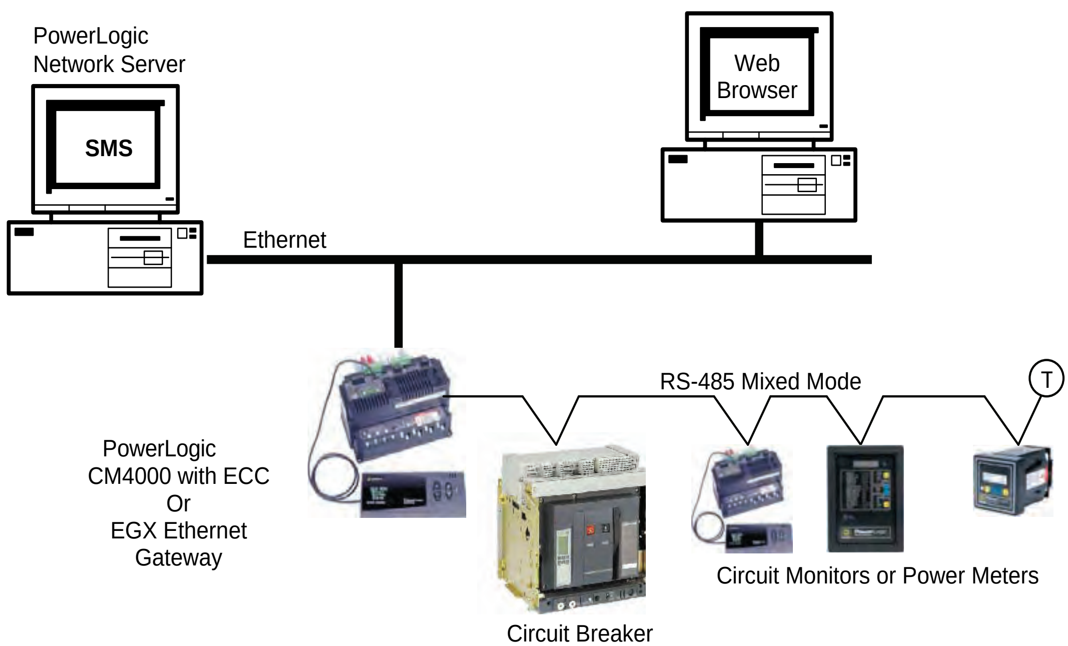
BCM and CCM

Figure 3: BCM and CCM Connections



Modbus TCP / IP Communication

Figure 4: Modbus TCP / IP Communication



Standard Wiring Practices

Communication System

- Belden 8723.
- 22 AWG shielded, twisted with bare drain wire from shield.
- Standard Colors:
  - Rx+ = green
  - Rx- = white
  - Tx+ = red
  - Tx- = black
  - shield – bare
- Up to 32 devices on a single daisy chain.
- Devices include:
  - Circuit monitors
  - Power meters
  - PIF-3's
  - PIF-85's
  - Powerlink™ panels
  - Digital relays
  - Digitrip™ 810D's
  - MicroLogic trip units
  - Model 98 temperature controllers
  - PLCs
- Requires unique addresses for each device on the daisy chain.
- Daisy chain wiring lengths:

Baud Rate	1–16 Devices	17–32 Devices
1200	10,000 ft. (3,050 m)	10,000 ft. (3,050 m)
2400	10,000 ft. (3,050 m)	5,000 ft. (1,525 m)
4800	10,000 ft. (3,050 m)	5,000 ft. (1,525 m)
9600	10,000 ft. (3,050 m)	4,000 ft. (1,220 m)
19200	10,000 ft. (3,050 m)	2,500 ft. (762.5 m)

- Requires resistor / capacitor terminator at the end of each daisy chain. Catalog number: 3090MCTAS485.
- Belden cable shield must be connected to ground at only one point. We recommend that this be done at the primary device.
- Maintain color code throughout system.
- Ensure connections are on proper stripped wires and connection is on wire not on insulation.
- Do not strip wires more than necessary or they may short together or to ground and disrupt communication.
- Maintain baud rate and parity throughout the daisy chain.
- Do not use "T" connections except from CCM to BCM, when less than 1 M of cable is needed.

System Problems

Most Modbus system problems are related to wiring and addressing.

Never

- Connect 24 Vdc to communication terminals—it will damage the BCM.
- Allow the shield to touch ground at more than one point—it can cause communication errors due to circulating currents in shield.
- Change cable type—it can cause communication errors.
- Use Modbus address 16 in a mixed-mode daisy chain (mixed mode means that there are more than one type of communication on the daisy chain). Address 16 can be used by other components in the system leading to communication errors.
- Use SY / MAX address 01 in a mixed-mode daisy chain. Address 01 can be used by other components in the system leading to communication errors.
- Mix two-wire and four-wire devices on the same daisy chain (two-wire Modbus is not recommended for MicroLogic trip unit communication systems)—it can cause additional load on the communication network and slow down or stop communication.

Troubleshooting

General

- Ensure all shipping splits and other connections are made.
- Confirm 24 Vdc control power exists at the CCM and E1 / E2 at proper polarities.
- Confirm circuit breaker is in Test or Connected positions.
- Confirm trip unit is powered (display should be active).
- Check communication parameters and press “address sync” on CCM.
- Check wiring color codes.

CCM LED Indicators

- No LEDs:
  24 Vdc control power present.
- One LED solid Green:
  24 Vdc control power; no network traffic.
- One LED solid Red:
  CCM is defective.
- One LED solid Green with short voids:
  seeing good Modbus packets on the wire.
- One LED solid Green with short Red flashes:

  indicates the CCM is seeing Modbus packets with errors,

  or

  indicates the CCM is connected to a “mixed-mode” daisy chain.
- Pressing “Address Sync” push-button on CCM:
  - three (3) flashes of red followed by three (3) flashes of green:
    information successfully transferred from BCM to CCM,
  - three (3) flashes of red followed by solid green:
    error transferring information from BCM to CCM.

- Racking circuit breaker into Test position:
  - — three (3) flashes of red followed by three (3) flashes of green: information successfully transferred from CCM to BCM.
  - — three (3) flashes of red followed by solid green: error transferring information from CCM to BCM.

Wiring Checks with Multi-Meter

- Continuity:
  - — disconnect primary device.
  - — check continuity between each wire.
  - — twist each pair together and check for continuity.
  - — ensure no continuity between wires and ground.
- DC voltage:
  - — with system fully connected, but NO communication activity.
  - — measure between Rx+ / Rx- (green / white) on each secondary device: should measure approximately 4 Vdc.
  - — measure between Tx+ / Tx- (red / black) on each secondary device: should measure approximately 0.8 Vdc.

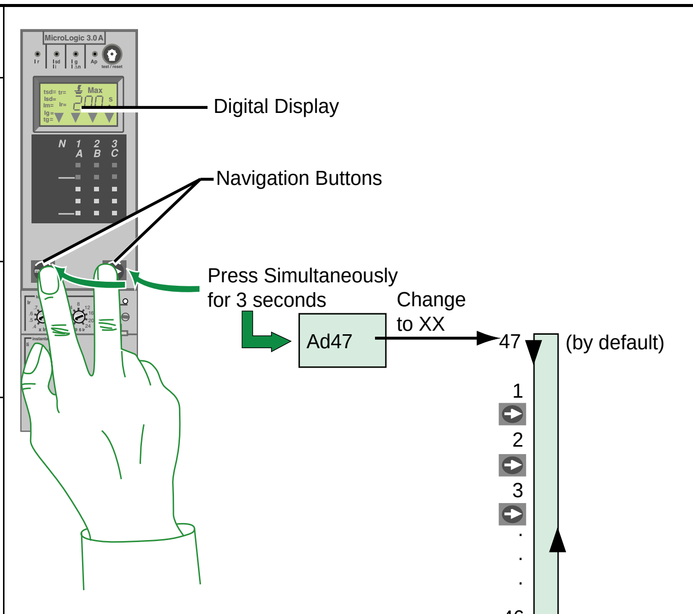
Addresses, Baud Rate, and Parity Settings

MicroLogic communication system uses four addresses: BCM, CCM, trip unit protection module, and trip unit metering module.

Addresses, baud rate, and parity are set through the HMI for the A, P, or H MicroLogic trip units. The HMI address setting actually addresses the BCM from 1 to 47 (47 is the default). The other three addresses are set automatically: CCM = BCM + 50 (97 is default), trip unit protection module = BCM + 100 (147 is the default), and trip unit metering module = BCM + 200 (247 is the default).

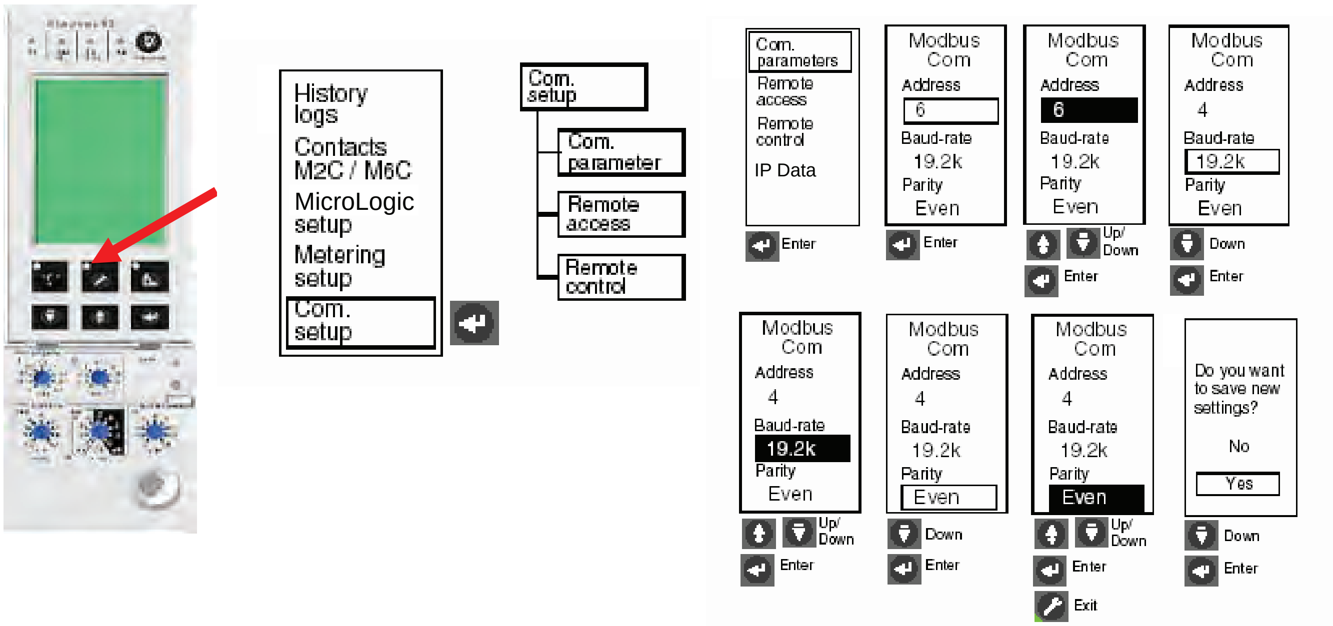
MicroLogic A Trip Unit

Enter configuration mode:	Press both buttons and hold for 3-seconds.
Menus to change:	Address Baud Rate Parity Language
To step between parameters:	Press and hold the arrow button. Display will “flash” twice when value is saved.
Note:	You cannot “go back”. You will have to start over if you need to make changes.



MicroLogic P and H Trip Unit

Figure 5: MicroLogic P and H Trip Unit Screens



Section 2— Communication Architecture

Introduction

Module

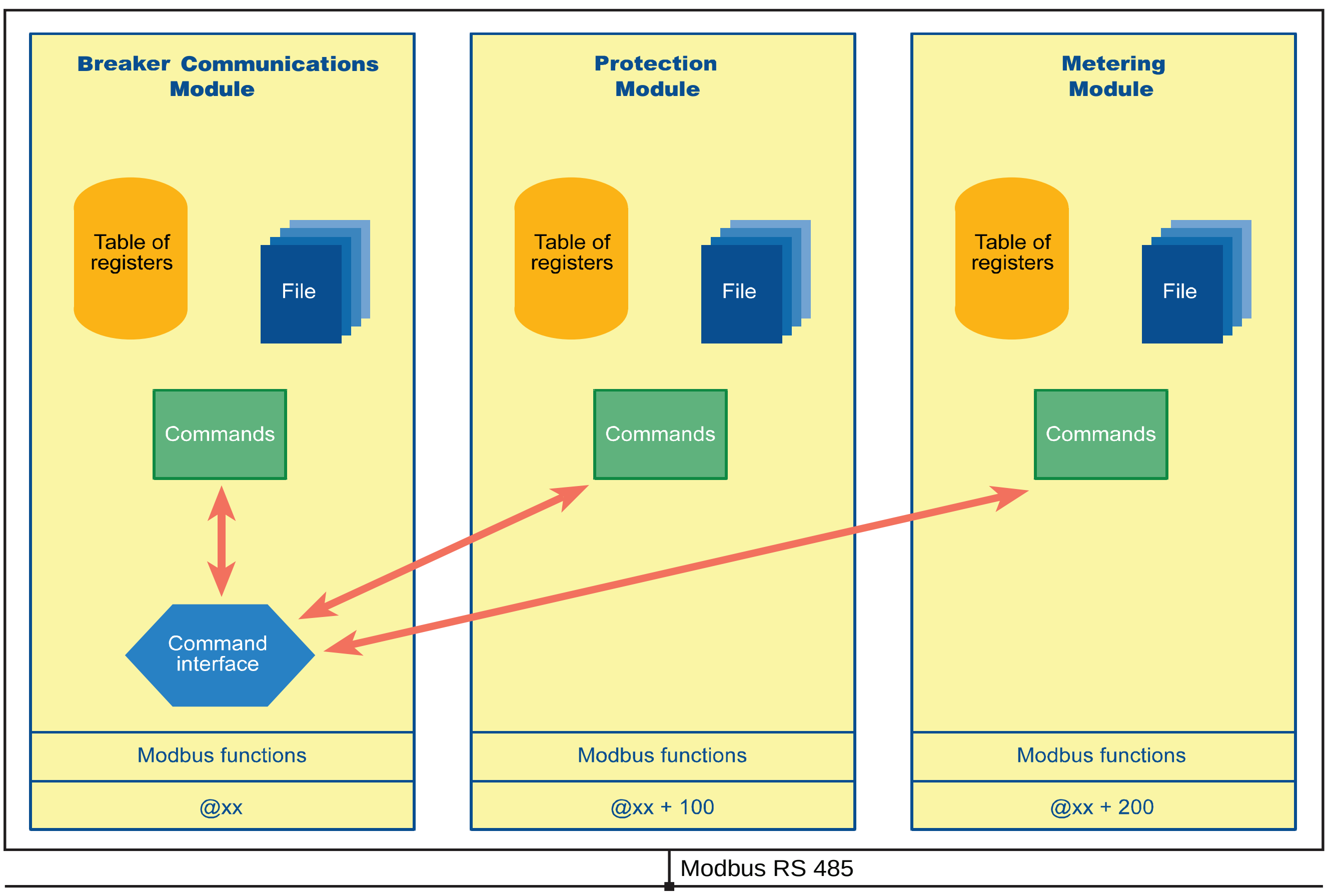
A module contains:

- a table of registers that may be read-accessed only.
- files such as the event log.
- commands for functions such as writing in the registers, turn the circuit breaker ON or OFF, reset counters, etc.
- Modbus functions used to remotely access the registers and the manger files.

Note: The commands for the metering and protection modules are controlled by the breaker communication module.

Command Interface

A command interface in the breaker communication module (BCM) and cradle communication module (CCM) is used to control the applications. This interface monitors execution of the command and issues a report.



Modbus Functions

The device and cradle Modbus options operate in secondary mode and enable a Modbus primary to access all the registers, files and applications contained in the modules.

Breaker Communication Module: @ Address xx

The Breaker Communication Module may be used to remotely monitor circuit breaker status:

- open (OFF).
- closed (ON).
- tripped (SDE).
- ready to close (PF), and so on.

It is also possible to remotely open or close the circuit breaker if the MX and / or XF communicating coils are installed.

Remote control may be disabled by locally setting the MicroLogic control unit to manual (“Manu”) mode. “Auto” mode enables remote control of the circuit breaker.

Table 2 – Breaker Communication Module Registers

Register Range	Description
515–543	Modbus configuration and identification
544–577	Diagnostics counters and Modbus password
603–624	Metering / protection module event notification
650–670	Tripping cause and circuit breaker status
671–715	Time-stamping of last status changes
718–740	Event log in the Breaker Communication Module (see “Access to Files” on page 35).
800	Communication profile activation
12000–12215	Communication profile

Note: More detailed information on these registers is presented in the Appendix, Table of Registers, “Breaker Communication Module @ Address xx” on page 87.

Communication Profile

In order to optimize the number of Modbus request, a communication profile has been implemented. The communication profile is located in the breaker communication module @address xx. This communication profile contains information coming from the breaker communication module, the metering module and the protection module. The communication profile is defined in the register range: 12000–12215.

Simplified Open/Close Command

In order to simplify the application software to remotely open or close the circuit breaker, a simplified Open/Close command has been implemented. The simplified Open/Close command is located in the Breaker Communication Module @ address xx. With the simplified Open/Close command, it is not necessary to request the flag, neither to enter in configuration mode or to read the control word. It is still necessary to be in Auto mode (see register 670). Furthermore, this simplified Open/Close command is password protected (default value = 0000). In order to change the password, it is mandatory to use the « magic box » and the associated MicroLogic utility RSU (please contact Schneider Electric for more information).

The simplified Open/Close command is a share command (command code = 57400).

Note: More detailed information on this command is presented in the Appendix, List of Command, “Breaker Communication Module Commands @ Address xx” on page 157.

Note: Communication profile and simplified Open/Close command are available only with a Breaker Communication Module firmware version greater or equal to V2.0 (register 577 must be greater or equal to 02000).

Cradle Communication Module: @ Address xx + 50

The cradle communication module indicates the position of the device on the cradle:

- “connected” position.
- “test” position.
- “disconnected” position.

Table 3 – Cradle Communication Module Registers

Register Range	Description
515–543	Modbus Configuration and Identification
544–577	Diagnostics Counters and Modbus Password
661–664	Cradle Status
679–715	Time-Stamping of Last Status Changes

Note: More detailed information on these registers is presented in the Appendix, Table of Registers, “Cradle Communication Module @ Address xx + 50” on page 92.

Metering Module: @ Address xx + 200

The metering module prepares the electrical values used to manage the low-voltage distribution system.

Every second, the metering module refreshes the “real-time” RMS measurements. Using this data, it then calculates the demand and energy values, and stores the minimum / maximum values recorded since the last reset.

Metering-module operation depends on the MicroLogic settings:

- type of neutral (internal, external, none).
- the normal direction for the flow of active power (this setting determines the sign of the measured power).
- voltage-transformation ratio.
- rated frequency.

The metering module must be set independently of the protection module to determine:

- the calculation mode for the power (type of distribution system).
- the calculation mode for the power factor (IEEE®, IEEE alt., IEC).

Table 4 – Metering Module Registers

Register Range	Description	Details
1000–1299	Real-Time Measurements	The metering module refreshes the real-time measurements every second.
1300–1599	Minimum Values for the Real-Time Measurements from 1000 to 1299	The minimum values for real-time measurements may be accessed at the registers of the real-time values + 300. All the minimum values are stored in memory and may be reset to zero, group by group according to the list below, by the command interface: • RMS current. • current unbalance. • RMS voltage. • voltage unbalance. • frequency. • power. • power factor. • fundamental. • total harmonic distortion. • voltage crest factor. • current crest factor. **Note:** The minimum and maximum values of the real-time measurements are stored in the memory. They may be reset to zero. The maximum values of the demand measurements are time stamped and stored in memory. They may be reset to zero.
1600–1899	Maximum Values for the Real-Time Measurements from 1000 to 1299	The maximum values for the real-time measurements may be accessed at the registers of the real-time values + 600. All the maximum values are stored in memory and may be reset to zero, group by group according to the list below, by the command interface: • RMS current. • current unbalance. • RMS voltage. • voltage unbalance. • frequency. • power. • power factor. • fundamental. • total harmonic distortion. • voltage crest factor. • current crest factor.
2000–2199	Energy Measurements	The energy counters may be: • reset to zero. • preloaded with an initial value. using the reset applications via the command interface.
2200–2299	Demand Values	The demand values are refreshed every 15 seconds for sliding windows or at the end of the time interval for block windows. When block windows are used, an estimation of the value at the end of the time interval is calculated every 15 seconds.
3000–3299	Time-Stamping	The time-stamping function becomes useful once the time and date have been set on the MicroLogic control unit, either locally or via the communication network. If power to the MicroLogic control unit is cut, the time and date must be set again. With firmware release “logic 2002 AA” and above, the clock is powered by the battery. So, it is no more necessary to set time and date after power comes off on the MicroLogic control unit. If power to the communication option is cut, the time and date must be set again. The maximum drift of the MicroLogic clock is approximately 0,36 seconds per day. To avoid any significant drift, the clocks must be periodically synchronized via the communication network.
3300–3999	Configuration of the Metering Module	The configuration registers may be read at all times. The registers may be modified via the command interface in configuration mode.
4000–4099	Reserved	

Table 4 – Metering Module Registers *(continued)*

Register Range	Description	Details	
4100–5699	Spectral Components	• RMS / phase of voltage harmonic. • RMS / phase of current harmonic.	
5700–6899	Analog Pre-Defined Alarm (1 to 53)	The alarms registers may be read at all times. The registers may be modified via the command interface in configuration mode. These alarms (available with MicroLogic H only) can be used to trigger wave form capture.	
7100–7499	File Header / Status (See “Access to Files” on page 35)	Event log configuration / characteristics and format of records for:	
		Wave Form Capture	(file n° 5)
		Event Log of the Metering Module	(file n° 10)
		Min-Max Event Log	(file n° 11)
		Maintenance Event Log of the Metering Module	(file n° 12)

Note: More detailed information on these registers is presented in the Appendix, Table of Registers, “Metering Module @ Address xx + 200” on page 95.

Protection Module: @ Address xx + 100

The protection module ensures the critical circuit breaker functions. The MicroLogic control unit was designed to make this module completely independent to minimize any issues with the protection functions of the trip units.

It does not use the measurements generated by the metering module, but rather calculates the protection-function inputs and outputs itself. This ensures extremely fast reaction times.

The protection module **manages**:

- the basic protection: the long-time (LT), short-time (ST), instantaneous and ground-fault current protection functions.
- the advanced protection: currents I_{max}, I_{unbal}, voltages V_{max}, V_{min} and V_{unbal}, frequency F_{max} and F_{min}, maximum reverse power Rp_{max}, phase rotation $\Delta\ \Phi$.

The protection module **controls**:

- the automatic load shedding and reconnection functions, depending on current and power.
- the optional M2C and M6C contacts.

Remote access to the protection module depends on the parameters set locally on the MicroLogic control unit and on the position of the protective cover for the settings.

A local operator may disable all remote access to the protection module. It is also possible to limit access to certain users by setting up a password on the MicroLogic control unit.

A protection function intended to trip the circuit breaker cannot be modified if the protective cover is closed, with or without the password.

Table 5 – Protection Module Registers

Register Range	Description
8750–8753	Characteristics of the Protection Module
8754–8803	Fine Settings for the Long-Time, Short-Time, Instantaneous, Ground-Fault and Earth-Leakage Protection Functions
8833–8842	Measurements Carried Out by the Protection Module
8843–8865	Status of the Protection Module
9000–9599	Time-Stamping and Trip / Alarm History
9600–9628	MicroLogic Configuration
9629–9799	Advanced Protection Settings
9800–9899	Relay Configuration (M2C / M6C)
9900–9924	Event Log (See Section: “Access to Files” on page 35) File N° 20
9932–9956	Maintenance Event Log (See Section: “Access to Files” on page 35) File N° 12
9964–9989	Fault Wave Form Capture (See Section: “Access to Files” on page 35) File N° 22

Note: More detailed information on these registers is presented in the Appendix, Table of Registers, “Protection Module @ Address xx + 100” on page 116.

Section 3— Command Interface

Operating Principle

Write-access to MicroLogic data and control-unit options is monitored to inhibit accidental operation and operation by unauthorized persons.

Commands sent to MicroLogic control units are carried out using a command interface.

The command interface manages transmission and execution of the various commands using the registers numbered from 7700 to 7729 that may be accessed by the Modbus read and write functions.

The breaker communication module supports the command interface for the commands intended for the circuit breaker, measurement, and protection modules.

The cradle communication module supports its own command interface.

Table 6: Command Interface

Secondary @ xx [breaker communication module]	Secondary @ xx+50 [cradle communication module]
Command interface 7700 to 7729	Command interface 7700 to 7729
Commands intended for the breaker communication module	Commands intended for the cradle communication module only
Commands intended for the protection module	—
Commands intended for the metering module	—

The command interface offers two command modes:

- Shared Mode:

  This mode may be used to send up to 20 commands in series. It returns exclusively the indications on command transmission via the Modbus protocol. This mode does not return the result of command execution.
- Protected Mode:

  This mode may be used to monitor execution of a command and to manage access by a number of supervisors to a single circuit breaker. This is the case for the Modbus multi-primary architectures on Ethernet TCP / IP.

When a command is written, the command interface updates its registers with information on command execution. **It is necessary to wait until the command is terminated before sending the next command**.
(Recommended time-out is 500 ms.)

Furthermore, when the command is terminated, it is necessary to respect a delay before sending the next command.
(Recommended delay is 20 ms.)

Access control is achieved by a flag reservation and freeing mechanism. In protected mode, a command may be issued only after receiving a flag.

Note: Certain commands may be accessed only in protected mode. See “List of Commands” on page 156 to determine the possible command-management modes.

Table 7 – Command Interface Registers

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
7700	10	R / W	—	—	INT	0..65535	A	P / H	command interface in shared mode—commands [1, 2]	ShCmdIf
7715	5	R	—	—	INT	0..65535	A	P / H	command interface in protected mode—state [1, 2]	PrCmdIfState
7720	10	R / W	—	—	INT	0..65535	A	P / H	command interface in protected mode—commands [1, 2]	PrCmdIf
7730	100	R	—	—	INT	0..65535	A	P / H	command interface in protected mode—return [1, 2]	PrCmdIfBuffer

[1] See “MicroLogic Command Interface for the Modbus Programmer”.

[2] See “List of Commands” on page 156.

Send Commands in Shared Mode

The shared mode uses the registers numbered 7700 to 7709 in the command interface:

Table 8 – Shared Mode Registers in the Command Interface

Registers	Description
7700	Command number
7701	Parameter P1
7702	Parameter P2
7703	Parameter P3
7704	Parameter P4
7705	Parameter P5
7706	Parameter P6
7707	Parameter P7
7708	Parameter P8
7709	Parameter P9

See the “List of Commands” on page 156 that may be accessed in shared mode and the corresponding parameters in the section with the list of commands for MicroLogic control units.

Proceed in the following manner to send a command in shared mode.

1. Parameters:

   Fill in the command parameters in registers 7701 to 7709.
2. Write command:

   Write the command number to register 7700 to initiate execution.

It is possible to optimize data flow on the communication system by using function 16 in the Modbus protocol. In this case, the data may be written to registers 7700 to 7709 in a single step. The circuit breaker communication option will automatically put steps 1 and 2 in the correct order.

Send Commands in Protected Mode

The protected mode uses the registers numbered 7715 to 7829 in the command interface.

Registers 7715 to 7719:

May be read-accessed only and provide the indications required to use the protected mode.

Table 9 – Protected Mode Registers in the Command Interface

Registers	Description
7715	Flag query.[1]
7716	Flag active.[2]
7717	Number of the command being executed.[3]
7718	Number of the last command executed.[4]
7719	Result code of the last command executed.[4]

1 Register 7715 must be read-accessed to ensure it is 0, if it is not 0 then another user is in configuration mode and you cannot proceed to the next step, see page 164.

2 The active flag indicates to a supervisor the number of the flag with current access rights to the command interface in protected mode. Only the supervisor that was attributed the given number during a flag query has the right to use the command interface in protected mode. The active flag returns to 0 if no command is sent for two minutes or if the user returns the flag (see the command table for information on return).

3 The number of the command currently being executed remains set to 0 as long as no command is sent to 7720. As soon as a command is sent, register 7717 indicates the number of the command. It returns to 0 when command execution is terminated.

4 When command execution is terminated, register 7718 receives the number of the command and register 7719 indicates the result code. The contents of registers 7718 and 7719 are not modified until the next command has been completely executed.

Register 7719:

Command result codes table.

Table 10 – Command Result Codes

Result Codes	Description of Register 7719
0	Command successfully executed.
10	Command not executed, the necessary resources are not available or the option is not installed or remote access = NO.
11	Command not executed, a local user is using the resources.
12	Command not executed, the portable test kit is using the local resources.
14	Command not executed, the resources are being used by a remote user.
15	Invalid record size.
16	Illegal file command.
17	Insufficient memory.
42	Invalid file number.
81	Command not defined.
82	Command parameters not set or invalid.
107	Invalid record number.
125	Invalid number of records.
200	Protected mode not active.
201	End of time delay. Command not executed.
202	Invalid password. Command not executed.

Registers 7720 to 7729:

May be read-accessed. They are used to send parameters and run execution of commands in protected mode.

Table 11 – Read-Accessed Commands

Registers	Description
7720	Command number
7721	Parameter P1
7722	Parameter P2
7723	Parameter P3
7724	Parameter P4
7725	Parameter P5
7726	Parameter P6
7727	Parameter P7
7728	Parameter P8
7729	Parameter P9

See the “List of Commands” on page 156 that may be accessed in protected mode and the corresponding parameters in the section with the list of commands for MicroLogic control units.

Command interface registers 7730–7829 may be read accessed. They are used as a buffer for the returned data.

Proceed as follows to send a command in protected mode.

1. Request the flag:

   Read register 7715 to ensure it is 0, if it is not 0 then another user is in configuration mode and you cannot proceed to the next step, see page 164. It is possible, however, that you already took the flag for another command and did not return it. For example: if you wished to sequence sending of a series of commands. It is possible to check if you have the rights by reading the active flag at register 7716. In this case, even if you did not read 0 at 7715 when you made the request, it is possible to send the commands.
2. Fill in parameters:

   Fill in the command parameters (P1 to P9) in registers 7721 to 7729.
3. Write command:

   Write the command number to register 7720 to initiate execution.
4. Wait for command execution:

   Wait until the command is fully terminated, by reading registers 7717 and 7718 (recommended time-out = 500 ms).
5. Check result code:

   Check the result code for the command by reading register 7719.
6. Send new command:

   Send new commands in protected mode by starting with step 2 or go on to step 7 (recommended delay between command fully terminated and new command = 20 ms).
7. Release the flag:

   Return the flag to free the protected mode. See the command table for information on returning the flag.

Optimize Sending of Commands

It is possible to optimize data flow on the communication system by using function 16 in the Modbus protocol. In this case, the data may be written to registers 7720 to 7729 in a single step. The command interface will automatically put steps 2 and 3 in the correct order.

Note: Do not use function 23 to optimize steps 1, 2 and 3, because this function does not check access rights to protected mode before sending the command. This may cause problems for another supervisor who currently has the access rights.

Most of the commands that may be used to remotely control the circuit breaker implement two steps, namely the request for the flag (step 1) and return of the flag (step 7).

This mechanism makes it possible for a number of supervisors to issue commands, on the condition that the two steps be implemented.

Using this procedure, you take and return the flag for each of the commands to be issued. In this case, the possible degree of parallelism between the various supervisors is increased, but at the cost of more traffic on the communication system.

If you have a number of commands to send, optimize the mechanism by sending all the commands between the two steps; for example, request the flag, send all the commands in one shot and then return the flag. In this case, you occupy the command interface for a longer time, but traffic on the communication system is optimized.

Remote Configuration

Note: Detailed information on the registers is presented in the Appendix containing the “Table of Registers” on page 85.

A number of simple concepts must be clear in order to remotely configure the circuit breaker successfully.

- Configuration is carried out via the registers:

  The configuration for all the modules (circuit breaker, cradle, measurements, and protection functions) may be read-accessed in the table of registers.

The only way to remotely modify a configuration is to modify the contents of the configuration registers.

- The table of registers may be write-accessed in configuration mode only:

  To modify the configuration registers, it is necessary to remove the register write-protect function by running the command required to enter configuration mode, via the command interface. Once in configuration mode, it is possible to write access the configuration registers and you may modify one or more registers using the standard Modbus write functions.

Table 12: Breaker Communication Module Remote Configuration

Breaker Communication Module	Secondary @ xx
Regular range	Configuration registers
534–543	Identification of the breaker communication Module

Table 13: Cradle Communication Module Remote Configuration

Cradle Communication Module	Secondary @ xx + 50
Regular range	Configuration registers
534–543	Identification of the cradle communication Module

Table 14: Metering Module Remote Configuration

Metering Module	Secondary @ xx + 200
Regular range	Configuration registers
3303–3355	Configuration of the metering module
6000–6011	Configuration of analog pre-defined alarm 1
6012–6635	Configuration of analog pre-defined alarm 2 to 53

Table 15: Protection Module Remote Configuration

Protection Module	Secondary @ xx + 100
Regular range	Configuration registers
8753–8803	Fine adjustments for the basic protection
9604–9618	Configuration of the protection module
9629–9798	Settings for the advanced protections
9800–9846	Configuration of the output relays (M2C / M6C)

xx = breaker communication module address.

Specific conditions must be met to enter the configuration mode.

Remote access is not possible if local configuration is underway and vise versa.

When a user is in the process of locally modifying the configuration of MicroLogic or of its options, it is not possible to start a remote-configuration sequence.

MicroLogic considers that a local user is in the process of modifying the configuration when a parameter field is highlighted or as soon as the MicroLogic plastic cover is opened.

Access to configuration mode is subject to different restrictions depending on the module.

Access to configuration mode for the protection module requires the remote-access code that was programmed on the front panel of the MicroLogic control unit.

This code may be obtained only via the setting screen on the MicroLogic control unit itself. It is only possible to access the configuration mode for the protection module if the MicroLogic control unit has been set to authorize remote access. This setting must be made manually via the front panel of the MicroLogic control unit. It is possible to consult the protection module register 9800 to check the status of this parameter.

Access to configuration mode for the breaker communication, cradle communication and metering modules requires a check word that must first be read in the table of registers. This two-step operation is intended to avoid inadvertent access to the configuration mode.

The access commands for configuration mode implement the protected mode and systematically inform on the command result.

New configurations are always checked before being accepted.

When writing in the configuration registers, the Modbus write functions are accepted, even if the written value exceeds the limits presented in the tables of registers that should be consulted first.

To assist in configuring the protection functions, MicroLogic provides access to a set of registers that list the minimum and maximum permissible values for the various protection settings.

All the configuration data entered are checked before they enter into effect. This check is run when you exit configuration mode, using the commands Out_pCfg, Out_mCfg or Out_CommCfg.

If one of the configuration settings is incorrect, all the new configuration data are rejected. The system indicates why the data are rejected via the result returned for the command used to exit the configuration mode. The protection module indicates the first ten faulty configuration registers. See the information on command Out_pCfg for further details.

The new configuration data take effect only on exiting configuration mode.

The new configuration data take effect only on exiting configuration mode so that the data can be checked; for example, it is when the Out_pCfg, Out_mCfg or Out_CommCfg command has been successfully run that the new configuration settings become active.

Example of a Remote Parameter-Setting Sequence

Below are the steps that must be followed to modify the long-time (LT) current setting.

1. Check that remote access is authorized by reading register 9800 at address @+100 [protection module].
2. Make sure you have the remote-access code, noted on the “Local / Remote” screen in the “COM setup” menu of MicroLogic.
3. Enter configuration mode for the protection module, using the In_pCfg command. See the Appendix, “Examples of Commands” on page 163.
4. Enter the new setting in registers 8753 to 8803, at the address @+100 [protection module]. Make sure these new settings are below the value set by the rotary switch.
5. Exit configuration mode for the protection module, using the Out_pCfg command, and check first for an error code returned by the command interface, then the parameters returned by Out_pCfg in registers 7730 to 7739 of the circuit breaker command interface.
6. Read the contents of the registers 8756 and 8757. The settings should be those entered, if step 5 did not return an error.

Section 4— Access to Files

Introduction

MicroLogic stores events and wave form in different files. These files may be read with the command interface: ReadFileX_RecY. The requested recording may be read starting in registers 7730.
See the Appendix, “Examples of Commands” on page 163.

A file is made up of records. All records in a file have the same structure and size.

Each file is linked to a descriptor. The descriptor is made up of a read zone for file configuration (Header) and for file characteristics (Status). Descriptors are updated each time new data is added to the file.

The file configuration (Header) gives information about size of file and records. The file characteristics (Status) gives information about record numbers. The file characteristics (Status) makes available to the supervisor two sequence registers that indicate the first and last events recorded in the file. They enable the supervisor to determine whether certain events were deleted before they could be read. The sequence number for the last event increments from 1 to 8000 each time a new event is recorded. When the file is full (maximum of 100), the new events overwrite the oldest events. The sequence number for the last event continues to increment normally. When the oldest event is overwritten, the sequence number for the first event also increments.

When the sequence number reaches 8000, the next sequence number will be one.

Event Logs

Event logs	Breaker communication module @ xx	MicroLogic A / P / H	The system stores the events that concern circuit breaker control (for example: opening or closing of the contacts) in the file **N° 30**. This file is made up of 100 records, each record is made up of 5 registers. This file is reset in case of 24 vdc power loss to the breaker communication module.
	Protection module @ xx + 100	MicroLogic P / H	The system stores the events that concern the protection module (for example: trips, alarms) in the file **N° 20**. This file is made up of 100 records, each record is made up of 9 registers.
	Metering module @ xx + 200	MicroLogic H	The system stores the events that concern the metering module (for example: analog pre-defined alarms 1 to 53) in the file **N° 10**. This file is made up of 100 records, each record is made up of 9 registers.
Maintenance event logs	Protection module @ xx + 100	MicroLogic H	The system stores the events that concern the maintenance protection module (for example: power-up, M6C relays, max. peak fault current, and so on) in the file **N° 21**. This file is made up of 20 records, each record is made up of 6 registers. This maintenance event log has been implemented as well on MicroLogic P with firmware Plogic2002AA and above.
	Metering module @ xx + 200	MicroLogic H	The system stores the events that concern the maintenance metering module (for example: counter reset, and so on) in the file **N° 12**. This file is made up of 20 records, each record is made up of 6 registers.
Min-Max event log	Metering module @ xx + 200	MicroLogic H	The system stores the events that concern the metering module (for example: minimum and maximum values for the real time measurements 1000 to 1136) in the file **N° 11**. This file is made up of 136 records, each record is made up of 8 registers.

Wave Form Capture (WFC)

Wave form capture	In the metering module @ xx + 200	MicroLogic H	The system stores the variables Va, Vb, Vc, Ia, Ib, Ic, Ineutral, during 4 cycles (64 points per cycles) in the file **N° 5**. The capture is triggered: • manually (user request) by using the command "Forcelog" (see the Appendix, "Metering Module Commands @ Address xx + 200" on page 159), • automatically attached to pre-defined analog alarms (1 to 53) by setting the log action to 1 (see register 6010 for alarm N° 1, register 6634 for alarm N° 53).
Fault wave form capture	In the protection module @ xx + 100	MicroLogic H	The system stores the variables Va, Vb, Vc, Ia, Ib, Ic, Ineutral, during 12 cycles (16 points per cycles) in the file **N° 22**. The capture is triggered: • automatically attached to alarms (1000 to 1030) by setting the log action to 1 (see register 8762 for alarm N° 1000, register 9797 for alarm N° 1030).

Event Log of the Breaker Communication Module @ Address xx

Table 16 – Descriptor of the Event Log in the Breaker Communication Module

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
Event log configuration (HEADER)										
718	1	R	—	—	INT	0xFFFF	A	P / H	File status. 0xFFFF: file enabled. Always equal to: 0xFFFF.	NvCMFilHdrEvtLog CtrlReg
719	1	R	—	—	INT	30	A	P / H	Type of file. Event log of the Breaker Communication Module. Always equal to: 30.	NvCMFilHdrEvtLog FileType
720	1	R	—	—	INT	0xFFFF	A	P / H	File allocation. 0xFFFF: file allocated. Always equal to: 0xFFFF.	NvCMFilHdrEvtLog Allocation
721	1	R	x 1	register	INT	5	A	P / H	Size of records in register. Always equal to: 5.	NvCMFilHdrEvtLog RecSize
722	1	R	—	—	INT	0	A	P / H	File filling mode. 0: circular. Always equal to: 0.	NvCMFilHdrEvtLog Mode
Event log characteristics (STATUS)										
734	1	R	x 1	rec.	INT	100	A	P / H	Size of file in records. Always equal to: 100.	NvCMFilStatusEvtLo g_ AllocFileSize
735	1	R	x 1	register	INT	5	A	P / H	Size of a record in registers. Always equal to: 5.	NvCMFilStatusEvtLo g_ AllocRecSize
737	1	R	x 1	rec.	INT	0..100	A	P / H	Number of records in the file. 0: no record in the file.	NvCMFilStatusEvtLo g_ NbOfRecords
738	1	R	x 1	rec.	INT	0..8000	A	P / H	Sequence number of first record in the file (the oldest). 0: no record in the file.	NvCMFilStatusEvtLo g_ FirstRecNum
739	1	R	x 1	rec.	INT	0..8000	A	P / H	Sequence number of last record in the file (the most recent). 0: no record in the file.	NvCMFilStatusEvtLo g_ LastRecNum
740	3	R	—	—	DATE	—	—	P / H	Date the last file was reset.	NvCMFilStatusEvtLo g_ LastResetTime

Table 17 – Format of Records in the Event Log of the Breaker Communication Module

Registers	Description
1–4	Event date, in the XDATE format (see the appendix, “Formats” on page 81).
5	Event number (see below).

Table 18 – Events in the Event Log of the Breaker Communication Module

Event Number	Description
1	RESET or system energized.
2	Configuration data stored in the cradle communication module.
3	Spring charged.
4	Circuit breaker opened (O).
5	Circuit breaker closed (F).
6	Circuit breaker tripped (SD).
7	Circuit breaker fault tripped (SDE).
8	Reserved.
9	Reserved.
10	Closing command input remotely (AUTO) (XF).
11	Opening command input remotely (AUTO) (MX).
12	Modification of Modbus address.
13	Event log reset.
14	Clock update input locally accepted.
15	Clock update input locally rejected (synchronization by the supervisor).

Event Log of the Protection Module @ Address xx + 100

Table 19 – Descriptor of the Event Log in the Protection Module

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
Event log configuration (Header)										
9900	1	R / W	—	—	INT	0x0000, 0xFFFF	—	P / H	File status. • 0xFFFF: file enabled. • 0: file disabled. Default value: 0xFFFF.	NvPMFilHdrEvtLog CtrlReg
9901	1	R	—	—	INT	20	—	P / H	Type of file. Protection Module event log. Always equal to: 20.	NvPMFilHdrEvtLog FileType
9902	1	R	x 1	rec.	INT	100	—	P / H	Size of file in records. Always equal to: 100.	NvPMFilHdrEvtLog Allocation
9903	1	R	x 1	register	INT	9	—	P / H	Size of a record in registers. Always equal to: 9 registers per record.	NvPMFilHdrEvtLog RecSize
9904	1	R	—	—	INT	0	—	P / H	File filling mode 0: circular. Always equal to: 0.	NvPMFilHdrEvtLog Mode
Event log characteristics (Status)										
9916	1	R	x 1	rec.	INT	100	—	P / H	Size of file in records. Always equal to: 100.	NvPMFilStatusEvtLog _ AllocFileSize
9917	1	R	x 1	register	INT	9	—	P / H	Size of a record in registers. Always equal to: 9.	NvPMFilStatusEvtLog _ AllocFileSize
9918	1	R	x 1	—	INT	0, 10, 20, 30, 250, 253, 254, 255, 0xFF00, 0xFE00, 0xFD00, 0xFC00	—	P / H	• 0: file OK. • 10: record size smaller than expected. • 20: record size larger than expected. • 30: insufficient memory. • 250: internal error. • 253: corrupted allocation table. • 254: configuration zero. • 255: invalid configuration. • 0xFF00: cannot allocate file. • 0xFE00: file not supported. • 0xFD00: invalid record number. • 0xFC00: invalid file number.	NvPMFilStatusEvtLog _ FileStatus
9919	1	R	x 1	rec.	INT	0..100	—	P / H	Number of records in the file. 0: no record in the file.	NvPMFilStatusEvtLog _ NbOfRecords
9920	1	R	x 1	rec.	INT	0..8000	—	P / H	Sequence number of first record in the file (the oldest). 0: no record in the file.	NvPMFilStatusEvtLog _ FirstRecNum
9921	1	R	x 1	rec.	INT	0..8000	—	P / H	Sequence number of last record in the file (the most recent). 0: no record in the file.	NvPMFilStatusEvtLog _ LastRecNum
9922	3	R	—	—	DATE	cfformat	—	P / H	Date the last file was reset. Default value: 0x8000 0x8000 0x8000.	NvPMFilStatusEvtLog _ LastResetTime

Table 20 – Format of Records in the Event Log of the Protection Module

Registers	Description
1–4	Event date, in the XDATE format (see the Appendix, “Formats” on page 81).
5	Event number (see below).
6	Event characteristics.[1]
7	Type of event.[2]
8	Logging bitmap associated to the alarm.[3]
9	Action bitmap associated to the alarm.[3]

[1]For alarms 1000 to 1004, the data is the value of the fault current interrupted by the circuit breaker. For all other events, this value is forced to 32768.

[2]Bits 0 to 7
The value 1 indicates an alarm of the “Over” type.
The value 2 indicates an alarm of the “Under” type.
The value 3 indicates an alarm of the “Minimum” type.
The value 4 indicates an alarm of the “Maximum” type.
The value 5 indicates an alarm of the “Assorted” type.

[2]Bits 8 to 11
The value 1 indicates the start of an alarm.
The value 2 indicates the end of an alarm.

[2]Bits 12 to 15
Alarms 1100 to 1106 are priority 3. For the other alarms, the value contained in these four bits represents the priority linked to the event (if applicable and depending on the alarm configuration.

[3]Registers 8 and 9 are a copy of the alarm-configuration registers at the moment the event occurred. They depend entirely on the user configurations. For the events 1100 to 1106, these registers are forced to 32768.

Table 21 – Events in the Event Log of the Protection Module

Event Number	Description
1000..1015	Basic protection[1]
1016..1031	Advanced protection[1]
1100..1115	Digital alarms[1]

[1]See description of the “Alarm Numbers” in the Appendix, “Trip / Alarm History” on page 82.

Event Log of the Metering Module @ Address xx + 200

Table 22 – Descriptor of the Event Log in the Metering Module

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
Event log configuration (HEADER)										
7164	1	R / W	—	—	INT	0x0000, 0xFFFF	—	H	Log status. • 0xFFFF: file enabled. • 0: file disabled. Default value: 0xFFFF.	NvMMFilHdrEvtLog CtrlReg
7165	1	R	—	—	INT	10	—	H	Type of file: Metering Module event log. Default Value: 10.	NvMMFilHdrEvtLog FileType
7166	1	R	x 1	rec.	INT	100	—	H	Size of file in records. Default Value: 100 records per file.	NvMMFilHdrEvtLog Allocation
7167	1	R	x 1	register	INT	9	—	H	Size of a record in registers. Default Value: 9 registers per record.	NvMMFilHdrEvtLog RecSize
7168	1	R	—	—	INT	0	—	H	File filling mode. 0: circular. Always equal to: 0.	NvMMFilHdrEvtLog Mode
Event log characteristics (STATUS)										
7180	1	R	x 1	rec.	INT	100	—	H	Size of file in records: 100. Always equal to: 100.	NvMMFilStatusEvtLog _ AllocFileSize
7181	1	R	x 1	register	INT	9	—	H	Size of a record in registers. Always equal to: 9.	NvMMFilStatusEvtLog _ AllocRecSize
7182	1	R	x 1	—	INT	0, 10, 20, 30, 250, 253, 254, 255, 0xFF00, 0xFE00, 0xFD00, 0xFC00	—	H	• 0: file OK. • 10: record size smaller than expected. • 20: record size larger than expected. • 30: insufficient memory. • 250: internal error. • 253: corrupted allocation table. • 254: configuration zero. • 255: invalid configuration. • 0xFF00: cannot allocate file. • 0xFE00: file not supported. • 0xFD00: invalid record number. • 0xFC00: invalid file number.	NvMMFilStatusEvtLog _ FileStatus
7183	1	R	x 1	rec.	INT	0..100	—	H	Number of records in the file. 0: no record in the file.	NvMMFilStatusEvtLog _ NbOfRecords
7184	1	R	x 1	rec.	INT	0..8000	—	H	Sequence number of first record in the file (the oldest). 0: no record in the file.	NvMMFilStatusEvtLog _ FirstRecNum
7185	1	R	x 1	rec.	INT	0..8000	—	H	Sequence number of last record in the file (the most recent). 0: no record in the file.	NvMMFilStatusEvtLog _ LastRecNum
7186	3	R	—	—	DATE	cfformat	—	H	Date the last file was reset. Default value: 0x8000 0x8000 0x8000.	NvMMFilStatusEvtLog _ LastResetTime

Table 23 – Format of Records in the Event Log of the Metering Module

Registers	Description
1–3	Event date, in the XDATE format (see the Appendix, “Formats” on page 81).
4	Reserved.
5	Event number (see below).
6	Extreme value.
7	Type of event.[1]
8	Logging bitmap associated to the alarm.[2]
9	Action bitmap associated to the alarm.[2]

[1]Bits 0 to 7
The value 0 indicates an alarm of the “Over” type.
The value 1 indicates an alarm of the “Under” type.
The value 2 indicates an alarm of the “Equal to” type.
The value 3 indicates an alarm of the “Different from” type.
The value 5 is used for all other alarms.

[1]Bits 8 to 11
The value 1 indicates the start of an alarm.
The value 2 indicates the end of an alarm.

[1]Bits 12 to 15
The value contained in these four bits represents the priority linked to the event (if applicable and depending on the alarm configuration.

[2]Registers 8 and 9 are a copy of the alarm-configuration registers at the moment the event occurred. They depend entirely on the user configurations.

Table 24 – Events in the Event Log of the Metering Module

Event Number	Description
1 to 53	Analog pre-defined alarms.

See the “Analog Pre-Defined Alarms” on page 112, 1 to 53 in the Appendix, Table of Registers 6000 to 6624.

Maintenance Event Logs of the Protection Module @ Address xx + 100

Table 25 – Descriptor of the Maintenance Event Log in the Protection Module

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
Event log configuration (HEADER)										
9932	1	R / W	—	—	INT	0xFFFF	—	H	File status. 0xFFFF: file enabled. Always equal to: 0xFFFF.	NvPMFilHdrMaint CtrReg
9933	1	R	—	—	INT	**21**	—	H	Type of file. Maintenance Protection Module event log. Always equal to: 21.	NvPMFilHdrMaint FileType
9934	1	R	x 1	rec.	INT	20	—	H	Size of file in records. Always equal to: 20 records per file.	NvPMFilHdrMaint Allocation
9935	1	R	x 1	register	INT	6	—	H	Size of a record in registers. Always equal to: 6 registers per record.	NvPMFilHdrMaint RecSize
9936	1	R	—	—	INT	1	—	H	Log filling mode. 1: inhibition is full. Always equal to: 1.	NvPMFilHdrMaint Mode
Event log characteristics (STATUS)										
9948	1	R	x 1	rec.	INT	20	—	H	Size of file in records: 20. Always equal to: 20.	NvPMFilStatusMaint _ AllocFileSize
9949	1	R	x 1	register	INT	6	—	H	Size of a record in registers. Always equal to: 6.	NvPMFilStatusMaint _ AllocRecSize
9950	1	R	x 1	—	INT	0, 10, 20, 30, 250, 253, 254, 255, 0xFF00, 0xFE00, 0xFD00, 0xFC00	—	H	• 0: file OK. • 10: record size smaller than expected. • 20: record size larger than expected. • 30: insufficient memory. • 250: internal error. • 253: corrupted allocation table. • 254: configuration zero. • 255: invalid configuration. • 0xFF00: cannot allocate file. • 0xFE00: file not supported. • 0xFD00: invalid record number. • 0xFC00: invalid file number.	NvPMFilStatusMaint _ FileStatus
9951	1	R	x 1	rec.	INT	20	—	H	Number of records in the file. Always equal to: 20.	NvPMFilStatusMaint _ NbOfRecords
9952	1	R	x 1	rec.	INT	1	—	H	Sequence number of first record in the file. Always equal to: 1.	NvPMFilStatusMaint _ FirstRecNum
9953	1	R	x 1	rec.	INT	20	—	H	Sequence number of last record in the file. Always equal to: 20.	NvPMFilStatusMaint _ LastRecNum
9954	3	R	—	—	DATE	cfformat	—	H	Date the last file was reset. Default value: 0x8000 0x8000 0x8000.	NvPMFilStatusMaint _ LastResetTime

This file consists of a fixed number of records (20). All records are of similar size, for example, 6 registers wide.

Table 26 – Format of Records in the Maintenance Event Log of the Protection Module

Record Number	Registers	Description
1	1–3	Last power loss (XDATE format).
	4–6	Reserved.
2	1–3	Date / time of last counter reset (DATE format).
	4	Number of output operations for relay 1.
	5–6	Reserved.
3 to 6	1–3	Date / time of last counter reset (DATE format).
	4	Number of output operations for relay 3 to 6.
	5–6	Reserved.
7	1–3	Date / time of last counter reset (DATE format).
	4	Number of output operations for relay 6.
	5–6	Reserved.
8	1–3	Date / time of last record updated (DATE format).
	4	Worst contact wear.
	5–6	Reserved.
9	1–3	Date / time of last record updated (DATE format).
	4	Max reverse power.
	5–6	Reserved.
10	1–3	Date / time of last record updated (DATE format).
	4	Battery indicator (see register 8843).
	5–6	Reserved.
11	1–3	Date / time of last record updated (DATE format).
	4	Number of power losses.
	5–6	Reserved.
12	1–6	Reserved.
13	1–6	Reserved.
14	1–6	Reserved.
15	1–6	Reserved.
16	1–3	Date / time of last record updated (DATE format).
	4	Number of Max resets.
	5–6	Reserved.
17	1–6	Reserved.
18	1–3	Date / time of last record updated (DATE format).
	4	Max peak fault current circuit breaker ever opened.
	5–6	Reserved.
19	1–6	Reserved.
20	1–6	Reserved.

Maintenance Event Log of the Metering Module

Table 27 – Descriptor of the Maintenance Event Log in the Metering Module

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
Event log configuration (HEADER)										
7228	1	R / W	—	—	INT	0xFFFF	—	H	File status. 0xFFFF: file enabled. Always equal to: 0xFFFF.	NvMMFilHdrMaint CtrReg
7229	1	R	—	—	INT	**12**	—	H	Type of file. Maintenance Metering Module event log. Always equal to: 12.	NvMMFilHdrMaint FileType
7230	1	R	x 1	rec.	INT	20	—	H	Size of file in number of records. Always equal to: 20 records per file.	NvMMFilHdrMaint Allocation
7231	1	R	x 1	register	INT	6	—	H	Size of a record in number of registers. Always equal to: 6 registers per record.	NvMMFilHdrMaint RecSize
7232	1	R	—	—	INT	1	—	H	Log filling mode. 1: disabled if log is full. Always equal to: 1.	NvMMFilHdrMaint Mode
Event log characteristics (STATUS)										
7244	1	R	x 1	rec.	INT	20	—	H	Size of file in records: 20. Always equal to: 20.	NvMMFilStatusMaint _ AllocFileSize
7245	1	R	x 1	register	INT	6	—	H	Size of a record in registers. Always equal to: 6.	NvMMFilStatusMaint _ AllocFileSize
7246	1	R	x 1	—	INT	0, 10, 20, 30, 250, 253, 254, 255, 0xFF00, 0xFE00, 0xFD00, 0xFC00	—	H	• 0: file OK. • 10: record size smaller than expected. • 20: record size larger than expected. • 30: insufficient memory. • 250: internal error. • 253: corrupted allocation table. • 254: configuration zero. • 255: invalid configuration. • 0xFF00: cannot allocate file. • 0xFE00: file not supported. • 0xFD00: invalid record number. • 0xFC00: invalid file number.	NvMMFilStatusMaint _ FileStatus
7247	1	R	x 1	rec.	INT	20	—	H	Number of records in the file. Always equal to: 20.	NvMMFilStatusMaint _ NbOfRecords
7248	1	R	x 1	rec.	INT	1	—	H	Sequence number of first record in the file. Always equal to: 1.	NvMMFilStatusMaint _ FirstRecNum
7249	1	R	x 1	rec.	INT	20	—	H	Sequence number of last record in the file. Always equal to: 20.	NvMMFilStatusMaint _ LastRecNum
7250	3	R	—	—	DATE	cfformat	—	H	Date the last file was reset. Default value: 0x8000 0x8000 0x8000.	NvMMFilStatusMaint _ LastResetTime

This file consists of a fixed number of records (20). All records are of similar size, for example, 6 registers wide.

Table 28 – Format of Records in the Maintenance Event Log of the Metering Module

Record Number	Registers	Description
1	1–3	Date / time of last counter reset (DATE format).
	4	Number of min resets.
	5–6	Reserved.
2	1–3	Date / time of last counter reset (DATE format).
	4	Number of Max resets.
	5–6	Reserved.
3	1–3	Date / time of last counter reset (DATE format).
	4	Number of Peak current Demand resets.
	5–6	Reserved.
4	1–3	Date / time of last record updated (DATE format).
	4	Number of Peak power demand resets.
	5–6	Reserved.
5	1–3	Date / time of last record updated (DATE format).
	4	Number of Energy resets.
	5–6	Reserved.
6 to 20	1–6	Reserved.

Min-Max Event Log of the Metering Module @ Address xx + 200

Table 29 – Descriptor of the Min-Max Event Log in the Metering Module

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
Event log configuration (HEADER)										
7196	1	R / W	—	—	INT	0xFFFF	—	H	File status. 0xFFFF: file enabled. Always equal to: 0xFFFF.	NvMMFilHdrMinMax CtrlReg
7197	1	R	—	—	INT	**11**	—	H	Type of file: Min / Max event log: 11. Always equal to: 11.	NvMMFilHdrMinMax FileType
7198	1	R	x 1	rec.	INT	Real Time zone size	—	H	Size of file in number of records. Identical to: the size of the MM Real Time zone. Always equal to: 136.	NvMMFilHdrMinMax Allocation
7199	1	R	x 1	register	INT	8	—	H	Size of a record in number of registers. Always equal to: 8 registers per record.	NvMMFilHdrMinMax RecSize
7200	1	R	—	—	INT	1	—	H	Log filling mode. 1: disabled if log is full. Always equal to: 1.	NvMMFilHdrMinMax Mode
Event log characteristics (STATUS)										
7212	1	R	x 1	rec.	INT	Real Time zone size	—	H	Size of file in records. Size always equal to: Real Time zone size. Value equal to: 136.	NvMMFilStatusMinMax _ AllocFileSize
7213	1	R	x 1	register	INT	8	—	H	Size of a record in registers. Always equal to: 8.	NvMMFilStatusMinMax _ AllocRecSize
7214	1	R	x 1	—	INT	0, 10, 20, 30, 250, 253, 254, 255, 0xFF00, 0xFE00, 0xFD00, 0xFC00	—	H	• 0: file OK. • 10: record size smaller than expected. • 20: record size larger than expected. • 30: insufficient memory. • 250: internal error. • 253: corrupted allocation table. • 254: configuration zero. • 255: invalid configuration. • 0xFF00: cannot allocate file. • 0xFE00: file not supported. • 0xFD00: invalid record number. • 0xFC00: invalid file number.	NvMMFilStatusMinMax _ FileStatus
7215	1	R	x 1	rec.	INT	Real Time zone size	—	H	Actual number of records in the file. Always equal to: Real Time zone size. Value equal to: 136.	NvMMFilStatusMinMax _ NbOfRecords
7216	1	R	x 1	rec.	INT	1	—	H	Number of first record present. Always equal to: 1.	NvMMFilStatusMinMax _ FirstRecNum
7217	1	R	x 1	rec.	INT	Real Time zone size	—	H	Number of first record present. Always equal to: 20.	NvMMFilStatusMinMax _ LastRecNum
7218	3	R	—	—	DATE	cfformat	—	H	Date the last file was reset. Default value: 0x8000 0x8000 0x8000.	NvMMFilStatusMinMax _ LastResetTime

This file contains the minimum and maximum values reached by the Real Time measurements.

Real Time Value:	see registers 1000 to 1135.
Min of Real Time Value:	see registers 1300 to 1435.
Max of Real Time Value:	see registers 1600 to 1735.

All records are of similar size, for example, 8 registers wide.

Table 30 – Format of Records in the Min-Max Even Log of the Metering Module

Record Number	Registers	Description
1	1	Last min value (register 1300).
	2–4	Date / time of last min value (DATE format).
	5	Last max value (register 1600).
	6–8	Date / time of last max value (DATE format).
2	1	Last min value (register 1301).
	2–4	Date / time of last min value (DATE format).
	5	Last max value (register 1601).
	6–8	Date / time of last max value (DATE format).
X (3 to 135)	1	Last min value (register 130**x**).
	2–4	Date / time of last min value (DATE format).
	5	Last max value (register 160**x**).
	6–8	Date / time of last max value (DATE format).
136	1	Last min value (register 1435).
	2–4	Date / time of last min value (DATE format).
	5	Last max value (register 1735).
	6–8	Date / time of last max value (DATE format).

Wave Form Capture

Table 31 – Descriptor of the Wave Form Capture in the Metering Module

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
Wave form capture configuration (HEADER)										
7132	1	R / W	—	—	INT	0x0000, 0xFFFF	—	H	File status. • 0xFFFF: file enabled. • 0x000: file disabled. Default value: 0xFFFF.	NvMMFilHdrWFC CtrlReg
7133	1	R	—	—	INT	5	—	H	Type of file: Wave Form Capture. Always equal to: 5 (WFC).	NvMMFilHdrWFC FileType
7134	1	R	x 1	rec.	INT	29	—	H	Size of file in number records: 29. Always equal to: 29 records / file.	NvMMFilHdrWFC Allocation
7135	1	R	x 1	register	INT	64	—	H	Size of records in number of registers. Always equal to: 64 registers per record.	NvMMFilHdrWFC RecSize
7136	1	R	—	—	INT	0,1	—	H	File filling mode. 1: disabled if log is full. 0: circular. Default value: 0.	NvMMFilHdrWFC Mode
7137	—	R	1	segment	INT	1	—	H	Number of 4 cycle segments. Always equal to: 1.	NvMMFilHdrWFC MaxNumOfSegments
7138	—	R	1	cycle	INT	2	—	H	Number of cycle before capture. Always equal to: 2.	NvMMFilHdrWFC PreAlarmCycles
7139	—	R	1	points	INT	64	—	H	Number of points per cycle. Always equal to: 64.	NvMMFilHdrWFC PointsPerCycle
Wave form capture characteristics (STATUS)										
7148	1	R	x 1	rec.	INT	0,29	—	H	Size of file in records. Either equal to: 0 or 29.	NvMMFilStatusWFC _ AllocFileSize
7149	1	R	x 1	register	INT	64	—	H	Size of a record in registers. Always equal to: 64.	NvMMFilStatusWFC _ AllocRecSize
7150	1	R	x 1	—	INT	0, 10, 20, 30, 250, 253, 254, 255, 0xFF00, 0xFE00, 0xFD00, 0xFC00	—	H	• 0: file OK. • 10: record size smaller than expected. • 20: record size larger than expected. • 30: insufficient memory. • 250: internal error. • 253: corrupted allocation table. • 254: configuration zero. • 255: invalid configuration. • 0xFF00: cannot allocate file. • 0xFE00: file not supported. • 0xFD00: invalid record number. • 0xFC00: invalid file number.	NvMMFilStatusWFC _ FileStatus
7151	1	R	x 1	rec.	INT	0,29	—	H	Actual number of records in the file. Either equal to: 0 or 29.	NvMMFilStatusWFC _ NbOfRecords
7152	1	R	x 1	rec.	INT	0,1	—	H	Number of first record present. Either equal to: 0 or 1.	NvMMFilStatusWFC _ FirstRecNum
7153	1	R	x 1	rec.	INT	0,29	—	H	Number of last record present. Either equal to: 0 or 29.	NvMMFilStatusWFC _ LastRecNum
7154	3	R	—	—	DATE	cfformat	—	H	Date the last file was reset. Default value: 0x8000 0x8000 0x8000.	NvMMFilStatusWFC _ LastResetTime

This file consists of a fixed number of records (29). All records are of similar size, for example, 64 registers wide.

Table 32 – Format of Records in the Wave Form Capture of the Metering Module

Record Number	Registers	Description
1	1–4	Extended date / time.
	5–11	Reserved.
	12	ID of WFC trigger (analog predefined alarm 1 to 53). Available with firmware version H Logic 2005 AF.
	13	System type: 30, 31, 40 or 41 (see register 3314).
	14	Circuit breaker nominal current in amperes.
	15	Voltage multiplier for phase A (format is SFIXPT).
	16	Voltage Offset for phase A (format is INT).
	17	Same as 15, for phase B.
	18	Same as 16, for phase B.
	19	Same as 15, for phase C.
	20	Same as 16, for phase C.
	21	Current multiplier for phase A (format is SFIXPT).
	22	Current Offset for phase A (format is INT).
	23	Same as 21, for phase B.
	24	Same as 22, for phase B.
	25	Same as 21, for phase C.
	26	Same as 22, for phase C.
	27	Current multiplier for neutral (format is SFIXPT).
	28	Same as 22, for neutral.
	29	Scaling factor used for SFIXPT math on voltage samples.
	30	Scaling factor used for SFIXPT math on phase current samples.
	31	Scaling factor used for SFIXPT math on neutral current samples.
	32–64	Not used.
2 to 5	1–64	Voltage A sample points (64 points – 4 cycles).
6 to 9	1–64	Voltage B sample points (64 points – 4 cycles).
10 to 13	1–64	Voltage C sample points (64 points – 4 cycles).
14 to 17	1–64	Current A sample points (64 points – 4 cycles).
18 to 21	1–64	Current B sample points (64 points – 4 cycles).
22 to 25	1–64	Current C sample points (64 points – 4 cycles).
26 to 64	1–64	Current N sample points (64 points – 4 cycles) Only valid in 41 system.

In order to derive phase A voltage, apply this rule:
Sample (volt) = [(sample – reg. 16 of 1st rec.) x reg. 15 of 1st rec.] / reg. 29 of 1st rec.
Register 18, 17 for phase B voltage; register 20, 19 for phase C voltage.

In order to derive phase A current, apply this rule:
Sample (amp) = [(sample – reg. 22 of 1st rec.) x reg. 21 of 1st rec.] / reg. 30 of 1st rec.
Register 24, 23 for phase B amp; register 26, 25 for phase C amp.

In order to derive neutral amp current, apply this rule:
Sample (amp) = [(sample – reg. 28 of 1st rec.) x reg. 27 of 1st rec.] / reg. 31 of 1st rec.

Fault Wave Form Capture

Table 33 – Descriptor of the Fault Wave Form Capture in the Protection Module

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
Fault wave form capture configuration (HEADER)										
9964	1	R / W	—	—	INT	0x0000, 0xFFFF	—	H	File status. • 0xFFFF: file enabled. • 0: file disabled. Default value: 0xFFFF.	NvPMFilHdrFWFC CtrlReg
9965	1	R	—	—	INT	**22**	—	H	Type of file: Fault Wave Form Capture Default. Default value: 22 (FWFC).	NvPMFilHdrFWFC FileType
9966	1	R	x 1	rec.	INT	22	—	H	Size of file in number records. Always equal to: 22 records / file.	NvPMFilHdrFWFC Allocation
9967	1	R	x 1	register	INT	64	—	H	Size of records in number of registers. Always equal to: 64 registers per record.	NvPMFilHdrFWFC RecSize
9968	1	R	—	—	INT	0	—	H	File filling mode. 1: disabled if log is full. 0: circular. Default value: 0.	NvPMFilHdrFWFC Mode
9969	—	R	1	segment	INT	1	—	H	Number of 12 cycle segments. Always equal to: 1.	NvPMFilHdrFWFC MaxNumOfSegments
9970	—	R	1	cycle	INT	2	—	H	Number of cycle before capture. Always equal to: 2.	NvPMFilHdrFWFC PreAlarmCycles
9971	—	R	1	points	INT	16	—	H	Number of points per cycle. Always equal to: 16.	NvPMFilHdrFWFC PointsPerCycle
Fault wave form capture characteristics (STATUS)										
9980	1	R	x 1	rec.	INT	0,22	—	H	Size of file in records. Either equal to: 0 or 22.	NvPMFilStatusFWFC _ AllocFileSize
9981	1	R	x 1	register	INT	64	—	H	Size of a record in registers. Always equal to: 64.	NvPMFilStatusFWFC _ AllocRecSize
9982	1	R	x 1	—	INT	0, 10, 20, 30, 250, 253, 254, 255, 0xFF00, 0xFE00, 0xFD00, 0xFC00	—	H	• 0: file OK. • 10: record size smaller than expected. • 20: record size larger than expected. • 30: insufficient memory. • 250: internal error. • 253: corrupted allocation table. • 254: configuration zero. • 255: invalid configuration. • 0xFF00: cannot allocate file. • 0xFE00: file not supported. • 0xFD00: invalid record number. • 0xFC00: invalid file number.	NvPMFilStatusFWFC _ FileStatus
9983	1	R	x 1	rec.	INT	0,22	—	H	Actual number of records in the file. Either equal to: 0 or 22.	NvPMFilStatusFWFC _ NbOfRecords
9984	1	R	x 1	rec.	INT	0,1	—	H	Number of first record present. Either equal to: 0 or 1.	NvPMFilStatusFWFC _ FirstRecNum
9985	1	R	x 1	rec.	INT	0,22	—	H	Number of last record present. Either equal to: 0 or 22.	NvPMFilStatusFWFC _ LastRecNum
9986	3	R	—	—	DATE	cfformat	—	H	Date the last file was reset. Default value: 0x8000 0x8000 0x8000.	NvPMFilStatusFWFC _ LastResetTime

This file consists of a fixed number of records (22). All records are of similar size, for example, 64 registers wide.

Table 34 – Format of Records in the Fault Wave Form Capture of the Protection Module

Record Number	Registers	Description
1	1–4	Extended date / time.
	5–11	Reserved.
	12	Id of fault WFC Trigger: Alarm number 1000 to 1031 (see the Appendix, “Trip / Alarm History” on page 82).
	13	System type: 30, 31, 40 or 41 (see register 3314).
	14	Circuit breaker nominal current in amperes.
	15	Voltage multiplier for phase A (format is SFIXPT).
	16	Voltage offset for phase A (format is INT).
	17	Same as 15, for phase B.
	18	Same as 16, for phase B.
	19	Same as 15, for phase C.
	20	Same as 16, for phase C.
	21	Current multiplier for phase A (format is SFIXPT).
	22	Current Offset for phase A (format is INT).
	23	Same as 21, for phase B.
	24	Same as 22, for phase B.
	25	Same as 21, for phase C.
	26	Same as 22, for phase C.
	27	Current multiplier for neutral (format is SFIXPT).
	28	Same as 22, for neutral.
	29	Scaling factor used for SFIXPT math on voltage samples.
	30	Scaling factor used for SFIXPT math on phase current samples.
	31	Scaling factor used for SFIXPT math on neutral current samples.
	32–64	Not used.
2 to 4	1–64	Voltage A sample points (16 points – 12 cycles).
5 to 7	1–64	Voltage B sample points (16 points – 12 cycles).
8 to 10	1–64	Voltage C sample points (16 points – 12 cycles).
11 to 13	1–64	Current A sample points (16 points – 12 cycles).
14 to 16	1–64	Current B sample points (16 points – 12 cycles).
17 to 19	1–64	Current C sample points (16 points – 12 cycles).
20 to 22	1–64	Current N sample points (16 points – 12 cycles) Only valid in 41 system.

In order to derive phase A voltage, apply this rule:
Sample (volt) = [(sample – reg. 16 of 1st rec.) x reg. 15 of 1st rec.] / reg. 29 of 1st rec.
Register 18, 17 for phase B voltage; register 20, 19 for phase C voltage.

In order to derive phase A current, apply this rule:
Sample (amp) = [(sample – reg. 22 of 1st rec.) x reg. 21 of 1st rec.] / reg. 30 of 1st rec.
Register 24, 23 for phase B amp; register 26, 25 for phase C amp.

In order to derive neutral amp current, apply this rule:
Sample (amp) = [(sample – reg. 28 of 1st rec.) x reg. 27 of 1st rec.] / reg. 31 of 1st rec.

Section 5— Modbus Functions

Introduction

Modbus is an application layer messaging protocol, positioned at level 7 of the OSI model, that provides client/server communication between devices connected on different types of buses or networks.

The Internet community can access Modbus at a reserved system port 502 on the TCP/IP stack.

Modbus is a request/reply protocol with services specified by function codes.

Modbus / JBus Protocol

In the Modbus protocol, register numbering begins with 1, whereas in the JBus protocol, numbering of the equivalent registers begins with 0. However, a JBus primary can dialogue with a Modbus secondary by addressing a register number – 1 to access the correct register on the Modbus secondary.

Example of a request to read a register.

In order to read the rms current on phase A (register 1016), you will have to address the register number 1016 – 1 = 1015
1015 = 0x03F7 (hexa).

Request			Response		
Function	—	03	Function	—	03
Starting address	Hi	03	Byte count	—	02
Starting address	Lo	F7	Register value	Hi	02
N° of registers	Hi	00	Register value	Lo	2B
N° of registers	Lo	01	—	—	—

The contents of register 1016 (rms current on phase A) are shown as the two byte values of 02 2B (hexa), or 555 (decimal). Therefore, rms current on phase A is 555 amperes.

Modbus Exception Responses

When a client device (primary) sends a request to a server device (secondary) it expects a normal response. One of four possible events can occur from the primary’s query:

- If the server device receives the request without a communication error, and can handle the query normally, it returns a normal response.
- If the server device does not receive the request due to a communication error, no response is returned. The client program will eventually process a time out condition for the request.
- If the server device receives the request, but detects a communication error (parity, LRC, CRC,…), no response is returned. The client program will eventually process a time out condition for the request.
- If the server device receives the request without a communication error, but cannot handle it (for example, if the request is to read a non existing register), the server will return an exception response informing the client of the nature of the error.

The exception response message has two fields that differentiate it from a normal response:

Function code: Function code of the original request + 0x80 (hexa)

Exception code: See the following list

01	ILLEGAL FUNCTION
02	ILLEGAL DATA ADDRESS
03	ILLEGAL DATA VALUE
04	SECONDARY DEVICE FAILURE
05	ACKNOWLEDGE (in conjunction with programming commands)
06	SECONDARY DEVICE BUSY (in conjunction with programming commands)
08	MEMORY PARITY ERROR (with function code 0x14)

Standard Modbus Functions

Table 35 – Read Functions

Function Code	Sub-Function	Description
3	—	Read n output or internal registers.[1, 2]
4	—	Read n input registers.[1,2]
23	—	Simultaneously read / write n and p registers.[1, 2]
43	—	Read deviceidentification[3]

1 Registers 4XXXX and 3XXXX are linked to the same data in registers XXXX in the data tables.

2 The n (or p) registers constitute a block specified by the basic block address and the size of the block.

3 Read Device Identification is available only with a Breaker Communication Module firmware version greater or equal to V2.0 (register 577 must be greater or equal to 02000).

Table 36 – Write Functions

Function Code	Sub-Function	Description
6	—	Write one register.
16	—	Write n registers.[1,2]
22	—	Write one register with mask.
23	—	Simultaneously read / write n and p registers.[1,2]

1 Registers 4XXXX and 3XXXX are linked to the same data in registers XXXX in the data tables.

2 The n (or p) registers constitute a block specified by the basic block address and the size of the block.

These functions act exclusively on the breaker communication module (@ XX) and the cradle communication module (@ XX + 50).

Table 37 – Diagnostic Functions

Function Code	Sub-Function	Description
8	—	Management of the diagnostics counters.
8	10	Clear the diagnostics counters.
8	11	Read the bus-messages counter managed by the secondary.
8	12	Read the bus-errors counter managed by the secondary.
8	13	Read the bus-exception answer counter managed by the secondary.
8	14	Read the counter for messages sent to the secondary.
8	15	Read the counter for messages sent to the secondary and to which the secondary did not answer.

Continued on next page

Table 37 – Diagnostic Functions *(continued)*

Function Code	Sub-Function	Description
8	16	Read the counter for messages sent to the secondary and to which the secondary replied with an exception code 07 “Negative Acknowledge”.
8	17	Read the counter for messages sent to the secondary and to which the secondary replied with an exception code 06 “Secondary Device Busy”.
8	18	Read the counter for messages sent to the secondary that it could not process due to a transmission error.
11	—	Read the Modbus event counter.
17	—	Read the identifier of the Modbus secondary.

Read File Record: Function 20 (0x14).

This function acts exclusively on the protection module (@ xx +100) and the metering module (@ xx + 200).

This function code is used to perform a file record read. All Request Data Lengths are provided in terms of number of bytes and all Record Lengths are provided in terms of registers.

The quantity of registers to be read, combined with all other fields in the expected response, must not exceed the allowable length of Modbus messages: 256 bytes.

Table 38 – File Record Read

Request			Response		
Function code	1 Byte	0x14	Function	1 Byte	0x14
Byte count	1 Byte	0x07	Data length	1 Byte	2 + Nx2
Reference type	1 Byte	0x06	File resp.length	1 Byte	1 + Nx2
File number	2 Byte	0x0000 to 0xFFFF	Reference type	1 Byte	0x06
Record number	2 Byte	0x0000 to 0x270F	Record data	Nx2 Bytes	Data
Record length	2 Byte	N	—	—	—

Example of a request to read the most recent record in the event log of the protection module.

The event log of the protection module is the file N° 20 (0x0014). This file is made up of 100 records, each record is made up of 9 registers. So, the record length is 9 (0x0009). The sequence number of last record in the file (the most recent) is the content of register 9921.
Let’s take 0x1234 for the content of register 9921.

Table 39 – Event Log

Request			Response		
Function code	1 Byte	0x14	Function	1 Byte	0x14
Byte count	1 Byte	0x07	Data length	1 Byte	0x14
Reference type	1 Byte	0x06	File resp. length	1 Byte	0x13
File number	2 Byte	0x0014	Reference type	1 Byte	0x06
Record number	2 Byte	0x1234	Record data	9x2 Bytes	Data
Record length	2 Byte	0x0009	—	—	—

Advanced Modbus Functions

Read n non-contiguous registers (function 100, sub-function 4).

The n non-contiguous registers must be specified one after the other by their register in the data table. The maximum for n is 100 (When using MicroLogic A, it is recommended to have n less than or equal to 21).

To optimize access to MicroLogic and its COM options, it may be very useful to read n non-contiguous registers in a data table.

Use of function 100, sub-function 4 avoids:

- reading a large block of contiguous data when only a few elements of data are required.
- multiplying read functions for n registers (functions 3 and 4) or for one word (function 1) simply to read a few elements of non-contiguous data.

The table below provides an example of reading the data in registers 101 and 103 of the secondary with the Modbus address 47.

Table 40 – Example of an Advanced Modbus Function

Request		Answer	
Name of Field	**Example**	**Name of Field**	**Example**
Secondary address	47	Secondary address (identical)	47
Function[1]	100	Function[1]	100
Number of registers read + 2	6	Number of bytes requested and returned + 2	6
Sub-function code[1]	4	Sub-function code[1]	4
Transmission number[2]	0xXX	Transmission number[2]	0xXX
Address of first register to read (most significant byte)	0	First word read (most significant bits)	0x12
Address of first register to read (least significant byte)	101	First word read (least significant bits)	0x0A
Address of second register to read (most significant byte)	0	Second word read (most significant bits)	0xFA
Address of second register to read (least significant byte)	103	Second word read (least significant bits)	0x0C
CRC high	XX	CRC high	XX
CRC low	XX	CRC low	XX

1 These values are constant.

2 The transmission number is provided by the primary prior to each request for a non-contiguous read. The secondary device must return the same number.

Section 6— Interfacing Legacy and New Communications Systems

Introduction

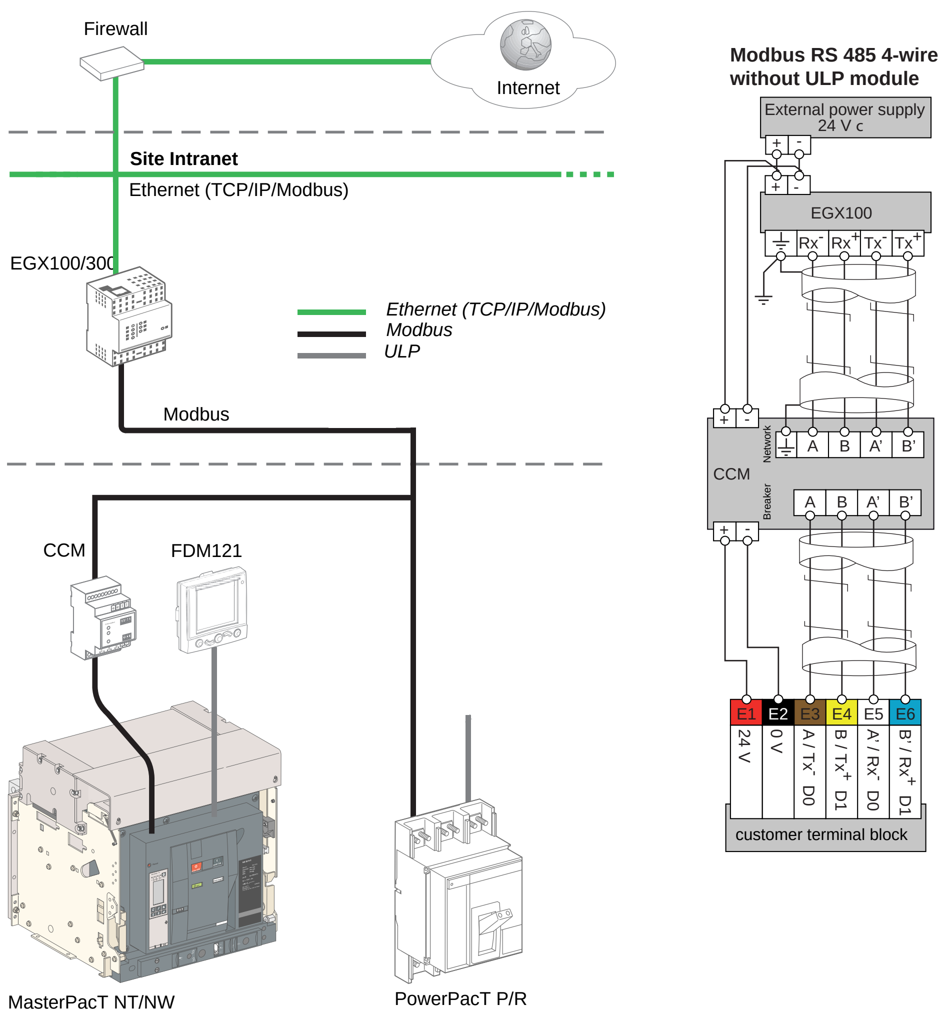
There are thousands of existing installations with MasterPacT and PowerPacT circuit breakers communicating on four-wire Modbus systems and two-wire Modbus systems without Smart System™ components.This section describes systems that are existing and how to interface the new two-wire systems and Smart System components.

The Smart System communication system is designed to connect installations to real savings in three steps: Measure, connect, and save using Smart System components which include MicroLogic trip units, display modules (FDM121 and FDM128), and communication devices (IO module, IFE module, IFM module). See 0613IB1313 Communication Guide for more information.

This section will also describe how to replace existing communication devices to keep your existing communication system functioning properly.

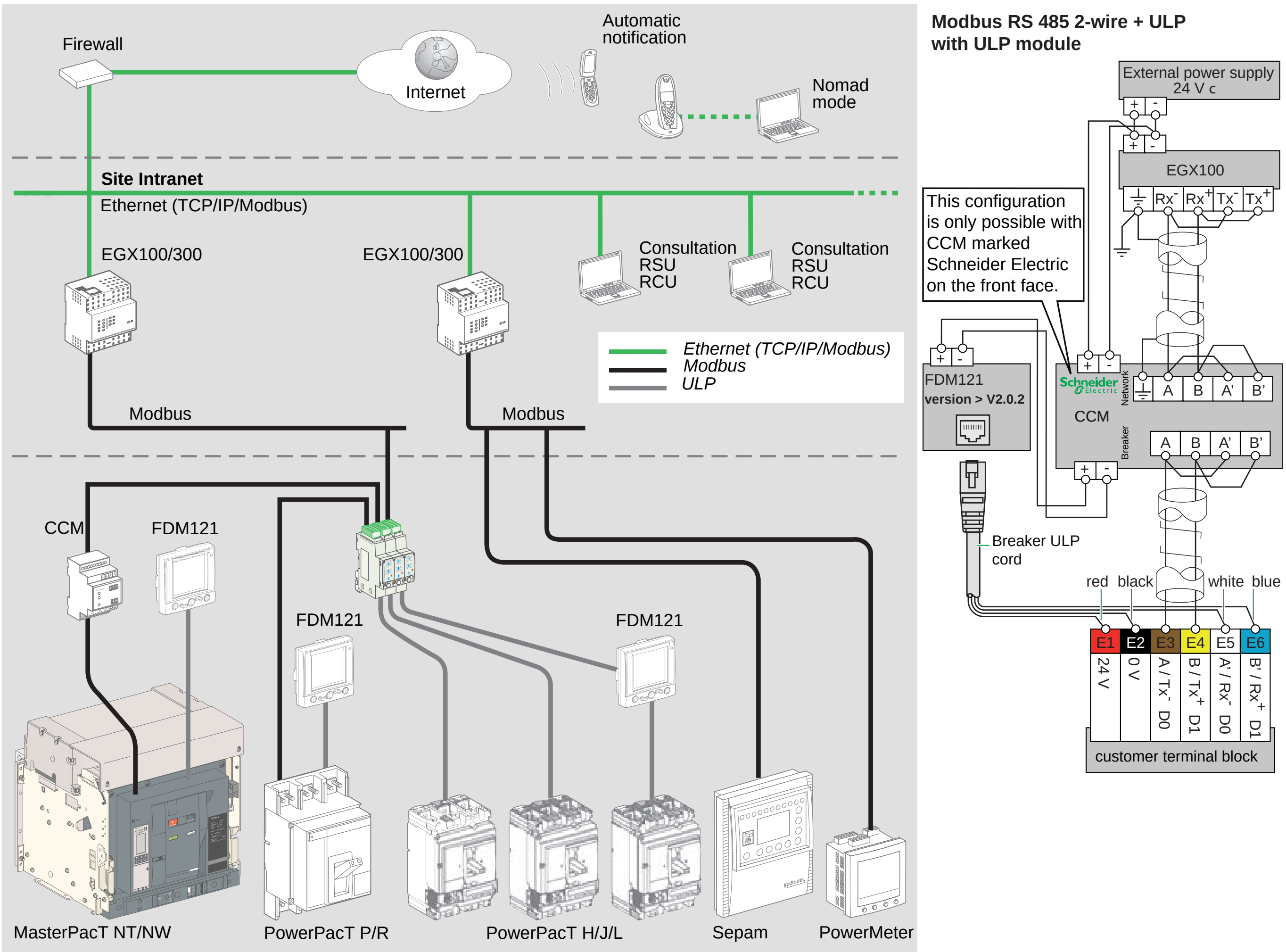
Typical Communication System Diagrams

Figure 1 – MasterPacT and PowerPacT P/R Circuit Breakers (Four-Wire System)



These systems were used in switchboards, switchgear and motor control centers and are covered by the information in the other sections of this instruction bulletin.

Figure 2 – MasterPacT, PowerPacT P/R-Frame in a System with H, J, and L-frame MicroLogic (Two-Wire Systems without Smart System Components)



These systems were used in switchboards and motor control centers where PowerPacT H-, J-, and L-frame circuit breakers with MicroLogic electronic trip units were added into communication systems with MasterPacT and/or PowerPacT P- and R-frame circuit breakers. These systems are covered in this instruction, 48940-329-01 *ULP User Guide* and in 48940-313-01 *PowerPacT H-, J-, and L-Frame with MicroLogic Trip Unit User Guide*.

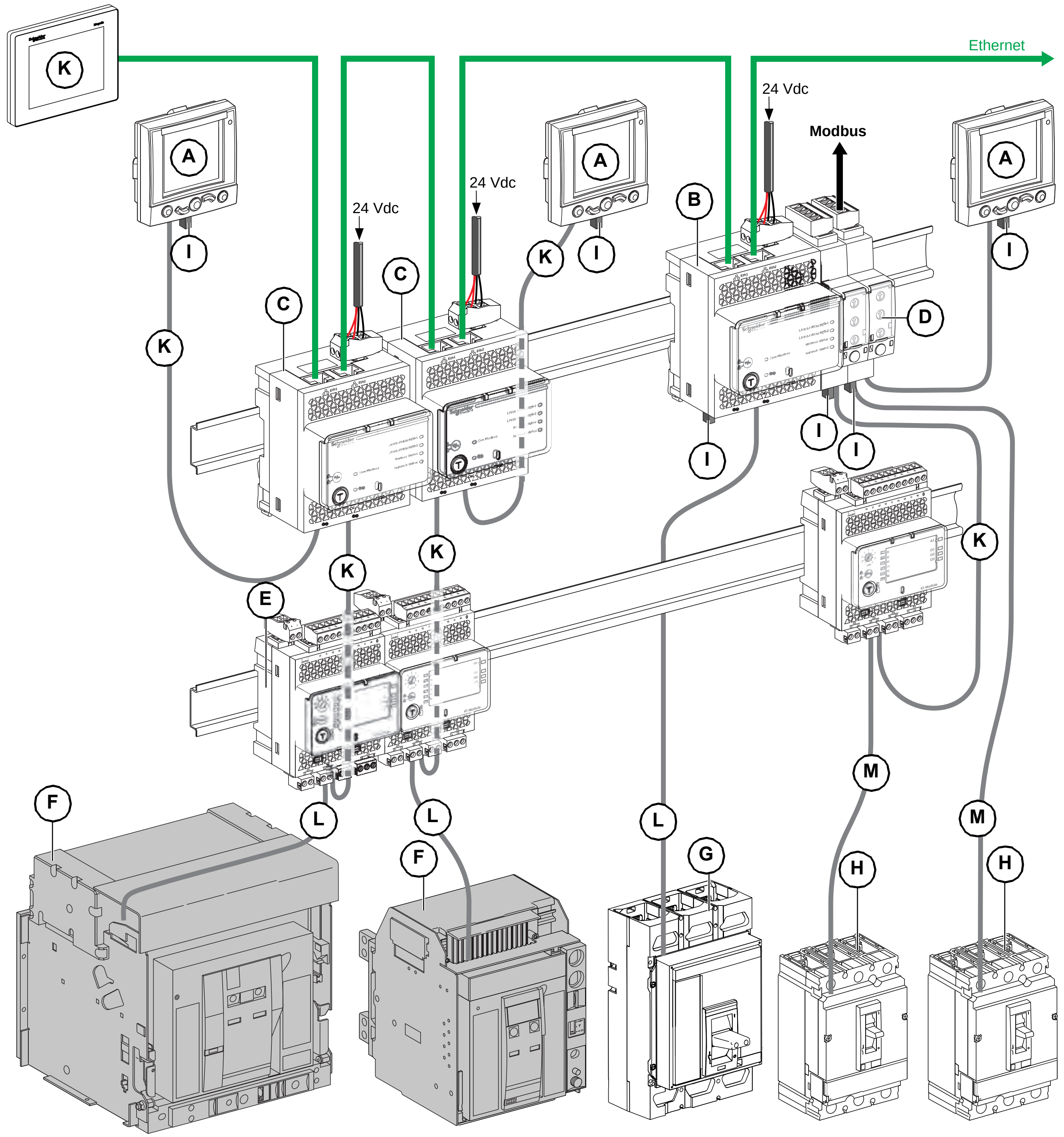
Interfacing New Two-Wire Modbus and Smart Communications Systems with Four-Wire Modbus Systems

Figure 3 shows the new Smart System wiring and components for two-wire Modbus + ULP.

In most cases you can keep the four-wire Modbus system and interface with a new installation at the Ethernet level either at the EGX gateway, IFE module, or at the power meter device. See Figure 4 for recommended connections.

If you want to interface new and existing systems at the Modbus level, See Figure 5 for recommended connections.

Figure 3 – MasterPacT and PowerPacT P/R Circuit Breakers in a System with H, J, and L-Frame Circuit Breakers with MicroLogic Trip Units (Two-Wire Systems with Smart System™ components)



A. FDM121 (TRV00121)
B. IFE Server (LV434002)
C. IFE (LV434001)
D. IFM (LV434000)
E. IO application module (LV434063)
F. MasterPacT NT/NW
G. PowerPacT P/R
H. PowerPacT H/J/L
I. ULP termination (TRV00880)
J. FDM128 (LV434128)
K. ULP cable
L. Circuit breaker ULP cord
M. NSX cord

Figure 4 – MasterPacT and PowerPacT P/R-Frame in a System with H, J, and L-Frame Circuit Breakers with MicroLogic Trip Units (Four-Wire and Two-Wire) Connected at Ethernet Level

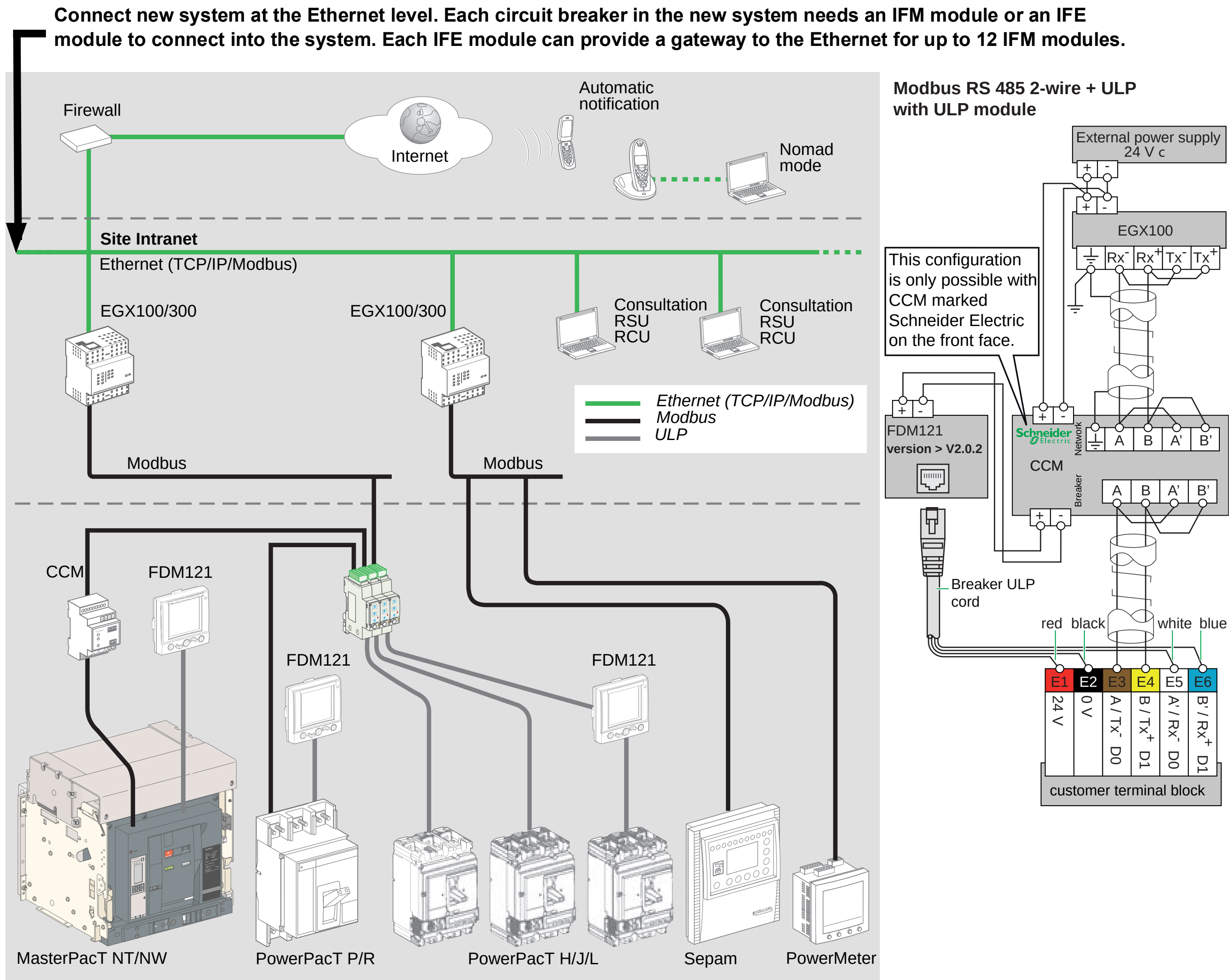
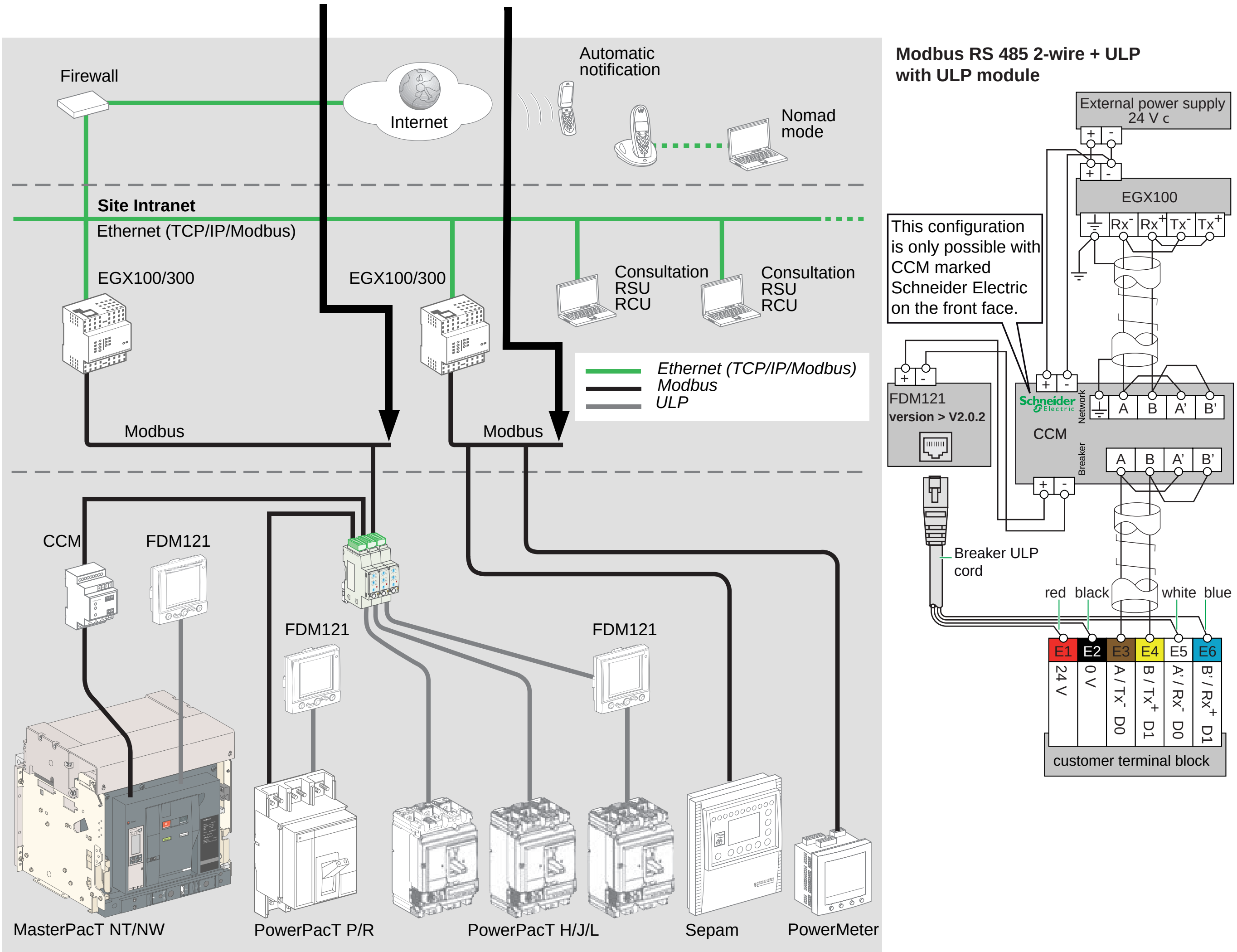


Figure 5 – MasterPacT and PowerPacT P/R-Frame in a System with H, J, and L-Frame Circuit Breakers with MicroLogic Trip Units (Four-Wire and Two-Wire) Connected at Modbus Level

Connect new system at the Modbus level. Each circuit breaker in the new system needs an IFM module to connect into the system so that it can be addressed and respond to the Modbus system. Be sure to select Modbus addresses in the new system that do not overlap with the addresses in the old system.



Converting Legacy Four-Wire Modbus Communications to Smart System Components.

General Information

For more information on Smart System with ULP, see 0613IB1313 and 0602IB1503 for instructions.

Fixed Circuit Breaker Communications System

Figure 6 – Existing Four-Wire Modbus System

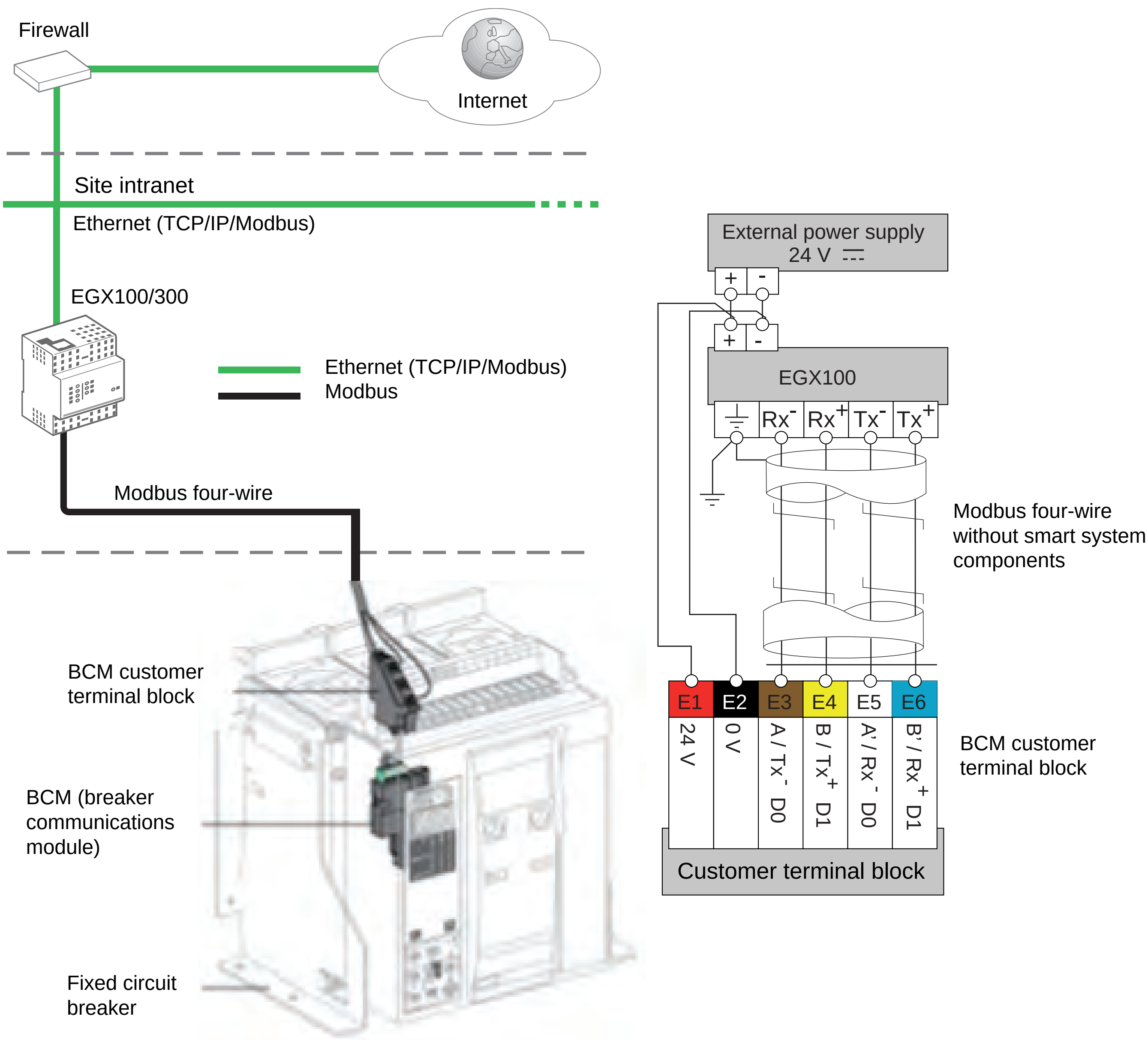
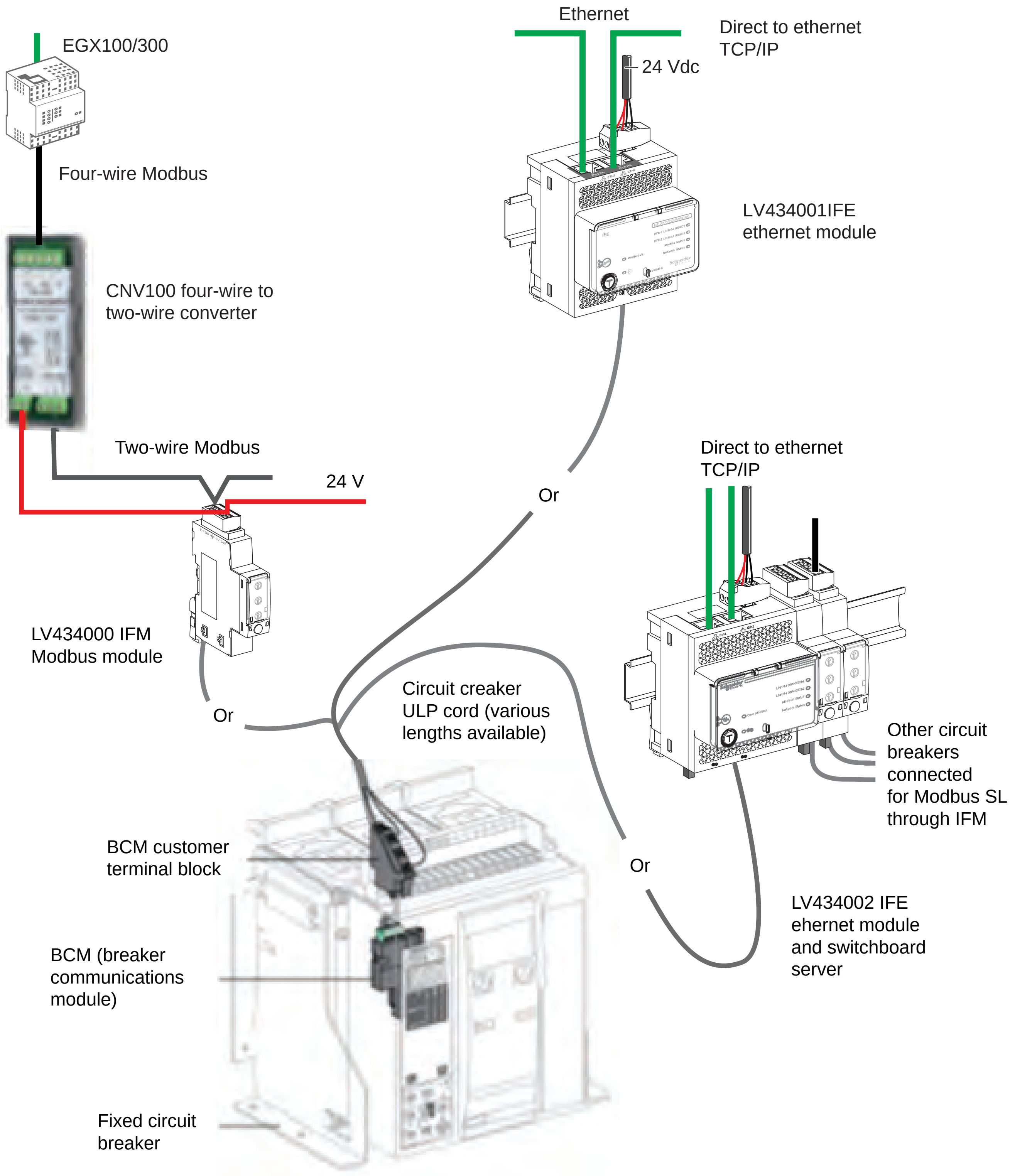


Figure 7 – New Smart System



Drawout Circuit Breaker Communications System

Figure 8 – Existing Four-Wire Modbus System

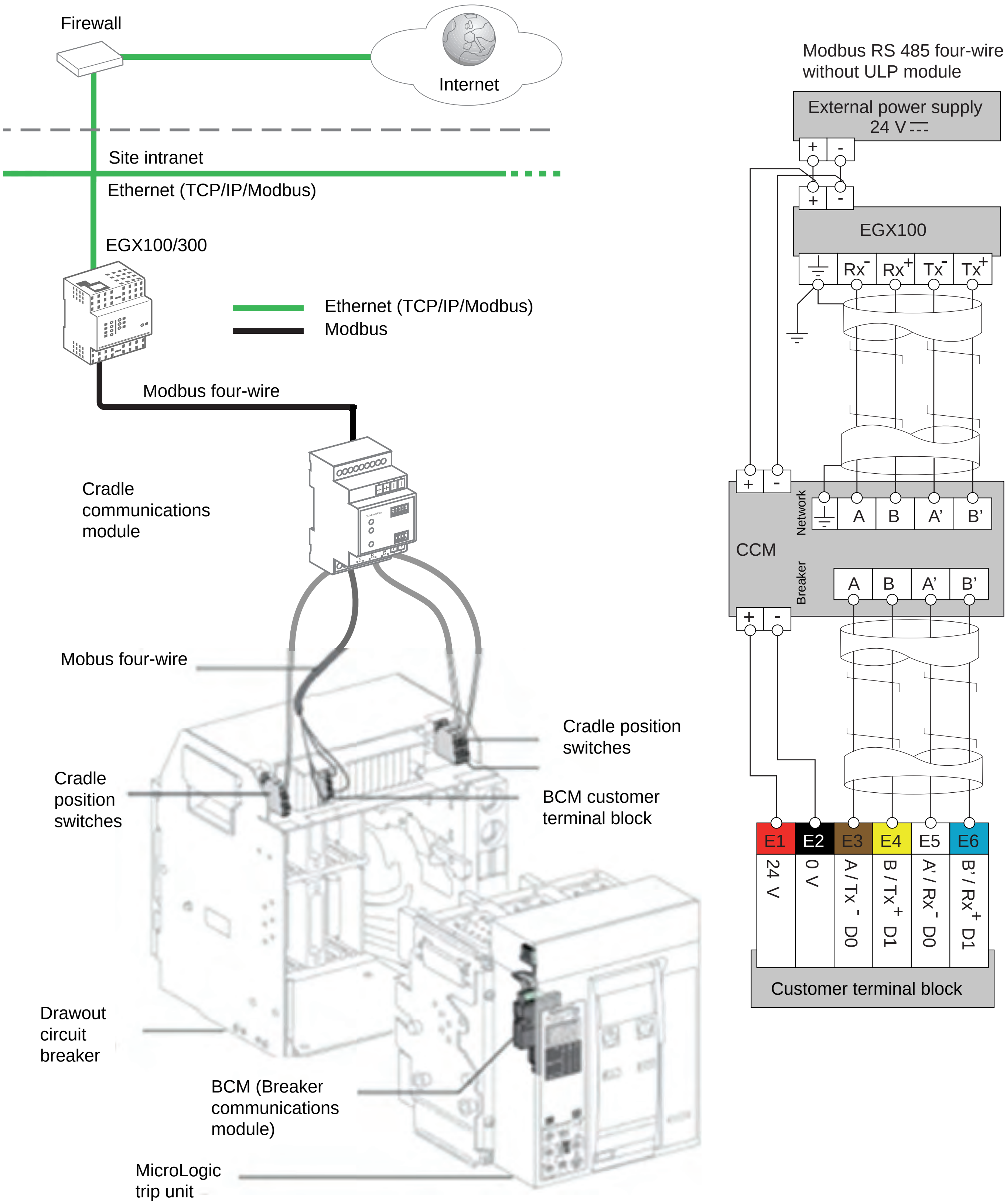
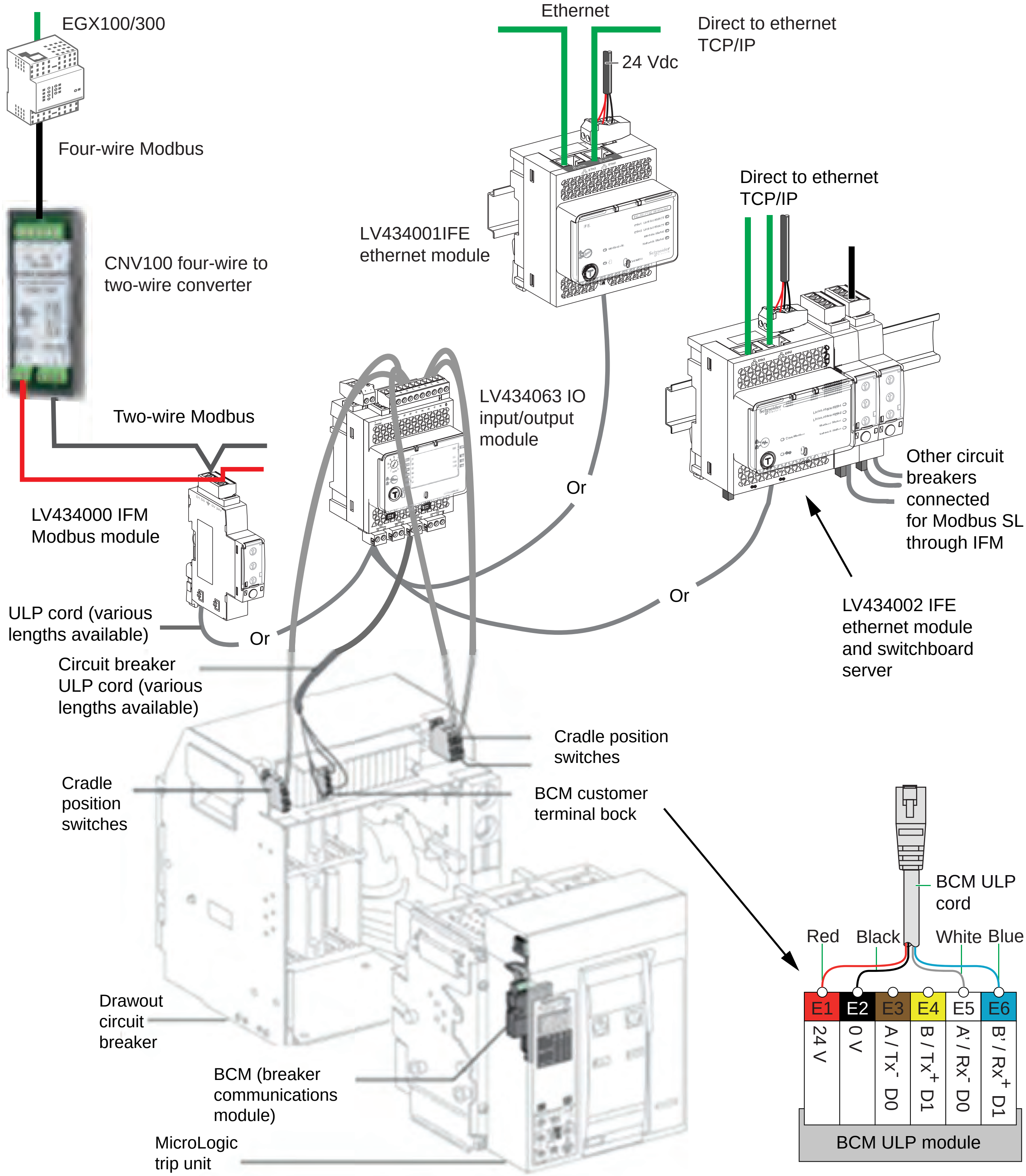


Figure 9 – New Smart System



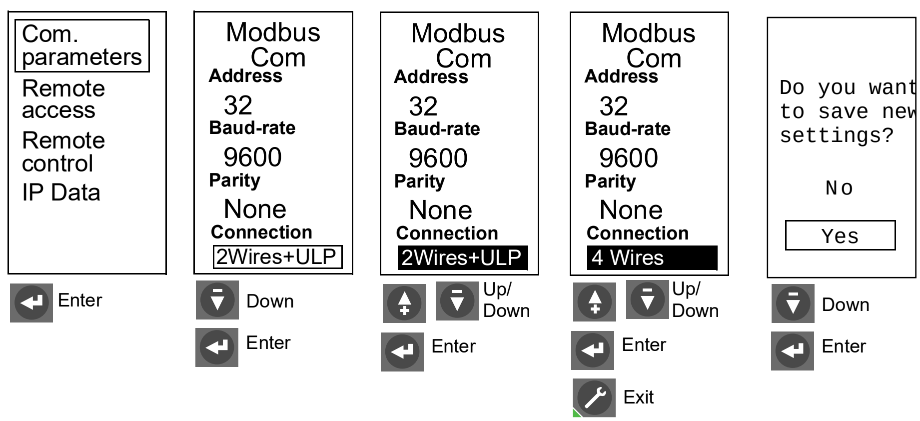
Replacing the BCM (Breaker Communications Module)

If you need to replace the BCM in an existing system with four-wire Modbus, do the following steps.

Note: This option is only available for P & H trip units with firmware version 2010AK or later. If your trip unit does not have this option then follow the process described in Step 3 for MicroLogic A trip units.

1. Order a replacement BCM – part number S48384.
2. For a MicroLogic P- or H-trip unit, change the communication parameter in the BCM to four-wire Modbus by doing the following.
   a. Replace the BCM using the Installation Bulletin that came with the new BCM.
   b. Connect the wiring to the BCM.
   c. Turn on the 24 Vdc control power to the BCM E1(+)-E2(-) and the MicroLogic trip unit F1(-) and F2 (+).
   d. Press the wrench key (Maintenance button) and scroll to COM SETUP.
   e. Scroll to COM PARAMETER and to the bottom of the screen to 2wire+ULP/4wires.
   f. Select 4wires and save selection.

Figure 10 – Setting Trip Unit Connection Value

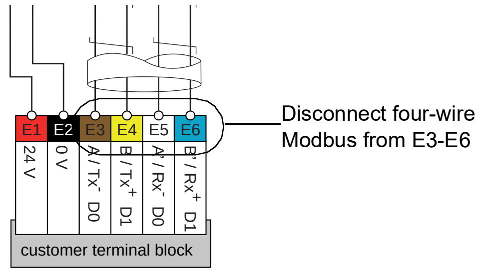


3. If you have a MicroLogic A trip unit, the communication parameter cannot be changed with the trip unit interface. The communication parameter can be changed by doing the following steps:
   a. Order the following parts:

Qty	Reference Number	Description
1	S48384	BCM (breaker communications module)
1	LV434001	IFE Ethernet interface module
1	Depending on length needed	Breaker ULP cord
	LV434196	L = 1.3 m (4.26 ft)
	LV434197	L = 3 m (9.84 ft)
1	Depending on length needed	ULP cable
	TRV00810	L = 1 m (3.28 ft), 5 cables
	TRV00820	L = 2 m (6.56 ft), 5 cables

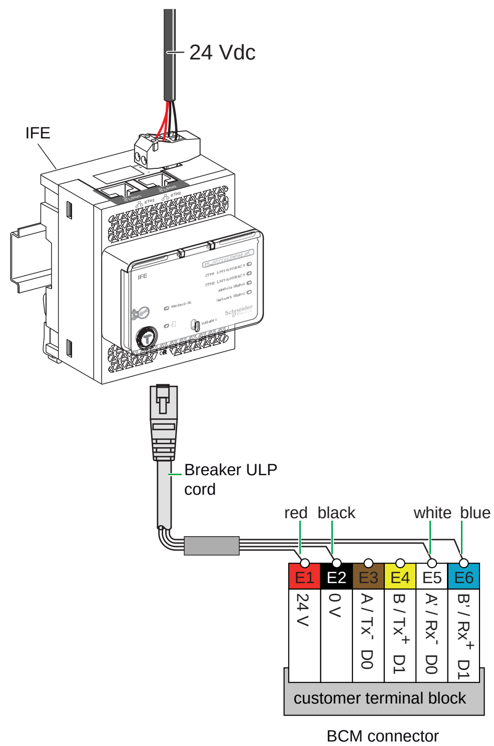
b. Replace the BCM using the Installation Bulletin that came with the new BCM.

c. Disconnect the four-wire Modbus from the green connector for the BCM. Mark and disconnect the wires from terminals E3, E4, E5, and E6. Also disconnect the 24 Vdc wiring from E1 and E2.



d. Connect the ULP cord (LV434196 or LV434197 depending on length) white wire to terminal E5 and the blue wire to terminal E6. Also connect the red wire to E1(+) and black wire to E2(-). Plug the connector into the new BCM.

e. Plug the other end of the ULP cord into an IFE (LV434001). Connect 24 Vdc wiring that was connected to the E1 and E2 connector in the BCM to the top of the IFE. Add terminals and additional wiring as necessary.



f. Download the Customer Engineering Tool - EcoStruxure Power Commission V2.2 or later from the Schneider Electric internet (http://www.schneider-electric.com). Install the EcoStruxure Power Commission software on your laptop.

g. Read the IFE address on the front of the IFE module (B) Example: IFE-E3.15.92. Convert the last two characters in the address from hexadecimal to decimal and add the decimal equivalents to the end of the default IP address: 169.254.xx.xxx. Example: 15 converts to 21 and 92 converts to 146. Then – 169.254.21.146 is the IP address for the IFE module shown in this example. Record the IP address from this step 169.254. __.___.

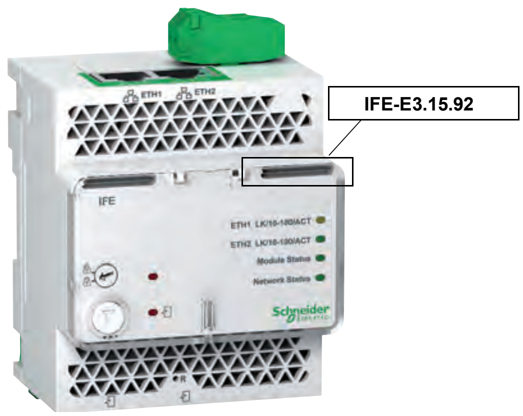
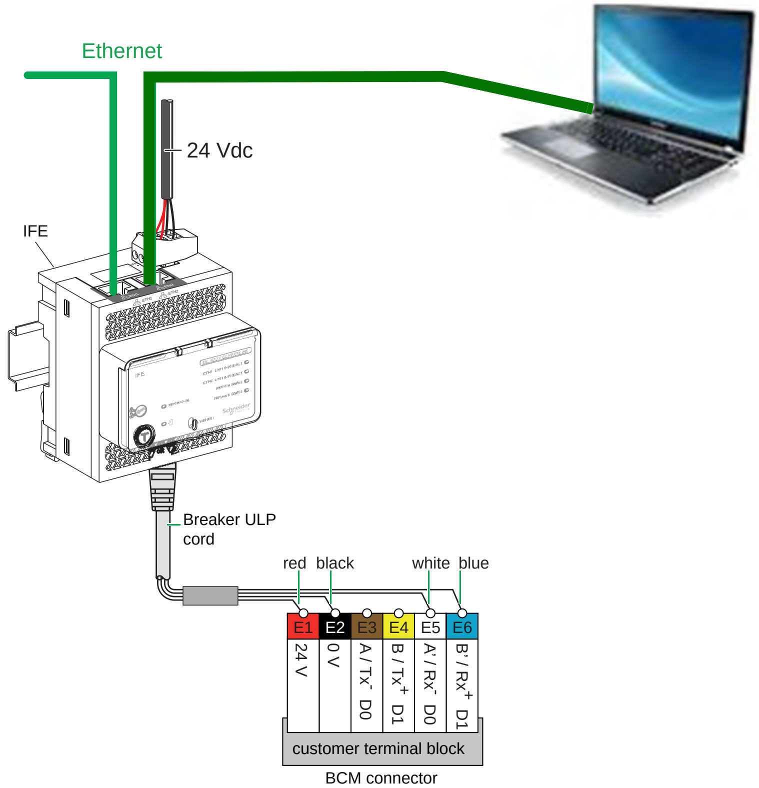


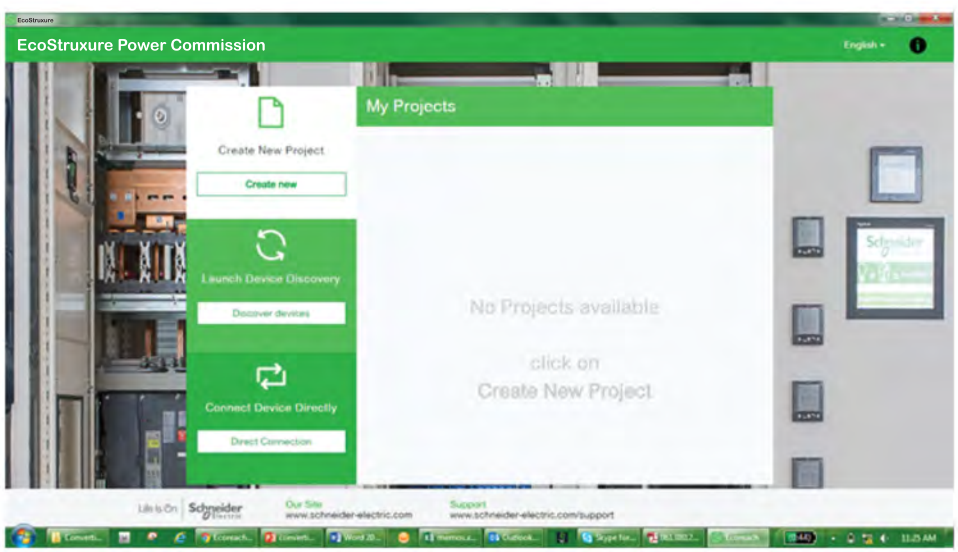
Table 1 – Hex to Decimal Conversion

Hex	Dec.	Hex	Dec.	Hex	Dec.	Hex	Dec.	Hex	Dec.	Hex	Dec.	Hex	Dec.	Hex	Dec.	Hex	Dec.	Hex	Dec.
0	0	1A	26	34	52	4E	78	68	104	82	130	9C	156	B6	182	D0	208	EA	234
1	1	1B	27	35	53	4F	79	69	105	83	131	9D	157	B7	183	D1	209	EB	235
2	2	1C	28	36	54	50	80	6A	106	84	132	9E	158	B8	184	D2	210	EC	236
3	3	1D	29	37	55	51	81	6B	107	85	133	9F	159	B9	185	D3	211	ED	237
4	4	1E	30	38	56	52	82	6C	108	86	134	A0	160	BA	186	D4	212	EE	238
5	5	1F	31	39	57	53	83	6D	109	87	135	A1	161	BB	187	D5	213	EF	239
6	6	20	32	3A	58	54	84	6E	110	88	136	A2	162	BC	188	D6	214	F0	240
7	7	21	33	3B	59	55	85	6F	111	89	137	A3	163	BD	189	D7	215	F1	241
8	8	22	34	3C	60	56	86	70	112	8A	138	A4	164	BE	190	D8	216	F2	242
9	9	23	35	3D	61	57	87	71	113	8B	139	A5	165	BF	191	D9	217	F3	243
A	10	24	36	3E	62	58	88	72	114	8C	140	A6	166	C0	192	DA	218	F4	244
B	11	25	37	3F	63	59	89	73	115	8D	141	A7	167	C1	193	DB	219	F5	245
C	12	26	38	40	64	5A	90	74	116	8E	142	A8	168	C2	194	DC	220	F6	246
D	13	27	39	41	65	5B	91	75	117	8F	143	A9	169	C3	195	DD	221	F7	247
E	14	28	40	42	66	5C	92	76	118	90	144	AA	170	C4	196	DE	222	F8	248
F	15	29	41	43	67	5D	93	77	119	91	145	AB	171	C5	197	DF	223	F9	249
10	16	2A	42	44	68	5E	94	78	120	92	146	AC	172	C6	198	E0	224	FA	250
11	17	2B	43	45	69	5F	95	79	121	93	147	AD	173	C7	199	E1	225	FB	251
12	18	2C	44	46	70	60	96	7A	122	94	148	AE	174	C8	200	E2	226	FC	252
13	19	2D	45	47	71	61	97	7B	123	95	149	AF	175	C9	201	E3	227	FD	253
14	20	2E	46	48	72	62	98	7C	124	96	150	B0	176	CA	202	E4	228	FE	254
15	21	2F	47	49	73	63	99	7D	125	97	151	B1	177	CB	203	E5	229	FF	255
16	22	30	48	4A	74	64	100	7E	126	98	152	B2	178	CC	204	E6	230		
17	23	31	49	4B	75	65	101	7F	127	99	153	B3	179	CD	205	E7	231		
18	24	32	50	4C	76	66	102	80	128	9A	154	B4	180	CE	206	E8	232		
19	25	33	51	4D	77	67	103	81	129	9B	155	B5	181	CF	207	E9	233		

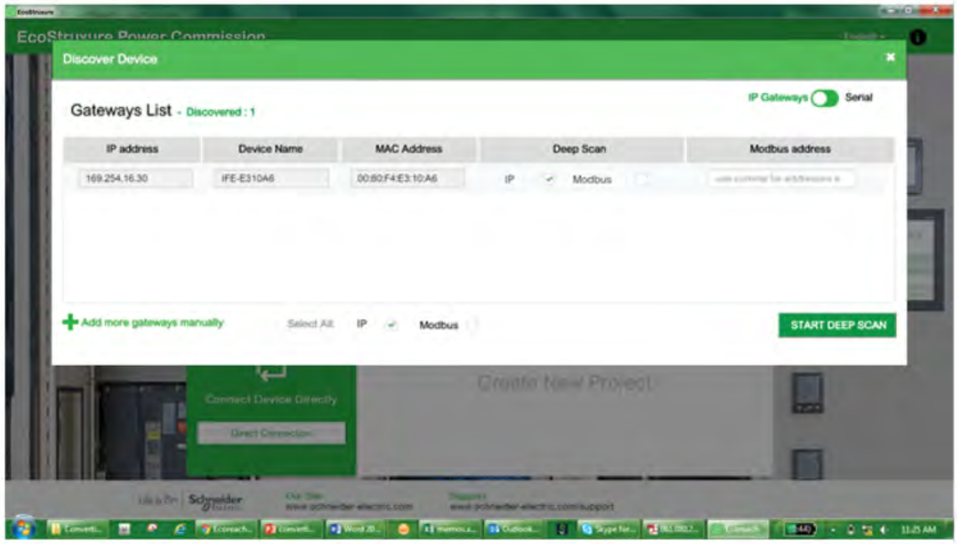
h. Use an appropriate length of ULP cable to connect the laptop to the Ethernet port ETH1 on top of the IFE module. Leave the Ethernet port ETH2 open.



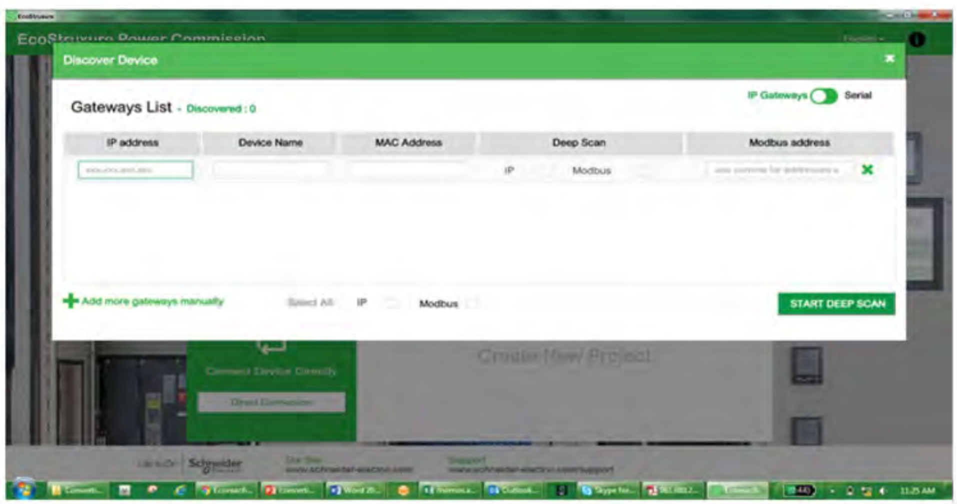
i. Open EcoStruxure Power Commission program and select Discover devices.



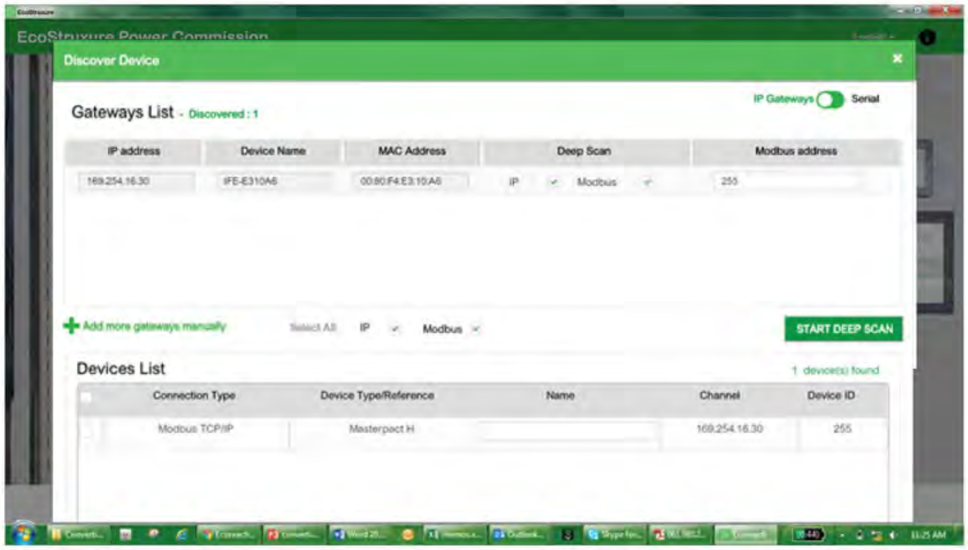
j. EcoStruxure Power Commission will normally discover the IFE connected. If the IFE is not discovered, go to next step.



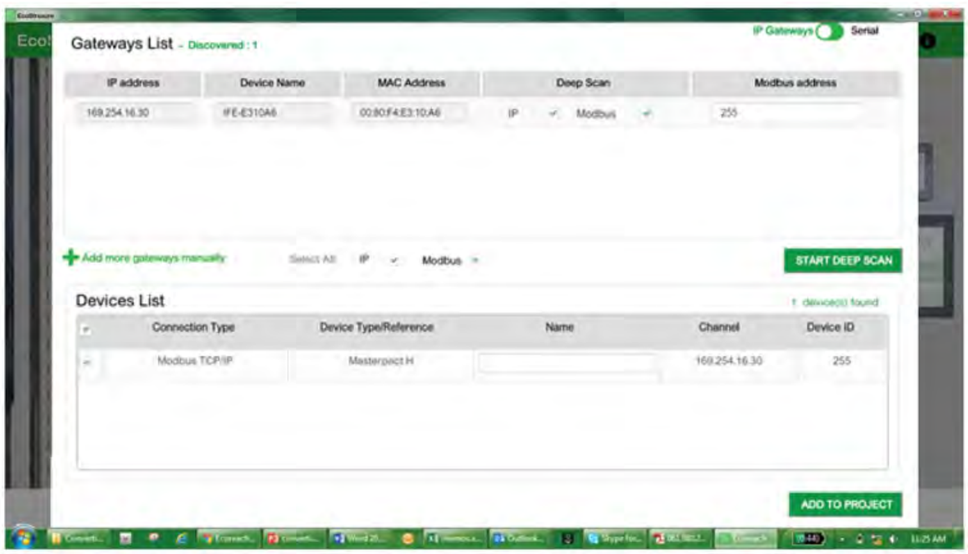
k. If EcoStruxure Power Commission did not discover the IFE, click on add more gateways manually and fill in the address you recorded in step g.



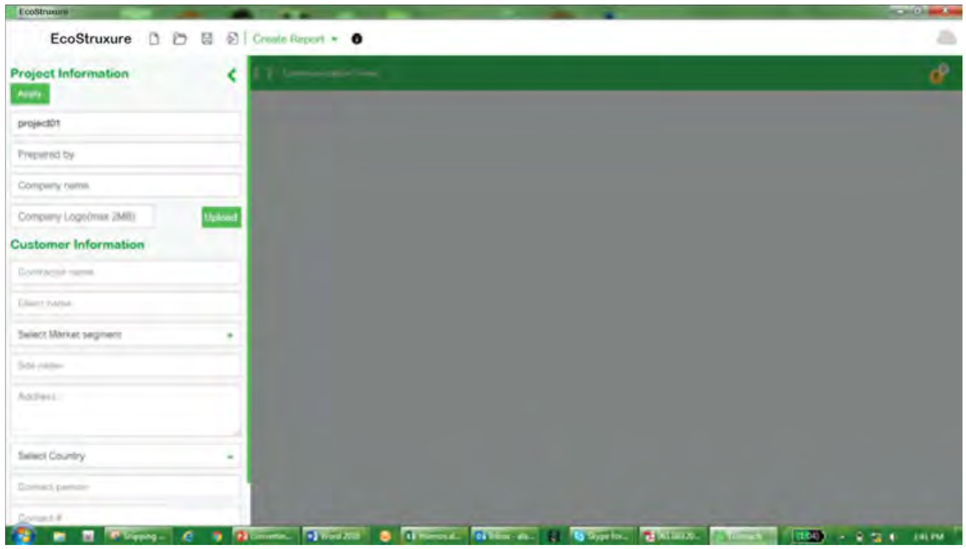
l. Check box by Modbus and enter address 255. Press Start Deep Scan.



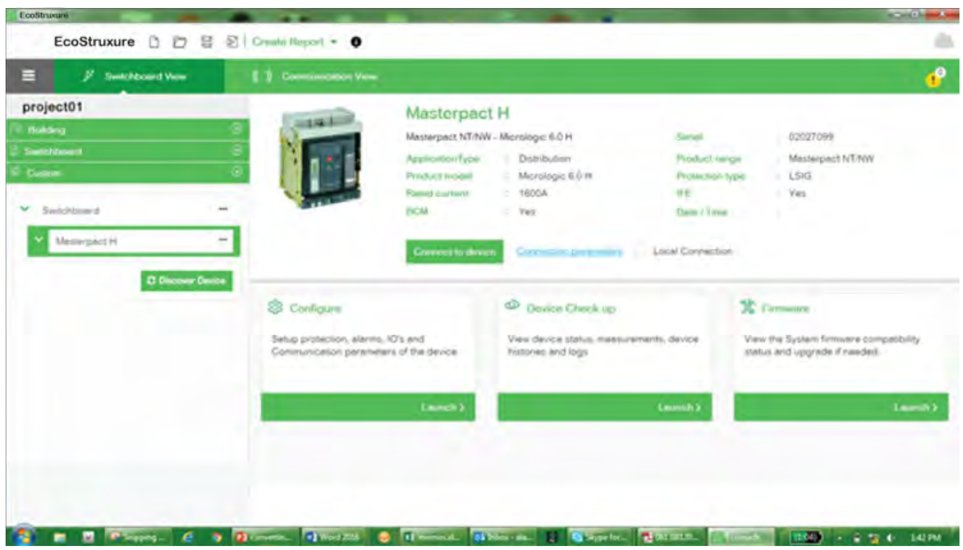
m. Check the box in the device list and click Add to Project.



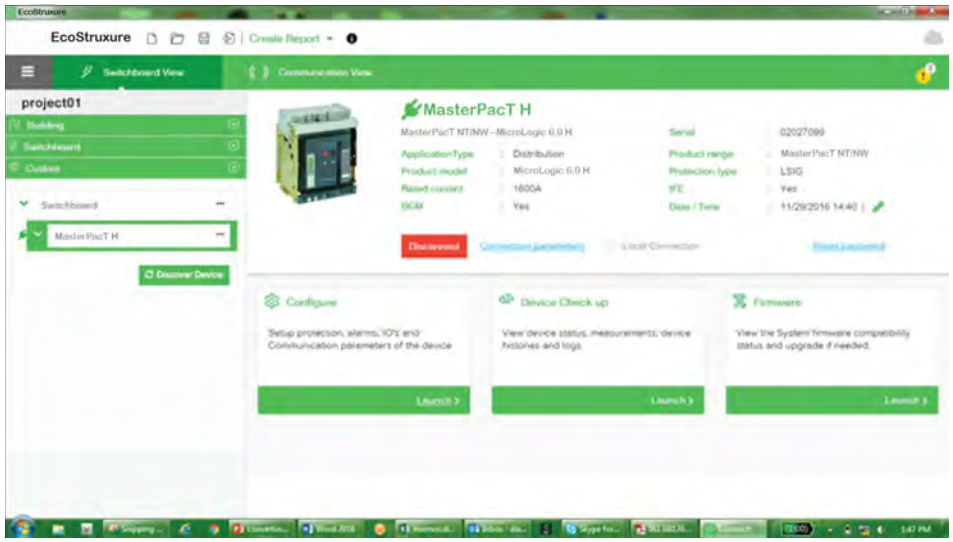
n. Click Apply.



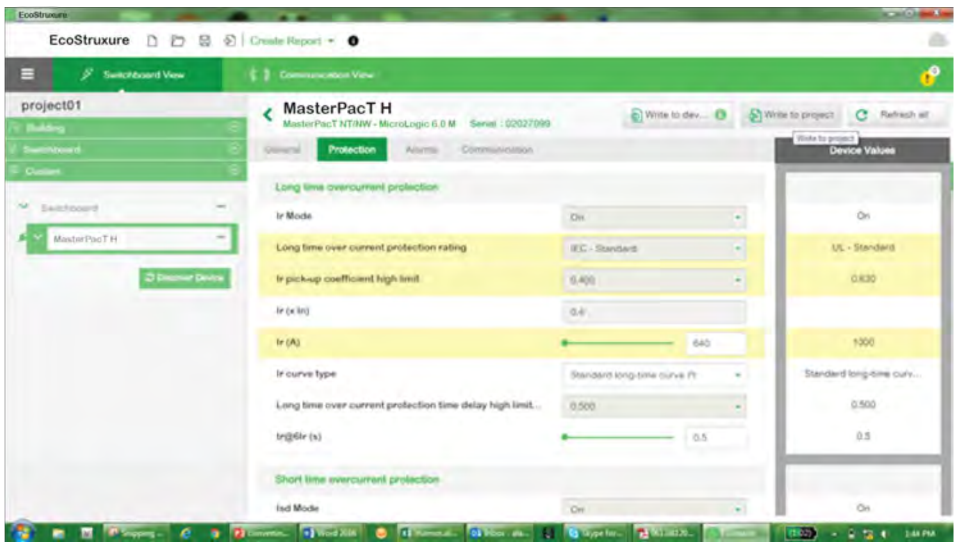
o. Click Connect to breaker.



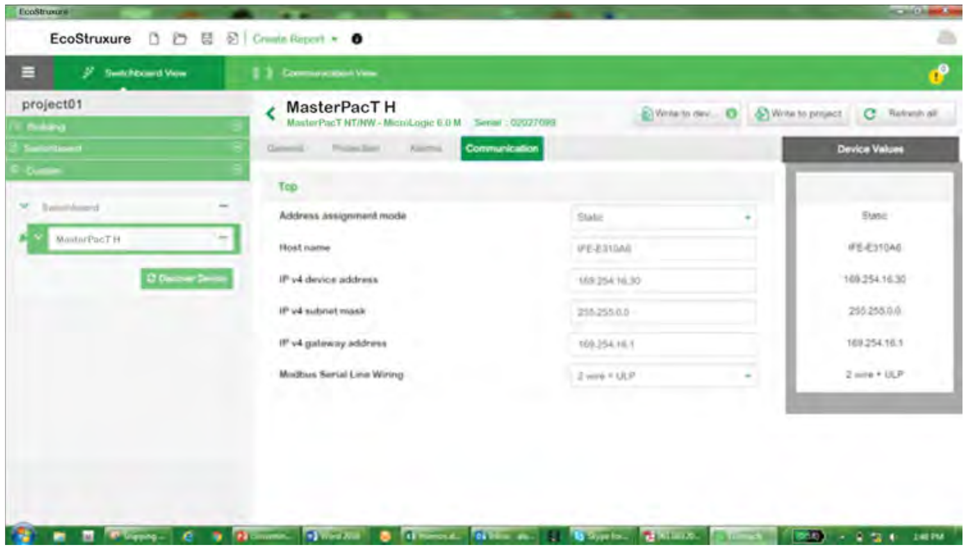
p. Click on Launch Configure.



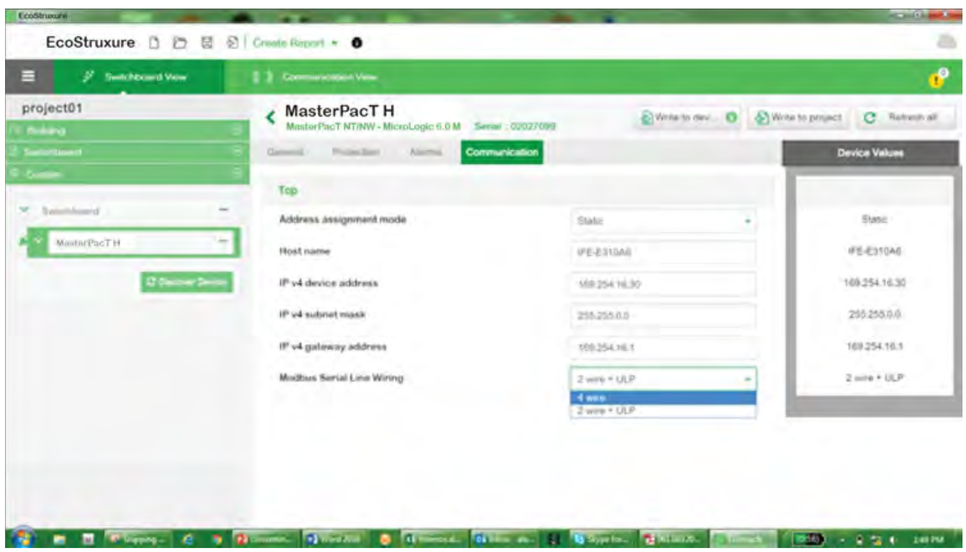
q. Click Write to project



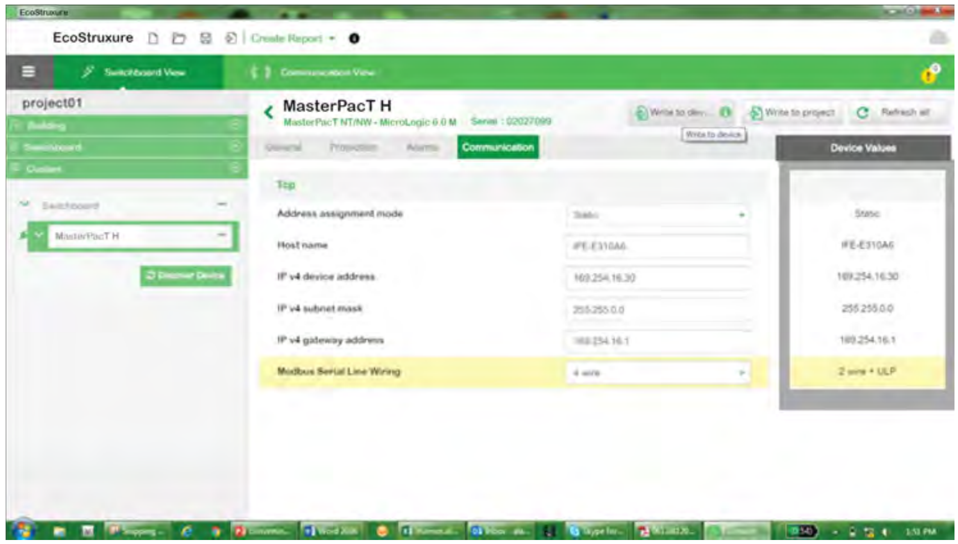
r. Click on Communications



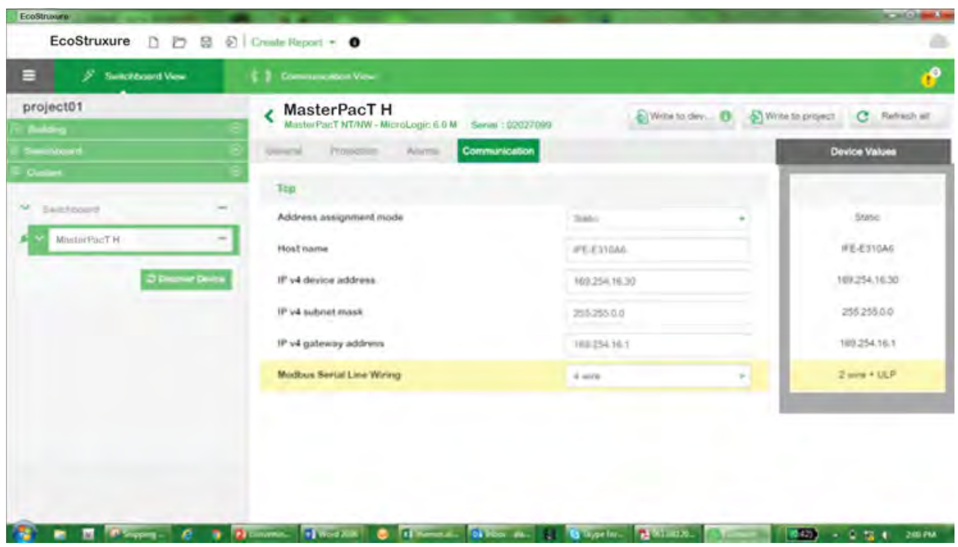
s. Change Modbus serial line wiring to 4 wire.



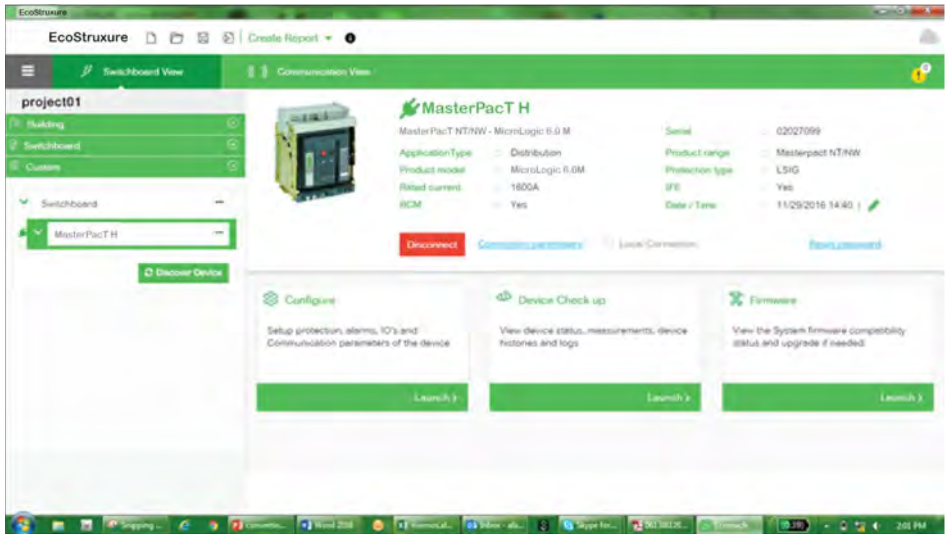
t. Click Write to device.



u. Click the back arrow.

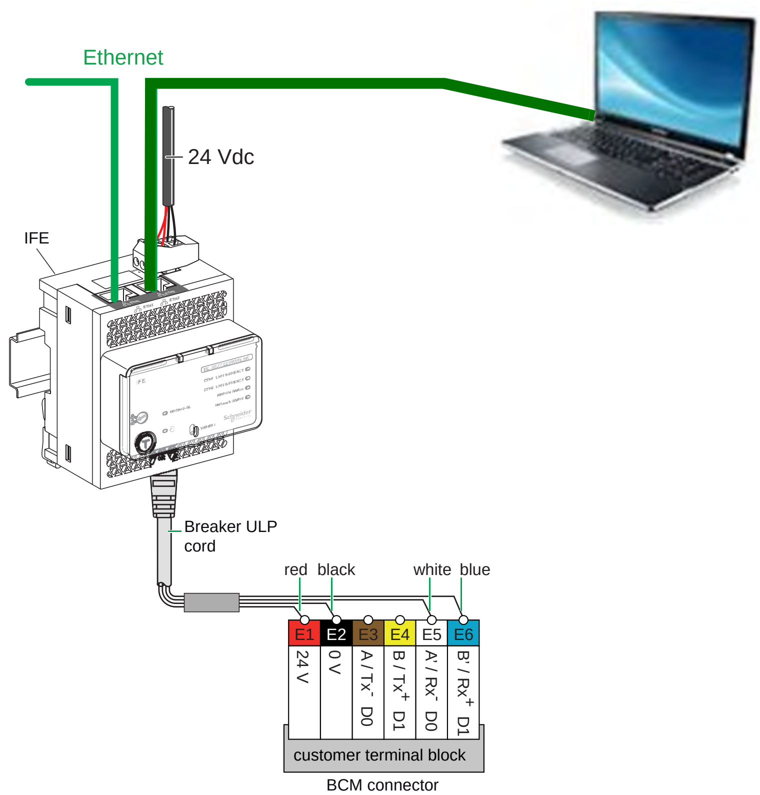


v. Click Disconnect.

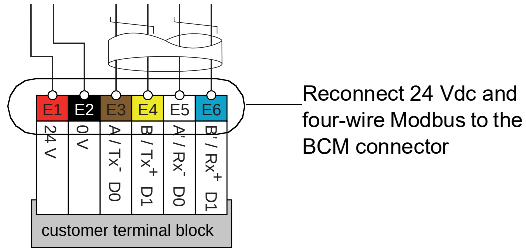


w. Close EcoStruxure Power Commission and click Leave.

x. Disconnect the laptop and ULP cable from the IFE. Disconnect the circuit breaker ULP cord from the IFE. Disconnect the ULP cord wires from the BCM connector.



y. Disconnect the 24 Vdc connections from the IFE. Reconnect the 24 Vdc red and black wires to the BCM connector at terminals E1(red) and E2 (black). Also reconnect the four-wire modbus connections to E3 – E6 per the marking done during disassembly.



Replacing the CCM (Cradle Communications Module)

If you need to replace the CCM (S48377) in an existing system.

1. Convert to the new system by using an IO module to replace the CCM. This will require the following steps to complete the conversion and to get your system functioning as before.

Convert to new system by using the IO module

Order the following parts:

Qty	Reference number	Description L
1	LV434063	IO module
1	S48384	BCM (breaker communications module)
1	LV434000	IFM module
1	CNV100	Four-wire to two-wire converter
1	Depending on length needed LV434195 LV434196 LV434197	Breaker ULP cord L = 0.35 m (1.15 ft) L = 1.3 m (4.26 ft) L = 3 m (9.84 ft)
1	Depends on length needed TRV00803 TRV00806 TRV00810 TRV00820	ULP cable L = 0.3 m (0.98 ft), 10 cables L = 0.6 m (1.97 ft), 10 cables L = 1 m (3.28 ft), 5 cables L = 2 m (6.56 ft), 5 cables

Determine the Address for the trip unit.

For MicroLogic P or H trip units, press the wrench key (maintenance) and do the following:

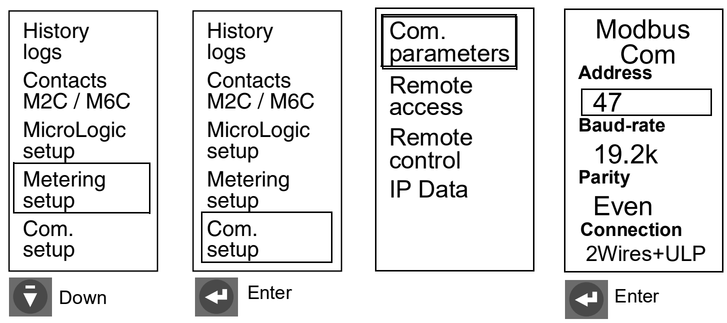
Communication Module Setup

1. Use “Com. setup” menu to set communication module setup.

   Note: Com. setup parameters can only be entered if a circuit breaker communication module (BCM) is installed.

2. Record the Address.

Figure 11: Communication Module Setup



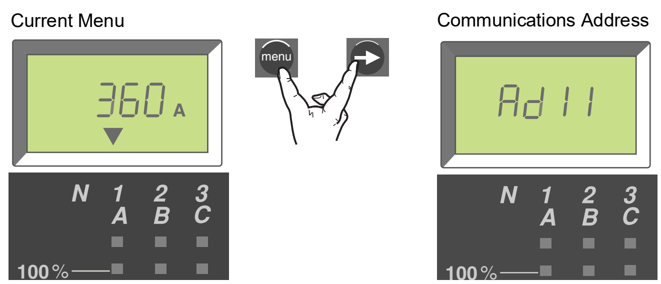
For MicroLogic A trip units, do the following steps:

Note: Com. setup parameters can only be entered if a circuit breaker communication module (BCM) is installed.

To access the communication module menu:

1. Current menu is displayed.
2. Simultaneously press both menu button and scroll button down for three seconds.
3. Communication module addressing menu will appear.
4. Record the address.

Figure 12: Access Communication Module Menu



⚠ ⚠ DANGER

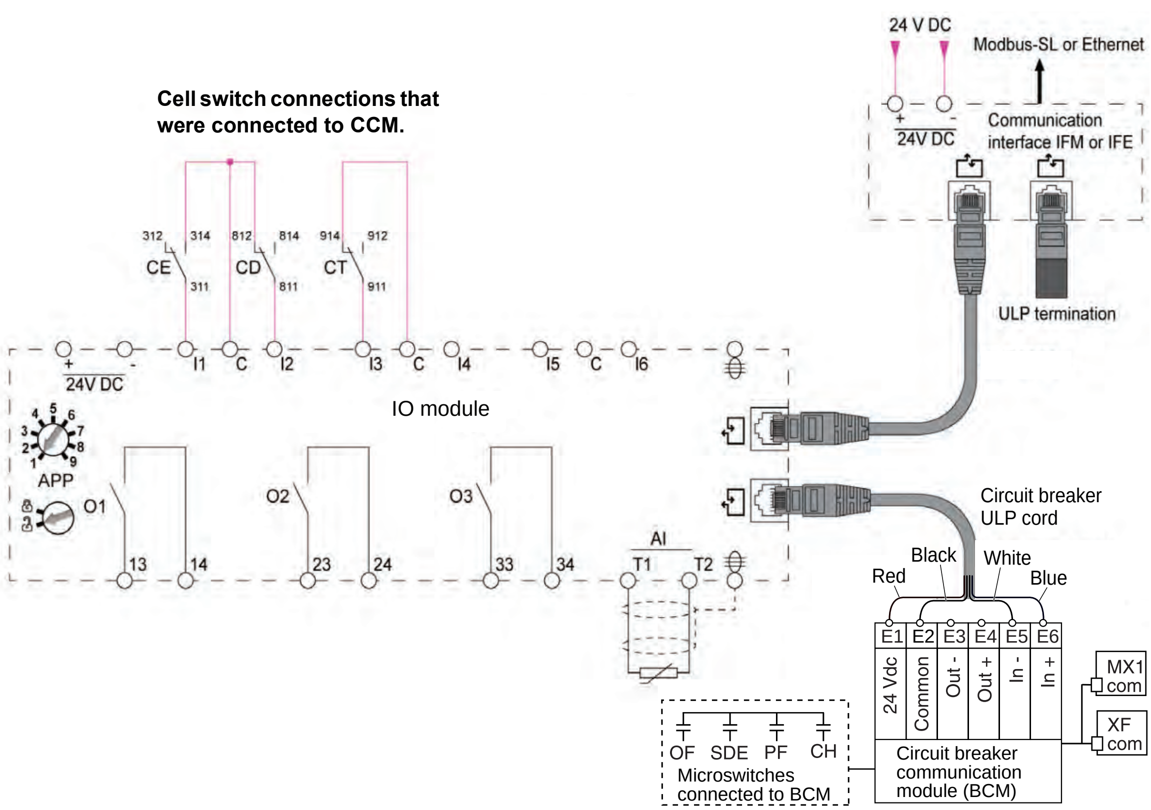
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E or CSA Z462.
- This equipment must only be installed and serviced 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.

5. Replace the BCM (See Figure 13 and for system diagram).
   a. Observe all safety instructions and warnings. Disconnect power to the circuit breaker.
   b. Use the instructions supplied with the BCM. Remove the trip unit and BCM from the circuit breaker.
   c. Install the new BCM and replace the trip unit.
   d. Disconnect the Modbus wiring from the circuit breaker cradle connections that come from the CCM.
   e. Install the circuit breaker ULP cord to the circuit breaker cradle connection for the BCM. Connect E1 – E6 as shown below.

Figure 13 – Connect E1 through E6



f. Find the CCM on the DIN rail near the circuit breaker cradle. Mark the wires connected to the CCM to make sure they can be installed correctly onto the IO module. Disconnect 24 Vdc power from the CCM.

g. Remove the CCM from the DIN rail.

h. Check the DIN rail for proper grounding – make sure the DIN rail is grounded to a good system ground.

i. Install the IO module onto the DIN rail. There is a ground shoe in the DIN rail mounting on the IO module.

j. Use the instructions with the IO module to connect the circuit breaker cradle position switches to the IO module terminals.

k. Connect the circuit breaker ULP cord from the BCM to one of the ULP connections in the IO module. See Figure 13 above.

l. Determine a suitable mounting area for the IFM module and the four-wire to two-wire converter. Keep in mind that the 24 Vdc control power that was connected to the CCM will need to be moved to power the IFM module and the four-wire to two-wire converter. Also the four-wire Modbus wiring that was connected to the CCM will need to be moved to the four-wire to two-wire converter. Add terminals and additional wiring as necessary.

m. Install the IFM module and four-wire to two-wire converter near the IO module as necessary. Connect the 24 Vdc control power that was on the CCM to the IFM module and four-wire to two-wire converter.

n. Connect the four-wire Modbus wiring to the four-wire to two-wire converter as described in the installation instructions.

o. Also connect two-wire Modbus between the four-wire to two-wire converter and the IFM module terminals.

p. Use a ULP cable to connect between the IO module ULP connection to the IFM module.

q. Use the dials on the IFM module to select the trip unit address that was recorded in steps 2 or 4.

Note: The IFM module is shipped with the standard firmware. This standard firmware responds to one unique Modbus secondary address (set by the two rotary switches on the front panel of the IFM module) and therefore is not compatible with legacy application firmware using Modbus secondary address offset (x + 100, x + 200 and x + 50 for the CCM cradle communication module application with IO module). (See page 15 for offset addresses.) In order to be compatible with legacy application firmware using Modbus secondary address offset (x + 100, x + 200 and x + 50 for the CCM application using IO module), it is mandatory to download the MasterPacT legacy firmware into the IFM module. Please contact Schneider Electric customer support for IFM legacy firmware.

Customer Engineering Tool (EcoStruxure Power Commission)

Definition

The customer engineering tool used to configure the IFM module or IFE module is EcoStruxure Power Commission, the Electrical Asset Manager software, or:

- ComPacT NSX RSU software
  - to configure the IFM module
  - to update the IFM and IFE firmware
  - to manage the passwords
  - to set date and time.
- MasterPacT RSU software
  - to configure the IFM module
  - to configure the MasterPacT predefined alarm.
- RCU software to check the network communication with IFM and IFE modules.

The customer engineering tools are available at www.schneider-electric.com.

EcoStruxure Power Commission

For more information, see the EcoStruxure Power Commission Online Help.

Appendix A— Registers

Formats

UINT	UINT corresponds to a 16-bit unsigned integer with an interval of values from 0x 0000…0 x FFFF (0…65535).
INT	INT corresponds to a 16-bit signed integer with an interval of values from 0x 8000…0 x 7FFF (-32768…+32767).
Mod10000	Mod10000 corresponds to n registers in the INT format. Each register contains an integer from 0 to 9999. A value V representing n registers is calculated as indicated below: V = sum(R[n] + R[n + 1] x 10000 +..+ R[n + m] x 10000 (m-1)), where Rn is the number of register n. Example: Register 2000 = 123; Register 2001 = 4567; Register 2002 = 89; Register 2003=0 Energy = 123 + 4567 x 10 000 + 89 x (10 000)² + 0 = 89 4567 0123 kWh
SFIXPT	SFIXPT corresponds to a signed INT integer with a fixed point. The position of the point is indicated by the scale factor. The interval of values is: -32767… +32767 with a scale factor “x 1”. Other example: -32.767 … +32.767 with a scale factor “x 1000”.
Date	Date corresponds to a normal date made up of three UINT, as follows: • first UINT: month expressed using the eight most-significant bits (January = 0x41)[1] day expressed using the eight least-significant bits, • second UINT: year expressed using the eight most-significant bits (modulo 100) (00 to 49 = years 2000 to 2049, from 50 to 99 = years 1950 to 1999) hours expressed using the eight least-significant bits, • third UINT: minutes expressed using the eight most-significant bits seconds expressed using the eight least-significant bits.
XDATE	XDATE corresponds to an extended date made up of four UINT, as follows: • first UINT: month expressed using the eight most-significant bits (January = 0x41)[1] day expressed using the eight least-significant bits, • second UINT: year expressed using the eight most-significant bits (modulo 100) (00 to 49 = years 2000 to 2049, from 50 to 99 = years 1950 to 1999) hours expressed using the eight least-significant bits, • third UINT: minutes expressed using the eight most-significant bits seconds expressed using the eight least-significant bits. • fourth UINT: milliseconds.
ASCII	ASCII corresponds to a series of n UINT registers forming a string of ASCII characters. The first character is contained in the eight most-significant bits of the register. The start of the string is in the first register.

[1] If the most-significant bit is set, the date and time may be incorrect.
There are two possibilities:
• no synchronization with the supervisor,
• loss of power.
If power has been lost, the self-test bitmap “D/T loss” is enabled until the date and time are enabled (via the control unit or the communication module).

Trip / Alarm History

Trip Record

Trip Record format matches the trip history displayed on the graphic screen of the MicroLogic (P/H only).

Trip Record format presents the characteristics of a fault trip. It corresponds to a series of ten fields (9100, 9120, 9140,…,9280) with a total of 20 registers.

Register 9099 returns the value of the pointer for the last fault recorded in the trip history.

Each field (containing 20 registers) is presented below:

Table 42 – Trip Record Fields

Field	Number of Registers	Format	Interval	N/A	Description
___.XtedDT	4	XDATE	Cfformat	0x8000	Trip date.
___.ActCause AlarmNum	1	INT	0..1031	0x8000	Number of alarm causing activation.
___.PuValue	2	MOD 1000	See Text	0x8000	Value of protection setting that caused trip.
___.PuDelay	1	INT	See Text	0x8000	Value of time delay that caused trip.
___.FaultI[0]	1	INT	0..16000	0x8000	Trip current phase A, expressed with respect to the rated current.[1]
___.FaultI[1]	1	INT	0..16000	0x8000	Trip current phase B, expressed with respect to the rated current.[1]
___.FaultI[2]	1	INT	0..16000	0x8000	Trip current phase C, expressed with respect to the rated current.[1]
___.FaultI[3]	1	INT	0..16000	0x8000	Trip current on neutral, expressed with respect to the rated current.[1]
___.WorstContact Wear	1	INT	0..32767	0x8000	New value of contact-wear indicator following a trip. The control unit records one indicator per contact. Here, only the value for the most worn contact is given. (See registers 9094 to 9097).
___.AddInfo	2	See Text	See Text	0x8000	Reserved.
___.Reserved	5	—	—	0x8000	Reserved.

[1] Expressed as x 0.1 of In (rated current).

Alarm Record

Alarm Record format matches the alarm history displayed on the graphic screen of the MicroLogic (P/H only).

Alarm Record format presents the characteristics of a fault alarm. It corresponds to a series of ten fields (9302, 9317, 9332, ..., 9437) with a total of 15 registers.

Register 9301 return the value of the pointer for the last alarm recorded in the alarm history.

Each field (containing 15 registers) is presented below:

Table 43 – Alarm Record Fields

Field	Number of Registers	Format	Interval	N/A	Description
___.XtedDT	4	XDATE	cfformat	0x8000	Alarm date.
___.ActCause AlarmNum	1	INT	0..1031	0x8000	Number of alarm causing activation.
___.PuValue	2	MOD 10000	See Text	0x8000	Value of protection setting that caused alarm activation.
___.PuDelay	1	INT	See Text	0x8000	Value of time delay that caused alarm activation.

Table 43 – Alarm Record Fields *(continued)*

Field	Number of Registers	Format	Interval	N/A	Description
___.FaultI[0]	1	INT	0..16000	0x8000	Alarm current phase A, expressed with respect to the rated current.[1]
___.FaultI[1]	1	INT	0..16000	0x8000	Alarm current phase B, expressed with respect to the rated current.[1]
___.FaultI[2]	1	INT	0..16000	0x8000	Alarm current phase C, expressed with respect to the rated current.[1]
___.FaultI[3]	1	INT	0..16000	0x8000	Alarm current on neutral, expressed with respect to the rated current.[1]
___.AddInfo	2	See Text	See Text	0x8000	Additional information, depending on type of alarm.
___.Reserved	1	—	—	0x8000	Reserved.

[1] Expressed as x 0.1 of In (rated current)

Alarm Numbers

Table 44 – Basic Protections

Description		Number
Long-time protection.	Ir	1000
Short-time protection.	Isd	1001
Instantaneous protection.	Ii	1002
Ground-fault protection.	Ig	1003
Earth-leakage protection.	IDelta n	1004
Auto Protection (DIN).		1005
Reserved.		1006..1007
Trip due to advanced protection.		1008
Trip due to extended advanced protection.		1009
Reserved.		1010..1013
Ground-fault protection alarm.		1014
Earth-leakage protection alarm.		1015

Table 45 – Advanced Protections

Description	Number
Current unbalance.	1016
Over current phase A.	1017
Over current phase B.	1018
Over current phase C.	1019
Over current on the neutral.	1020
Under voltage.	1021
Over voltage.	1022
Voltage unbalance.	1023
Over power.	1024
Reverse power.	1025
Under frequency.	1026
Over frequency.	1027
Phase rotation	1028
Current load shedding.	1029
Power load shedding.	1030
Reserved.	1031

Table 46 – Digital Alarms

Description	Number
System energized / reset.	1100
Reserved.	1101..1105
Loss of date and time.	1106
Reserved.	1107..1114
Battery low.	1115

Table of Registers

Structure of the Table

Each Modbus logical table is made up of the fields listed below.

Register	Number of the Modbus register.
Number of Registers	Number of registers that must be read or written for a given complete piece of information. This data indicates the type of register (8-bit, 16-bit or 32-bit register).
Read / Write:	
"R"	Register that may be accessed by the Modbus read functions 3, 4, 23, 20, 100 (see page 53).
"W"	Register that may be accessed by the Modbus write functions 6, 16, 22, 23 (see page 53).
"R/W"	Register that may be read and write accessed.
Scale (x n)	Value contained in the register multiplied by n. The requested information is obtained by dividing the register contents by n. The result is expressed in the indicated unit.
Unit	Unit of measurement for the value contained in the register.
Format	Format in which the information is coded.
Interval	Interval of the possible values that each register in the group {Register, Register +1, ..., Register + Nb} can have.
A, P, H	Type of control unit using the register: "A": MicroLogic A control unit "P": MicroLogic P control unit "H": MicroLogic H control unit
Description	Additional information describing the register, providing coding data and any necessary information on how to modify the register, particularly when the command interface is required to carry out the modification.
Label	Name given to all the concerned registers.

Scale Factors

Table 47 – Scale Factors

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	Description
3325	1	R / W	—	—	INT	3 2 1 0 -1 -2 -3	Scale Factor A (default value = 0) 3: Scale by 1000 2: Scale by 100 1: Scale by 10 0: Scale by 1 (no scaling) -1: Scale by 0.1 -2: Scale by 0.01 -3: Scale by 0.001

Continued on next page

Table 47 – Scale Factors *(continued)*

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	Description
3326	1	R / W	—	—	INT	3 2 1 0 -1 -2 -3	Scale Factor B (default value = 0) 3: Scale by 1000 2: Scale by 100 1: Scale by 10 0: Scale by 1 (no scaling) -1: Scale by 0.1 -2: Scale by 0.01 -3: Scale by 0.001
3327	1	R / W	—	—	INT	3 2 1 0 -1 -2 -3	Scale Factor C (default value = 0) 3: Scale by 1000 2: Scale by 100 1: Scale by 10 0: Scale by 1 (no scaling) -1: Scale by 0.1 -2: Scale by 0.01 -3: Scale by 0.001
3328	1	R / W	—	—	INT	3 2 1 0 -1 -2 -3	Scale Factor D (default value = 0) 3: Scale by 1000 2: Scale by 100 1: Scale by 10 0: Scale by 1 (no scaling) -1: Scale by 0.1 -2: Scale by 0.01 -3: Scale by 0.001
3329	1	R / W	—	—	INT	3 2 1 0 -1 -2 -3	Scale Factor E (default value = 0) 3: Scale by 1000 2: Scale by 100 1: Scale by 10 0: Scale by 1 (no scaling) -1: Scale by 0.1 -2: Scale by 0.01 -3: Scale by 0.001
3330	1	R / W	—	—	INT	3 2 1 0 -1 -2 -3	Scale Factor F (default value = -1) 3: Scale by 1000 2: Scale by 100 1: Scale by 10 0: Scale by 1 (no scaling) -1: Scale by 0.1 -2: Scale by 0.01 -3: Scale by 0.001

Breaker Communication Module @ Address xx

Table 48 – Configuration

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
515	1	R	—	—	INT	15139	A	P / H	Square D product identification. 15139 = Breaker Communication Module.	EeSQD_Prod_ID
531	1	R/W	—	—	INT	1..47	A	P / H	Modbus address of the COM option (@XX). Default value: 47.	EeAdrBus
532	1	R/W	—	—	INT	0..1	A	P / H	Parity. • 0: no parity. • 1: even parity. Default value: 1.	EeParityBus
533	1	R/W	—	—	INT	1200.... 38400	A	P / H	Baud rate: • 1200: 1200 baud • 2400: 2400 baud • 4800: 4800 baud • 9600: 9600 baud • 19200: 19200 baud • 38400: 38400 baud Default value: 19200.	EeBaudRate

Table 49 – Identification

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
534	2	R/W	—	—	ASCII	0x00..0x7F	A	P / H	Short identifier of Breaker Communication Module, coded over 4 ASCII characters. Default value: 0x00.	EeBCM_Loc
536	8	R/W	—	—	ASCII	0x00..0x7F	A	P / H	Long identifier of Breaker Communication Module, coded over 16 ASCII characters. Default value: 0x00.	EeBCM_NamePlate

Table 50 – Diagnostics Counters and Password

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
544	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—messages sent to the secondary (identical to function 8-14).[1]	CtrMsgSentThisUnit
545	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—messages sent to other secondarys.[1]	CtrMsgSentOtherUnit
546	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—bus messages managed by the secondary (identical to function 8-11).[1]	CtrMsgRX_ValidCRC
547	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—bus errors managed by the secondary (identical to function 8-12).[1]	CtrMsgRX_InvalidCRC
548	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—messages sent to the secondary comprising a non-supported Modbus function.[1]	CtrMsgRX_InvalidFC
549	1	R	—	—	INT	0..32767	A	P / H	Modbus event counter—(identical to function 11).[1]	CtrModbusEvtCtr
550	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—bus exception replies managed by the secondarysecondary (identical to function 8-13).[1]	CtrExceptionReplies
551	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—broadcast messages received by the secondary (identical to function 8-17).[2]	CtrMsgRX_Broadcast
553	1	R	—	—	INT	0..65535	A	P / H	Control word of the Cradle Communication Module. This control word cannot be set by the user. It is randomly changed each time the system is energized. It is necessary to read the control word before sending certain commands to the Cradle Communication Module.	ControlWord
554	1	R	—	—	INT	0..65535	A	P / H	Counter for number of times the Cradle Communication Module is energized.[2]	EeCtrPowerUp
555	1	R	—	—	INT	0..65535	A	P / H	Counter for the number of Cradle Communication Module resets, whether following power loss or not.[2]	EeCtrReset
577	1	R	1	—	INT	—	A	P / H	Breaker Communication Module firmware version.	EeFWVersion

[1] The counter automatically cycles from 32767 to 0.

[2] The counter automatically cycles from 65535 to 0.

Table 51 – Metering / Protection Module Event Notification

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
603	1	R	—	—	INT	1..8000	—	H	Number of first (oldest) record in the metering module event log (file N° 10).	CurrentFirstRecord OfMM_EvtLog
604	1	R	—	—	INT	1..8000	—	H	Number of last (most recent) record in the metering module event log (file N° 10).	CurrentLastRecord OfMM_EvtLog
623	1	R	—	—	INT	1..8000	—	P / H	Number of first (oldest) record in the protection module event log (file N° 20).	CurrentFirstRecord OfPM_EvtLog
624	1	R	—	—	INT	1..8000	—	P / H	Number of last (most recent) record in the protection module event log (file N° 20).	CurrentLastRecord OfPM_EvtLog

Table 52 – Cause of Tripping

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
650	1	R	—	—	INT	0..65535	A	P / H	• 0x01: long-time protection • 0x02: short-time protection • 0x04: instantaneous protection • 0x08: ground-fault protection • 0x10: earth-leakage protection • 0x20: integrated instantaneous protection • 0x40: self-protection (temperature) • 0x80: self-protection (overvoltage) • 0x0100: other protection (see registers 651 and 652).	MitopBasActCause
651	1	R	—	—	INT	0..65535	—	P / H	Status word indicating cause of tripping by protection functions: • 0x01: current unbalance • 0x02: over current phase A • 0x04: over current phase B • 0x08: over current phase C • 0x10: over current on neutral • 0x20: under voltage • 0x40: over voltage • 0x80: voltage unbalance • 0x0100: over power • 0x0200: reverse power • 0x0400: under frequency • 0x0800: over frequency • 0x1000: phase rotation • 0x2000: load shedding based on current • 0x4000: load shedding based on power	MitopAdvActCause
652	1	R	—	—	INT	0..65535	—	P / H	Continuation of alarm status word: • 0x01: ground-fault alarm • 0x02: earth-leakage alarm • 0x04: ground-fault push to trip	MitopAdvXtedActCause

Table 53 – Circuit Breaker Status, Auto / Menu

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
661	1	R	—	—	Bitmap 16	—	A	P / H	Circuit breaker status: see next page.	BrStatus
662	1	R	—	—	INT	0..65535	A	P / H	Counter for total number of operations (OF): the counter increments when bit 0 in register 661 switches from 0 to 1.[1]	CtrOF_OvrLife
663	1	R	—	—	INT	0..65535	A	P / H	Counter for operations (OF) since last reset: the counter increments when bit 0 in register 661 switches from 0 to 1.[1]	CtrOF
664	1	R	—	—	INT	0..65535	A	P / H	Counter for operations (SD): the counter increments when bit 1 in register 661 switches from 0 to 1.[1]	CtrSD
665	1	R	—	—	INT	0..65535	A	P / H	Counter for operations (SDE): the counter increments when bit 2 in register 661 switches from 0 to 1.[1]	CtrSDE
669	1	R	—	—	Bitmap 16	0..65535	A	P / H	Authorization word for actuation by MX and XF auxiliaries: • when bit 1 and 3 are set, MX is authorized to actuate the circuit breaker, • when bit 2 and 3 are set, XF is authorized to actuate the circuit breaker.	CoilControl
670	1	R	—	—	INT	0..1	—	P / H	Auto / Manu mode: • 0, "Manu" mode: remote opening and closing of the circuit breaker are disabled, • 1, "Auto" mode: remote opening and closing of the circuit breaker are enabled. Auto / Manu mode can be modified on MicroLogic P / H (only locally). Default value = 1	AutoManu

SD: Trip indication.

SDE: Fault-trip indication.

OF: ON / OFF.

1 The counter automatically cycles from 65535 to 0.

Table 54 – List of Possible Values for Register 881 (Circuit Breaker Status) in the Breaker Communication Module

BrStatus Bitmap Detail:
Bit 0 (0x01): OF; Indication contacts For ComPacT and MasterPacT: 0 = circuit breaker is opened, 1 = circuit breaker is closed
Bit 1 (0x02): SD; Trip indication contact For ComPacT: 0 = no trip, 1 = circuit breaker has tripped due to electrical fault or shunt trip For MasterPacT: always 0
Bit 2 (0x04): SDE; Fault trip indication contact For ComPacT and MasterPacT: 0 = no trip, 1 = circuit breaker has tripped due to electrical fault
Bit 3 (0x08): CH; Charged (used only with motor mechanism) For ComPacT: always 0 For MasterPacT: 0 = Spring discharged, 1 = spring loaded
Bit 4 (0x10): Reserved (internal use only)
Bit 5 (0x20): Reserved (internal use only)
Bit 6 (0x40): ComPacT / MasterPacT differentiation 0 = ComPacT NS, 1 = MasterPacT
Bit 7–15: Reserved

NOTE: A bitmap mask should be used to test the circuit breaker status.
If a value test is used, the following values should be used for MasterPacT:

0x44 Tripped discharged not RTC	0x51 ON discharged not RTC
0x4C Tripped charged not RTC	0x59 ON charged RTC
0x50 OFF discharged not RTC	0x78 OFF charged RTC

Table 55 – Time Stamping

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
671	3	R	—	—	DATE	—	A	P / H	Date of last actuation of MX auxiliary.	LastXFCoilActivationD_T
674	1	R	—	—	INT	0..65535	A	P / H	MX actuation counter.[1]	CtrXFCoilActivation
675	3	R	—	—	DATE	—	A	P / H	Date of last actuation of XF auxiliary.	LastMXCoilActivationD _T
678	1	R	—	—	INT	0..65535	A	P / H	XF actuation counter.[1]	CtrMXCoilActivation
679	4	R	—	—	XDATE	—	A	P / H	Current date of Cradle Communication Module.	CurrentD_T
684	3	R	—	—	DATE	—	A	P / H	Date of last circuit breaker opening.	LastOFContactOpenD_T
687	3	R	—	—	DATE	—	A	P / H	Date of last circuit breaker closing.	LastOFContactCloseD_T
690	3	R	—	—	DATE	—	A	P / H	Date of last trip without an electrical fault.	LastSDContactSetD_T
693	3	R	—	—	DATE	—	A	P / H	Date of last trip with an electrical fault.	LastSDEContactSetD _T
696	3	R	—	—	DATE	—	A	P / H	Date of last PAF (ready-to-close) closing.	LastPAFContactSetD _T
699	3	R	—	—	DATE	—	A	P / H	Date of last DLO (half moon) closing.	LastDLOContactSetD _T
702	3	R	—	—	DATE	—	A	P / H	Date of last AD (charged) closing.	LastADContactSetD_ T
705	3	R	—	—	DATE	—	A	P / H	Date of last address change (register 531).	LastAddressChangeD_T
708	3	R	—	—	DATE	—	A	P / H	Date of last reset of Cradle Communication Module event log.	LastCM_EvtLogResetD_T
711	4	R	—	—	XDATE	—	A	P / H	Date when time for Cradle Communication Module was last set.	LastDateTimeSetD_T
715	1	R	—	—	INT	0..65535	A	P / H	Counter for time setting for Cradle Communication Module.[1]	CtrDateTimeSets

Continued on next page

Table 55 – Time Stamping *(continued)*

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
800	1	R / W	—	—	—	0..1	A	P / H	Communication profile activation 0 = Not activated 1 = activated Default value = 0[2]	—
802	1	R	—	—	—	—	A	P / H	Open command status.	—
803	1	R	—	—	—	—	A	P / H	Close command status.	—

Registers 718 to 740 file N° 30 (see "Access to Files" on page 35).

[1] The counter automatically cycles from 65535 to 0.

[2] Communication profile is available only with a Breaker Communication Module firmware version greater or equal to V2.0 (register 577 must be greater or equal to 02000)

Cradle Communication Module @ Address xx + 50

Table 56 – Configuration

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
515	1	R	—	—	INT	15140	A	P / H	Square D product identification 15140 = Cradle Communication Module.	EeSQD_Prod_ID
531	1	R/W	—	—	INT	51..97	A	P / H	Modbus address of the COM option (@ xx + 50). Default value: 97.	EeAdrBus
532	1	R/W	—	—	INT	0..1	A	P / H	Parity: • 0: no parity • 1: even parity Default value: 1.	EeParityBus
533	1	R/W	—	—	INT	1200.. 38400	A	P / H	Baud rate: • 1200: 1200 baud • 2400: 2400 baud • 4800: 4800 baud • 9600: 9600 baud • 19200: 19200 baud • 38400: 38400 baud Default value: 19200.	EeBaudRate

Table 57 – Identification

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
534	2	R/W	—	—	ASCII	0x00..0x7F	A	P / H	Short identifier of the cradle COM option coded over 4 ASCII characters. Default value: 0x00.	CCM_Loc
536	8	R/W	—	—	ASCII	0x00..0x7F	A	P / H	Long identifier of the cradle COM option coded over 16 ASCII characters. Default value: 0x00.	CCM_NamePlate

Table 58 – Diagnostics Counters and Password

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
544	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—messages sent to the secondary (identical to function 8-14).[1]	CtrMsgSentThisUnit
545	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—messages sent to other secondarys.[1]	CtrMsgSentOtherUnit
546	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—bus messages managed by the secondary (identical to function 8-11).[1]	CtrMsgRX_ValidCRC
547	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—bus errors managed by the secondary (identical to function 8-12).[1]	CtrMsgRX_InvalidCRC
548	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—messages sent to the secondary comprising a non-supported Modbus function.[1]	CtrMsgRX_InvalidFC
549	1	R	—	—	INT	0..32767	A	P / H	Modbus event counter (identical to function 11).[1]	CtrModbusEvtCtr
550	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—bus exception replies managed by the secondary (identical to function 8-13).[1]	CtrExceptionReplies
551	1	R	—	—	INT	0..32767	A	P / H	Modbus diagnostics counter—broadcast messages received by the secondary (identical to function 8-17).[1]	CtrMsgRX_Broadcast
553	1	R	—	—	INT	0..65535	A	P / H	Control register of the Cradle Communication Module. This control word cannot be set by the user. It is randomly changed each time the system is energized. It is necessary to read the control word before sending certain commands to the Cradle Communication Module.	ControlWord
554	1	R	—	—	INT	0..65535	A	P / H	Counter for number of times the Cradle Communication Module is energized.[2]	EeCtrPowerUp
555	1	R	—	—	INT	0..65535	A	P / H	Counter for the number of Cradle Communication Module resets, whether following power loss or not.[2]	EeCtrReset
577	1	R	1	—	INT	—	A	P / H	Cradle Communication Module firmware version.	EeFWVersion

[1] The counter automatically cycles from 32767 to 0.

[2] The counter automatically cycles from 65535 to 0

Table 59 – Cradle Status

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
661	1	R	—	—	Bitmap 16	—	A	P / H	Device status: if bit 9 (0x0200) is set to 1, the device is connected if bit 8 (0x0100) is set to 1, the device is disconnected if bit 10 (0x400) is set to 1, the device is in the test position.	CradleStatus
662	1	R	—	—	INT	0..65535	A	P / H	Counter for change to the “connected” position: the counter increments when bit 8 in register 661 switches from 0 to 1.[1]	CtrRackedIn
663	1	R	—	—	INT	0..65535	A	P / H	Counter for change to the “disconnected” position: the counter increments when bit 9 in register 661 switches from 0 to 1.[1]	CtrRackedOut
664	1	R	—	—	INT	0..65535	A	P / H	Counter for change to the “test” position: the counter increments when bit 10 in register 661 switches from 0 to 1.[1]	CtrTestPosition

[1] The counter automatically cycles from 65535 to 0.

Table 60 – Time Stamping

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
679	4	R	—	—	XDATE	—	A	P / H	current date of Cradle Communication Module	CurrentD_T
684	3	R	—	—	DATE	—	A	P / H	date of the last change to the “connected” position	LastRackedInD_T
687	3	R	—	—	DATE	—	A	P / H	date of the last change to the “disconnected” position	LastRackedOutD_T
690	3	R	—	—	DATE	—	A	P / H	date of the last change to the “test” position	LastTestPositionD_T
705	3	R	—	—	DATE	—	A	P / H	date of the last change in address (register 531)	LastAddressChange D_T
711	4	R	—	—	XDATE	—	A	P / H	date when time for Cradle Communication Module was last set	LastDateTimeSetD_T
715	1	R	—	—	INT	0..65535	A	P / H	counter for time setting for Cradle Communication Module	CtrDateTimeSets

Metering Module @ Address xx + 200

Table 61 – Voltages

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
1000	1	R	x 1	V	INT	0..1200	—	P / H	RMS phase-to-phase voltage V_{AB}.	V_RMS[0]
1001	1	R	x 1	V	INT	0..1200	—	P / H	RMS phase-to-phase voltage V_{BC}.	V_RMS[1]
1002	1	R	x 1	V	INT	0..1200	—	P / H	RMS phase-to-phase voltage V_{CA}.	V_RMS[2]
1003	1	R	x 1	V	INT	0..1200	—	P / H	RMS phase-to-neutral voltage V_{AN}.[1]	V_RMS[3]
1004	1	R	x 1	V	INT	0..1200	—	P / H	RMS phase-to-neutral voltage V_{BN}.[1]	V_RMS[4]
1005	1	R	x 1	V	INT	0..1200	—	P / H	RMS phase-to-neutral voltage V_{CN}.[1]	V_RMS[5]
1006	1	R	x 1	V	INT	0..1200	—	P / H	Arithmetic mean of the phase-to-phase voltages 1/3 x (V_{AB}+V_{BC}+V_{CA}).	V_AvRMS[0]
1007	1	R	x 1	V	INT	0..1200	—	P / H	Arithmetic mean of the phase-to-neutral voltages 1/3 x (V_{AN}+V_{BN}+V_{CN}).[1]	V_AvRMS[1]
1008	1	R	x 10	%	INT	-1000.. +1000	—	P / H	V_{AB} phase-to-phase voltage unbalance with respect to the arithmetic mean of the phase-to phase voltages.	V_Unbal[0]
1009	1	R	x 10	%	INT	-1000.. +1000	—	P / H	V_{BC} phase-to-phase voltage unbalance with respect to the arithmetic mean of the phase-to-phase voltages.	V_Unbal[1]
1010	1	R	x 10	%	INT	-1000.. +1000	—	P / H	V_{CA} phase-to-phase voltage unbalance with respect to the arithmetic mean of the phase-to-phase voltages.	V_Unbal[2]
1011	1	R	x 10	%	INT	-1000.. +1000	—	P / H	V_{AN} phase-to-neutral voltage unbalance with respect to the arithmetic mean of the phase-to-neutral voltages.[1]	V_Unbal[3]
1012	1	R	x 10	%	INT	-1000.. +1000	—	P / H	V_{BN} phase-to-neutral voltage unbalance with respect to the arithmetic mean of the phase-to-neutral voltages.[1]	V_Unbal[4]
1013	1	R	x 10	%	INT	-1000.. +1000	—	P / H	V_{CN} phase-to-neutral voltage unbalance with respect to the arithmetic mean of the phase-to-neutral voltages.[1]	V_Unbal[5]
1014	1	R	x 10	%	INT	-1000.. +1000	—	P / H	Maximum phase-to-phase voltage unbalance value in registers 1008, 1009 and 1010.	V_UnbalMax[0]
1015	1	R	x 10	%	INT	-1000.. +1000	—	P / H	Maximum phase-to-neutral voltage unbalance value in registers 1011, 1012 and 1013.[1]	V_UnbalMax[1]

[1] Value not accessible when the configuration register 3314 returns type 31.

Table 62 – Currents

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
1016	1	R	x 1	A	INT	0..32767	A	P / H	RMS current on phase A.	I_RMS[0]
1017	1	R	x 1	A	INT	0..32767	A	P / H	RMS current on phase B.	I_RMS[1]
1018	1	R	x 1	A	INT	0..32767	A	P / H	RMS current on phase C.	I_RMS[2]
1019	1	R	x 1	A	INT	0..32767	A	P / H	RMS current on the neutral.[1]	I_RMS[3]
1020	1	R	x 1	A	INT	0..32767	A	P / H	Maximum rms current in registers 1016, 1017, 1018 and 1019.	I_Max
1021	1	R	x 1	A	INT	0..32767	A	P / H	Ground-fault current: if this current exceeds 32767 A, the register blocks at 32767.[2]	I_RMSGnd
1022	1	R	x 1	mA	INT	0..32767	A	P / H	Earth-leakage current: if this current exceeds 32767 A, the register blocks at 32767.[3]	I_RMSVigi
1023	1	R	x 1	A	INT	0..32767	—	H	Apparent current phase A (peak √2).	I_APP[0]
1024	1	R	x 1	A	INT	0..32767	—	H	Apparent current phase B (peak √2).	I_APP[1]
1025	1	R	x 1	A	INT	0..32767	—	H	Apparent current phase C (peak √2).	I_APP[2]
1026	1	R	x 1	A	INT	0..32767	—	H	Apparent current neutral (peak √2).	I_APP[3]
1027	1	R	x 1	A	INT	0..32767	—	P / H	Arithmetic mean of phase currents A, B and C: 1/3 x (I_A+I_B+I_C).	I_Mean
1028	1	R	x 10	%	INT	-1000.. +1000	—	P / H	I_A current unbalance with respect to the arithmetic mean of the phase currents.	I_Unbal[0]
1029	1	R	x 10	%	INT	-1000.. +1000	—	P / H	I_B current unbalance with respect to the arithmetic mean of the phase currents.	I_Unbal[1]
1030	1	R	x 10	%	INT	-1000.. +1000	—	P / H	I_C current unbalance with respect to the arithmetic mean of the phase currents.	I_Unbal[2]
1031	1	R	x 10	%	INT	-1000.. +1000	—	P / H	I_N current unbalance with respect to the arithmetic mean of the phase currents.[1]	I_Unbal[3]
1032	1	R	x 10	%	INT	-1000.. +1000	—	P / H	Maximum current unbalance in registers 1028, 1029 and 1030.	I_UnbalMax
1033	1	R	—	—	—	—	—	P / H	Reserved.	—

1 Value not accessible when the configuration register 3314 returns type 31 or 40.

2 Accessible only with MicroLogic 5.0 P / H and 6.0 A / P / H.

3 Accessible only with MicroLogic 7.0 A / P / H.

Table 63 – Power

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
1034	1	R	x 1	kW	INT	+/- 0..32767	—	P / H	Active power on phase A.[1, 2]	ActivePwr[0]
1035	1	R	x 1	kW	INT	+/- 0..32767	—	P / H	Active power on phase B.[1, 2]	ActivePwr[1]
1036	1	R	x 1	kW	INT	+/- 0..32767	—	P / H	Active power on phase C.[1, 2]	ActivePwr[2]
1037	1	R	x 1	kW	INT	+/- 0..32767	—	P / H	Total active power.[2]	ActivePwr[3]
1038	1	R	x 1	kVAR	INT	+/- 0..32767	—	P / H	Reactive power on phase A.[1, 2]	ReactivePwr[0]
1039	1	R	x 1	kVAR	INT	+/- 0..32767	—	P / H	Reactive power on phase B.[1, 2]	ReactivePwr[1]
1040	1	R	x 1	kVAR	INT	+/- 0..32767	—	P / H	Reactive power on phase C.[1, 2]	ReactivePwr[2]
1041	1	R	x 1	kVAR	INT	+/- 0..32767	—	P / H	Total reactive power.[2]	ReactivePwr[3]

Continued on next page

Table 63 – Power *(continued)*

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
1034	1	R	x 1	kW	INT	+/- 0..32767	—	P / H	Active power on phase A.[1, 2]	ActivePwr[0]
1042	1	R	x 1	kVA	INT	0..32767	—	P / H	Apparent power on phase A with 3 wattmeters.[1]	ApparentPwr[0]
1043	1	R	x 1	kVA	INT	0..32767	—	P / H	Apparent power on phase B with 3 wattmeters.[1]	ApparentPwr[1]
1044	1	R	x 1	kVA	INT	0..32767	—	P / H	Apparent power on phase C with 3 wattmeters.[1]	ApparentPwr[2]
1045	1	R	x 1	kVA	INT	0..32767	—	P / H	Total apparent power.	ApparentPwr[3]

1 Value not accessible when the configuration register 3314 returns type 31.

2 The sign of the active and reactive power depends on configuration register 3316.

Table 64 – Power Factor

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
1046	1	R	x 1000	none	INT	-1000.. +1000	—	P / H	Power factor on phase A (absolute value equal to |P|/S).[1, 2]	PF[0]
1047	1	R	x 1000	none	INT	-1000.. +1000	—	P / H	Power factor on phase B (absolute value equal to |P|/S).[1, 2]	PF[1]
1048	1	R	x 1000	none	INT	-1000.. +1000	—	P / H	Power factor on phase C (absolute value equal to |P|/S).[1, 2]	PF[2]
1049	1	R	x 1000	none	INT	-1000.. +1000	—	P / H	Total power factor (absolute value equal to |Ptotal|/Stotal).[2]	PF[3]
1050	1	R	x 1000	none	INT	-1000.. +1000	—	H	Fundamental power factor on phase A (its absolute value is equal to |FundP|/FundS). Sign convention the same as the one for the real power factor. N/A if type 31 network.	FundPF[0]
1051	1	R	x 1000	none	INT	-1000.. +1000	—	H	Same as above phase B.	FundPF[1]
1052	1	R	x 1000	none	INT	-1000.. +1000	—	H	Same as above phase C.	FundPF[2]
1053	1	R	x 1000	none	INT	-1000.. +1000	—	H	Total fundamental power factor (its absolute value is equal to |FundPtot|/FundStot). Sign convention the same as the one for the real power factor.	FundPF[3]

1 Value not accessible when the configuration register 3314 returns type 31.

2 The sign of the power factor depends on configuration register 3318.

Table 65 – Frequency

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
1054	1	R	x 10	Hz	INT	0..4000	—	P / H	System frequency.	Frequency
1055	1	R	x.001	s	INT	0..32767	—	P / H	Duration of the interval between the last update of real time values and the current table (about 1s).	UpdateIval

Table 66 – Fundamental

Register	Number of Registers	Read / Write	Scale[1]	Unit	Format	Interval	A	P / H	Description	Label
1056	1	R	D	V	INT	0..1200	—	H	Fundamental (RMS) of phase-to-phase voltage V_{AB}.	FundV_RMS[0]
1057	1	R	D	V	INT	0..1200	—	H	Same as above V_{BC}.	FundV_RMS[1]
1058	1	R	D	V	INT	0 to 1200	—	H	Same as above V_{BA}.	FundV_RMS[2]
1059	1	R	D	V	INT	0..1200	—	H	Fundamental (RMS) of phase-to-neutral voltage V_{AN}. —N/A if type 31 network.	FundV_RMS[3]
1060	1	R	D	V	INT	0..1200	—	H	Same as above V_{BN}.	FundV_RMS[4]
1061	1	R	D	V	INT	0..1200	—	H	Same as above V_{CN}.	FundV_RMS[5]
1062	6	R	—	—	—	—	—	H	Reserved.	ReservedA
1068	1	R	A	A	INT	0..32767	—	H	Fundamental (RMS) of phase A current.	FundI_RMS[0]
1069	1	R	A	A	INT	0..32767	—	H	Same as above phase B. Measured with type 31.	FundI_RMS[1]
1070	1	R	A	A	INT	0..32767	—	H	Same as above phase C.	FundI_RMS[2]
1071	1	R	B	A	INT	0..32767	—	H	Same as above neutral. —N/A with type 31, 40 networks. Measured with type 41.	FundI_RMS[3]
1072	4	R	—	—	—	—	—	H	Reserved.	—
1076	1	R	E	kW	INT	0..32767	—	H	Phase A fundamental active power with 3 wattmeters (type 40 & 41) N/A for type 31. Same sign convention as with active power.	FundActivePwr[0]
1077	1	R	E	KW	INT	0..32767	—	H	Phase B fundamental active power with 3 wattmeters (type 40 & 41) N/A for type 31. Same sign convention as with active power.	FundActivePwr[1]
1078	1	R	E	KW	INT	0..32767	—	H	Phase C fundamental active power with 3 wattmeters (type 40 & 41) N/A for type 31. Same sign convention as with active power.	FundActivePwr[2]
1079	1	R	E	kW	INT	0..32767	—	H	Total fundamental active power. Same sign convention as with active power	FundActivePwr[3]
1080	1	R	E	kVAR	INT	0..32767	—	H	Phase A fundamental reactive power with 3 wattmeters (type 40 & 41) N/A for type 31.	FundReactivePwr[0]
1081	1	R	E	kVAR	INT	0..32767	—	H	Phase B fundamental reactive power with 3 wattmeters (type 40 & 41) N/A for type 31.	FundReactivePwr[1]
1082	1	R	E	kVAR	INT	0..32767	—	H	Phase C fundamental reactive power with 3 wattmeters (type 40 & 41). N/A for type 31.	FundReactivePwr[2]
1083	1	R	E	kVAR	INT	0..32767	—	H	Total fundamental reactive power.	FundReactivePwr[3]
1084	1	R	E	kVA	INT	0..32767	—	H	Phase A fundamental apparent power. N/A for type 31.	FundApparentPwr[0]

Continued on next page

Table 66 – Fundamental *(continued)*

Register	Number of Registers	Read / Write	Scale[1]	Unit	Format	Interval	A	P / H	Description	Label
1085	1	R	E	KVA	INT	0..32767	—	H	Phase B fundamental apparent power. N/A for type 31.	FundApparentPwr[1]
1086	1	R	E	KVA	INT	0..32767	—	H	Phase C fundamental apparent power. N/A for type 31.	FundApparentPwr[2]
1087	1	R	E	kVA	INT	0..32767	—	H	Total fundamental apparent power.	FundApparentPwr[3]
1088	1	R	E	kVAR	INT	0..32767	—	H	Phase A distortion power. N/A for type 31.	DistortionPwr[0]
1089	1	R	E	kVAR	INT	0..32767	—	H	Phase B distortion power. N/A for type 31.	DistortionPwr[1]
1090	1	R	E	kVAR	INT	0..32767	—	H	Phase C distortion power. N/A for type 31.	DistortionPwr[2]
1091	1	R	E	kVAR	INT	0..32767	—	H	Total distortion power.	DistortionPwr[3]

[1] For scale values, see page 85.

Table 67 – Total Harmonic Distortion

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
1092	1	R	x 10	%	INT	0..5000	—	H	Total harmonic distortion of V_{AB} voltage compared to the fundamental.	THD_V[0]
1093	1	R	x 10	%	INT	0..5000	—	H	Same as above V_{BC}.	THD_V[1]
1094	1	R	x 10	%	INT	0..5000	—	H	Same as above V_{CA}.	THD_V[2]
1095	1	R	x 10	%	INT	0..5000	—	H	Total harmonic distortion of V_{AN} voltage compared to the fundamental. —N/A with type 31 network.	THD_V[3]
1096	1	R	x 10	%	INT	0..5000	—	H	Same as above V_{BN}.	THD_V[4]
1097	1	R	x 10	%	INT	0..5000	—	H	Same as above V_{CN}.	THD_V[5]
1098	1	R	x 10	%	INT	0..5000	—	H	Total harmonic distortion of phase A current compared to the fundamental.	THD_I[0]
1099	1	R	x 10	%	INT	0..5000	—	H	Same as above phase B. Measured with type 31.	THD_I[1]
1100	1	R	x 10	%	INT	0..5000	—	H	Same as above phase C.	THD_I[2]
1101	1	R	x 10	%	INT	0..5000	—	H	Same as above neutral. —N/A with type 31 networks. Measured with type 41, calculated with type 40.	THD_I[3]
1102	1	R	x 10	%	INT	0..1000	—	H	Total harmonic distortion of V_{AB} voltage compared to the RMS value.	thd_V[0]
1103	1	R	x 10	%	INT	0..1000	—	H	Same as above V_{BC}.	thd_V[1]
1104	1	R	x 10	%	INT	0..1000	—	H	Same as above V_{CA}.	thd_V[2]
1105	1	R	x 10	%	INT	0..1000	—	H	Total harmonic distortion of V_{AN} voltage compared to the RMS value. —N/A with type 31 network.	thd_V[3]
1106	1	R	x 10	%	INT	0..1000	—	H	Same as above V_{BN}.	thd_V[4]
1107	1	R	x 10	%	INT	0..1000	—	H	Same as above V_{CN}.	thd_V[5]
1108	1	R	x 10	%	INT	0..1000	—	H	Total harmonic distortion of phase A current compared to the RMS value.	thd_I[0]

Continued on next page

Table 67 – Total Harmonic Distortion *(continued)*

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
1109	1	R	x 10	%	INT	0..1000	—	H	Same as above phase B. Measured with type 31.	thd_I[1]
1110	1	R	x 10	%	INT	0..1000	—	H	Same as above phase C.	thd_I[2]
1111	1	R	x 10	%	INT	0..1000	—	H	Same as above neutral. —N/A with type 31 networks. Measured with type 41, calculated with type 40.	thd_I[3]
1112	1	R	x 10	Deg	INT	0..3600	—	H	Phase shift V_{AB} / I_A with type 31; V_{AN} / I_A with type 40 & 41.	FundVI_Angle[0]
1113	1	R	x 10	Deg	INT	0..3600	—	H	Phase shift V_{BC} / I_B with type 31; V_{BN} / I_B with type 40 & 41.	FundVI_Angle[1]
1114	1	R	x 10	Deg	INT	0..3600	—	H	Phase shift V_{CA} / I_C with type 31; Vcn / Ic with type 40 & 41.	FundVI_Angle[2]
1115	1	R	x 10	None	INT	0..1000	—	H	Phase A K-factor. —N/A in 400 Hz nominal freq. networks.	I_Kfactor[0]
1116	1	R	x 10	None	INT	0..1000	—	H	Phase B K-factor. —N/A in 400 Hz nominal freq. networks.	I_Kfactor[1]
1117	1	R	x 10	None	INT	0..1000	—	H	Phase C K-factor. —N/A in 400 Hz nominal freq. networks.	I_Kfactor[2]
1118	1	R	x 10	None	INT	0..1000	—	H	Neutral K-factor. —N/A with type 30 and 31 networks. —N/A in 400 Hz nominal freq. Networks.	I_Kfactor[3]
1119	1	R	x 100	None	INT	0..10000	—	H	V_{AB} voltage peak factor. —N/A with type 40 and 41 networks. —N/A in 400 Hz config.	V_Crest[0]
1120	1	R	x 100	None	INT	0..10000	—	H	V_{BC}voltage peak factor. —N/A with type 40 and 41 networks. —N/A in 400 Hz config.	V_Crest[1]
1121	1	R	x 100	None	INT	0..10000	—	H	V_{CA} voltage peak factor. —N/A with type 40 and 41 networks. —N/A in 400 Hz config.	V_Crest[2]
1122	1	R	x 100	None	INT	0..10000	—	H	V_{AN} voltage peak factor. —N/A with type 31 networks. —N/A in 400 Hz config.	V_Crest[3]
1123	1	R	x 100	None	INT	0..10000	—	H	V_{BN} voltage peak factor. —N/A with type 31 networks. —N/A in 400 Hz config.	V_Crest[4]
1124	1	R	x 100	None	INT	0..10000	—	H	V_{CN} voltage peak factor. —N/A with type 31 networks. —N/A in 400 Hz config.	V_Crest[5]
1125	1	R	x 100	None	INT	0..10000	—	H	Phase A current peak factor. —N/A in 400 Hz config.	I_Crest[0]

Continued on next page

Table 67 – Total Harmonic Distortion *(continued)*

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
1126	1	R	x 100	None	INT	0..10000	—	H	Phase B current peak factor. —N/A in 400 Hz config.	I_Crest[1]
1127	1	R	x 100	None	INT	0..10000	—	H	Phase C current peak factor. —N/A in 400 Hz config.	I_Crest[2]
1128	1	R	x 100	None	INT	0..10000	—	H	Neutral current peak factor. —N/A with type 31, 40 networks. Measured with type 41. —N/A in 400 Hz config.	V_Crest[1]
1129	4	R	—	—	—	—	—	H	Reserved.	
1133	1	R	x 10	Deg	INT	0..3600	—	H	Phase shift V_{AB} / V_{AB} with type 31; V_{AN} / V_{AN} with type 40 & 41. Definition leads to content being always 0.	FundVV[0]
1134	1	R	x 10	Deg	INT	0..3600	—	H	Phase shift V_{BC} / V_{AB} with type 31; V_{BN} / V_{AN} with type 40 & 41. Under phase balanced conditions, equals 240 degrees.	FundVV[1]
1135	1	R	x 10	Deg	INT	0..3600	—	H	Phase shift V_{CA} / V_{AB} with type 31; V_{CN} / V_{AN} with type 40 & 41. Under phase balanced conditions, equals 120 degrees.	FundVV[2]

Registers 1300 to 1599: minimum values of the real-time measurements from 1000 to 1299.

The minimum values for the real-time measurements may be accessed at the registers of the real-time values + 300 (available on MicroLogic P and H).

Registers 1600 to 1899: maximum values of the real-time measurements from 1000 to 1299.

The maximum values for the real-time measurements may be accessed at the registers of the real-time values + 600 (available on MicroLogic P and H).

Table 68 – Energy

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
2000	4	R	x 1	kWh	MOD 10000	0..+/- 9999 9999 9999 9999	—	P / H	Total active energy.[1]	EeActiveEnergy
2004	4	R	x 1	kVARh	MOD 10000	0..+/- 9999 9999 9999 9999	—	P / H	Total reactive energy.[1]	EeReactiveEnergy
2008	4	R	x 1	kWh	MOD 10000	0..+/- 9999 9999 9999 9999	—	P / H	Active energy positively incremented.[2]	EeActiveEnergyIn
2012	4	R	x 1	kWh	MOD 10000	0..+/- 9999 9999 9999 9999	—	P / H	Active energy negatively incremented.[2]	EeActiveEnergyOut
2016	4	R	x 1	kVARh	MOD 10000	0..+/- 9999 9999 9999 9999	—	P / H	Reactive energy positively incremented.[2]	EeReactiveEnergyIn
2020	4	R	x 1	kVARh	MOD 10000	0..+/- 9999 9999 9999 9999	—	P / H	Reactive energy negatively incremented.[2]	EeReactiveEnergyOut
2024	4	R	x 1	kVAh	MOD 10000	0..+/- 9999 9999 9999 9999	—	P / H	Total apparent energy.	EeApparentEnergy

1 As standard, the total calculated energy values are absolute total values. They represent the sum of the energy in and out values.
EP = EP in + EP out
EQ = EQ in + EQ out

2 The Energy in and Energy out values are incremented according to the power sign set in the MicroLogic menu « MicroLogic set-up » (see register 3316).

Table 69 – Demand Current

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
2200	1	R	x 1	A	INT	0..32767	—	P / H	Current demand on phase A.	I_Dmd[0]
2201	1	R	x 1	A	INT	0..32767	—	P / H	Current demand on phase B.	I_Dmd[1]
2202	1	R	x 1	A	INT	0..32767	—	P / H	Current demand on phase C.	I_Dmd[2]
2203	1	R	x 1	A	INT	0..32767	—	P / H	Current demand on the neutral.[1]	I_Dmd[3]
2204	1	R	x 1	A	INT	0..32767	—	P / H	Current demand maximum on phase A since the last reset.	NvI_DmdPk[0]
2205	1	R	x 1	A	INT	0..32767	—	P / H	Current demand maximum on phase B since the last reset.	NvI_DmdPk[1]
2206	1	R	x 1	A	INT	0..32767	—	P / H	Current demand maximum on phase C since the last reset.	NvI_DmdPk[2]
2207	1	R	x 1	A	INT	0..32767	—	P / H	Current demand maximum on the neutral since the last reset.[1]	NvI_DmdPk[3]

[1] Value not accessible when the configuration register 3314 returns type 31 or 40

Table 70 – K-Factor Demand

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
2212	1	R	x 10	None	INT	0..1000	—	H	K-factor demand, phase A.	K_Dmd[0]
2213	1	R	x 10	None	INT	0..1000	—	H	Same as above phase B.	K_Dmd[1]
2214	1	R	x 10	None	INT	0..1000	—	H	Same as above phase C.	K_Dmd[2]
2215	1	R	x 10	None	INT	0..1000	—	H	Same as above neutral. N/A with type 31 or 40 network.	K_Dmd[3]
2216	1	R	x 10	None	INT	0..1000	—	H	K-factor demand peak, phase A, since last reset.	NvK_DmdPk[0]
2217	1	R	x 10	None	INT	0..1000	—	H	Same as above phase B.	NvK_DmdPk[1]
2218	1	R	x 10	None	INT	0..1000	—	H	Same as above phase C.	NvK_DmdPk[2]
2219	1	R	x 10	None	INT	0..1000	—	H	Same as above neutral. N/A with type 31 or 40 network.	NvK_DmdPk[3]

Table 71 – Demand Power

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
2224	1	R	x 1	kW	INT	0..32767	—	P / H	Total active-power demand.[1]	ActivePwrDmd
2225	1	R	x 1	kW	INT	0..32767	—	P / H	Active-power demand maximum since the last reset.	NvActivePwrDmdPk
2226	1	R	x 1	kW	INT	0..32767	—	P / H	Predicted active-power demand at the end of the window.[2]	ActivePwrDmdPred
2227	1	R	x 1000	sans	INT	-1000.. +1000	—	P / H	Total power factor at last active-power demand maximum.	NvPF_atActivePwrDmdPk
2228	1	R	x 1	kVAR	INT	0..32767	—	P / H	Value of reactive-power demand at last active-power demand maximum.	NvkVAR_atActivePwrDmdPk
2229	1	R	x 1	kVA	INT	0..32767	—	P / H	Value of apparent-power demand at last active-power demand maximum.	NvkVA_atActivePwrDmdPk
2230	1	R	x 1	kVAR	INT	0..32767	—	P / H	Total reactive-power demand.[1]	ReactivePwrDmd
2231	1	R	x 1	kVAR	INT	0..32767	—	P / H	Reactive-power demand maximum since the last reset.	NvReactivePwrDmdPk
2232	1	R	x 1	kVAR	INT	0..32767	—	P / H	Predicted reactive-power demand at the end of the window.[2]	ReactivePwrDmdPred
2233	1	R	x 1000	sans	INT	-1000.. +1000	—	P / H	Total power factor at last reactive-power demand maximum.	NvPF_atReactivePwrDmdPk
2234	1	R	x 1	kW	INT	0..32767	—	P / H	Value of active-power demand at last reactive-power demand maximum.	NvkW_atReactivePwrDmdPk
2235	1	R	x 1	kVA	INT	0..32767	—	P / H	Value of apparent-power demand at last reactive-power demand maximum.	NvkVA_atReactivePwrDmdPk
2236	1	R	x 1	kVA	INT	0..32767	—	P / H	Total apparent power demand.[1]	ApparentPwrDmd
2237	1	R	x 1	kVA	INT	0..32767	—	P / H	Apparent-power demand maximum since the last reset.	NvApparentPwrDmdPk
2238	1	R	x 1	kVA	INT	0..32767	—	P / H	Predicted apparent-power demand at the end of the window.[2]	ApparentPwrDmdPred
2239	1	R	x 1000	sans	INT	-1000.. +1000	—	P / H	Total power factor at last apparent-power demand maximum.	NvPF_atApparentPwrDmdPk
2240	1	R	x 1	kW	INT	0..32767	—	P / H	Value of active-power demand at last apparent-power demand maximum.	NvkW_atApparentPwrDmdPk
2241	1	R	x 1	kVAR	INT	0..32767	—	P / H	Value of reactive-power demand at last apparent-power demand maximum.	NvkVAR_atApparentPwrDmdPk

1 Value updated at end of window for the “block” mode. For the “sliding” mode, the value is updated every 15 seconds.

2 Value updated every 15 seconds for both “block” and “sliding” modes.

Table 72 – Time Stamping

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
3000	4	R	—	—	DATE	—	—	P / H	Current date of the metering module.	XtedDateTime
3005	3	R	—	—	DATE	—	—	P / H	Date of last current demand maximum I_A (register 2204).	NvI_DmdPk[0]
3008	3	R	—	—	DATE	—	—	P / H	Date of last current demand maximum I_B (register 2205).	NvI_DmdPk[1]
3011	3	R	—	—	DATE	—	—	P / H	Date of last current demand maximum I_C (register 2206).	NvI_DmdPk[2]
3014	3	R	—	—	DATE	—	—	P / H	Date of last current demand maximum on the neutral (register 2207).[1]	NvI_DmdPk[3]
3017	3	R	—	—	DATE	—	—	P / H	Date of last active-power demand maximum (register 2224).	NvActivePwrDmdPk
3020	3	R	—	—	DATE	—	—	P / H	Date of last reactive-power demand maximum (register 2230).	NvReactivePwrDmdPk
3023	3	R	—	—	DATE	—	—	P / H	Date of last apparent-power demand maximum (register 2236).	NvApparentPwrDmdPk
3026	3	R	—	—	DATE	—	—	P / H	Date of last reset of current demand maximum values.	NvLastI_DmdReset
3029	3	R	—	—	DATE	—	—	P / H	Date of last reset of power demand maximum values.	NvLastPwrDmdReset
3032	3	R	—	—	DATE	—	—	P / H	Date-Time of last min registers reset (1300-1599).[2]	NvLastMinReset
3035	3	R	—	—	DATE	—	—	P / H	Date-Time of last max registers reset (1600-1899).[2]	NvLastMaxReset
3038	3	R	—	—	DATE	—	—	P / H	Date of last reset of energy meters.	NvLastEnReset
3041	3	R	—	—	DATE	—	—	P / H	Date of appearance of last K-factor demand peak (phase A).	NvK_DmdPk[0]
3044	3	R	—	—	DATE	—	—	P / H	Date of appearance of last K-factor demand peak (phase B).	NvK_DmdPk[1]
3047	3	R	—	—	DATE	—	—	P / H	Date of appearance of last K-factor demand peak (phase C).	NvK_DmdPk[2]
3050	3	R	—	—	DATE	—	—	P / H	Date of appearance of last K-factor demand peak (neutral) N/A for type 31 & 40 networks.	NvK_DmdPk[3]
3053	3	R	—	—	DATE	—	—	P / H	Date of appearance of last I^2 demand peak (phase A).	NvI2_DmdPk[0]
3056	3	R	—	—	DATE	—	—	P / H	Date of appearance of last I^2 demand peak (phase B).	NvI2_DmdPk[1]
3059	3	R	—	—	DATE	—	—	P / H	Date of appearance of last I^2 demand peak (phase C).	NvI2_DmdPk[2]
3062	3	R	—	—	DATE	—	—	P / H	Date of appearance of last I^2 demand peak (neutral) N/A for type 31 & 40 networks.	NvI2_DmdPk[3]

1 N/A for type 31 or 40 networks.

2 NOTE: This register is updated whenever any of the min register is reset. Command interface authorizes user to clear min of Current RMS & Unbal values, Voltage rms & Unbal values, frequency, P/Q/S/PF, Fundamental quantities & THD, Voltage Crest & Current crest independently. However, since only one date/time of last reset is maintained, it is recommended to always set all bits in the command that resets min values.

Table 73 – Configuration

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
3300	1	R	—	—	INT	0..65535	—	P / H	Control word for the metering module. This control word may not be user set. It is randomly modified and must be read before sending certain commands to the metering module.	ControlWord
3303	2	R / W	—	—	ASCII	0x00..0x7F	—	P / H	Short identifier of the metering module, coded over four ASCII characters. Default value: “set!”	NvUnitLabel
3305	8	R / W	—	—	ASCII	0x00..0x7F	—	P / H	Long identifier of the metering module, coded over 16 ASCII characters. Default value: “please set me up”.	NvUnitNamePlate
3314	1	R / W	—	—	INT	30, 31, 40, 41	—	P / H	Selection of the calculation algorithm. • If you have a system type: 3 Phase, 4 wire, 4 current transformer (3P circuit breaker with external neutral CT connected + external neutral voltage tap not connected to VN), select system type 30: measurement of the phase-to-neutral voltage is not available measurement of the neutral current is available. • If you have a system type: 3 phase, 3 wire, 3 current transformer (3P circuit breaker without external neutral CT connected, neutral not connected to VN), select system type 31: measurement of the phase-to-phase voltages is available measurement of the phase-to-neutral voltages is not available measurement of the neutral current is not available. • If you have a system type: 3 phase, 4 wire, 3 current transformer (3P circuit breaker without external neutral CT connected, neutral connected to VN), select system type 40: measurement of the phase-to-phase voltages is available measurement of the phase-to-neutral voltages is available measurement of the neutral current is not available. • If you have a system type: 3 phase, 4 wire, 4 current transformer (3P circuit breaker with external neutral CT connected or 4P circuit breaker, neutral connected to VN), select system type 41: measurement of the phase-to-phase voltages is available measurement of the phase-to-neutral voltages is available measurement of the neutral current is available. Default value: type 41.	NvSystemType

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Table 73 – Configuration *(continued)*

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
3316	1	R / W	—	—	INT	0,1	—	P / H	Sign convention for the power: • 0: "+" if the active power flows from upstream (top) to downstream (bottom) (↓). • 1: "+" if the active power flows from downstream (bottom) to upstream (top) (↑). Default value: 0.	NvConvPwrSign
3317	1	R / W	—	—	INT	0,1	—	P / H	Sign convention for the reactive power: • 0: alternate IEEE convention, • 1: IEEE & IEC convention. Default value: 1.[1]	NvConvReactivePwrsign
3318	1	R / W	—	—	INT	0,1, 2	—	P / H	Sign convention for the power factor: • 0: IEC convention, • 1: alternate IEEE convention, • 2: IEEE convention. Default value: 2.[1]	NvConvPFSign
3319	1	R / W	—	—	INT	0,1	—	H	Reactive power calculation convention: • 0: fundamental alone, • 1: harmonics included [DEFAULT].	NvConvReactivePwrCalc
3324	1	R / W	—	—	INT	0,1	—	P / H	Total energy metering convention: • 0: absolute accumulation (E = E+ + E-), • 1: signed accumulatio.n (E = E+ - E-). Default = 0: Absolute	NvEnAccumulationMode
3351	1	R / W	—	—	INT	—	—	P / H	Current-demand calculation method; window type: • 0: Block interval; sliding, • 1: Thermal; sliding. Default value: 1.	NvDmdMethod_I
3352	1	R / W	x 1	min	INT	5..60	—	P / H	Duration in minutes of the current-demand calculation window. Default value: 15 minutes.[2]	NvDmdIval_I
3354	1	R / W	—	—	INT	—	—	P / H	Power-demand calculation method; window type: • 0: Block interval; sliding, • 1: Thermal; sliding, • 2: Block interval; block, • 5: Synchronized to communication. Default value: 0.	NvDmdMethod_Pwr
3355	1	R / W	x 1	min	INT	5..60	—	P / H	Duration in minutes of the power-demand calculation window. Default value: 15 minutes.	NvDmdIval_Pwr
3816	1	R	—	—	INT	0..32767	A	P / H	Square D Identification number: MicroLogic A: PM = 15131, P: PM = 15133, MM = 15134, H: PM = 15135, MM = 15136.	EeSQD_Prod_ID

1 To have IEE alt., set 3317 to 0 and 3318 to 1.
To have IEC., set 3317 to 1 and 3318 to 0.
To have IEEE., set 3317 to 1 and 3318 to 2.

2 The duration in minutes of the current-demand calculation window set in this register is used for the maximum current I_A, I_B, I_C and I_N protection functions. When these protection functions are active, it is possible to modify the duration of the calculation window whether the protective cover for the dial settings is closed or not, whether remote access is authorized (MicroLogic) or not, and whether the supervisor knows the remote-access control word or not.

Table 74 – Spectral Components (Odd Rank)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
4100	1	R	x 10	%	INT	0..1200	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 3 of V_{AB}. —N/A in 400 Hz systems.	V_h3[0]
4101	1	R	x 10	%	INT	0..1200	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 3 of V_{BC}. —N/A in 400 Hz systems	V_h3[1]
4102	1	R	x 10	%	INT	0..1200	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 3 of V_{CA}. —N/A in 400 Hz systems.	V_h3[2]
4103	1	R	x 10	%	INT	0..1200	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 3 of V_{AN}. —N/A in 400 Hz systems. —N/A with type 31.	V_h3[3]
4104	1	R	x 10	%	INT	0..1200	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 3 of V_{BN}. —N/A in 400 Hz systems. —N/A with type 31.	V_h3[4]
4105	1	R	x 10	%	INT	0..1200	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 3 of V_{CN}. —N/A in 400 Hz systems. —N/A with type 31.	V_h3[5]
4106	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 5.	V_h5[..]
4112	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 7.	V_h7[..]
4118	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 9.	V_h9[..]
4124	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 11.	V_h11[..]
4130	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 13.	V_h13[..]
4136	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 15.	V_h15[..]
4142	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 17.	V_h17[..]
4148	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 19.	V_h19[..]
4154	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 21.	V_h21[..]
4160	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 23.	V_h23[..]
4166	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 25.	V_h25[..]
4172	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 27.	V_h27[..]
4178	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 29.	V_h29[..]
4184	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 31.	V_h31[..]
4190	1	R	x 10	%	INT	0..32767	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 3 of Ia. —N/A in 400 Hz systems.	I_h3[0]
4191	1	R	x 10	%	INT	0..32767	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 3 of Ib. —N/A in 400 Hz systems.	I_h3[1]
4192	1	R	x 10	%	INT	0..32767	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 3 of Ic. —N/A in 400 Hz systems.	I_h3[2]
4193	1	R	x 10	%	INT	0..32767	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 3 of In. —N/A in 400 Hz systems. —N/A with type 31.	I_h3[3]

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Table 74 – Spectral Components (Odd Rank) *(continued)*

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
4194	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 5.	I_h5[..]
4198	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 7.	I_h7[..]
4202	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 9.	I_h9[..]
4206	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 11.	I_h11[..]
4210	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 13.	I_h13[..]
4214	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 15.	I_h15[..]
4218	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 17.	I_h17[..]
4222	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 19.	I_h19[..]
4226	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 21.	I_h21[..]
4230	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 23.	I_h23[..]
4234	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 25.	I_h25[..]
4238	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 27.	I_h27[..]
4242	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 29.	I_h29[..]
4246	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 31.	I_h31[..]
4250	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 3 of V_{AB}. —N/A in 400 Hz systems.	V_Phi3[0]
4251	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 3 of V_{BC}. —N/A in 400 Hz systems.	V_Phi3[1]
4252	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 3 of V_{CA}. —N/A in 400 Hz systems.	V_Phi3[2]
4253	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 3 of V_{AN}. —N/A in 400 Hz systems. —N/A with type 31.	V_Phi3[3]
4254	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 3 of V_{BN}. —N/A in 400 Hz systems. —N/A with type 31.	V_Phi3[4]
4255	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 3 of V_{CN}. —N/A in 400 Hz systems. —N/A with type 31.	V_Phi3[5]
4256	6	R	x 10	Deg	INT	0..3600	—	H	Same as above harmonic 5.	V_Phi5[..]
4262	6	R	x 10	Deg	INT	0..3600	—	H	Same as above harmonic 7.	V_Phi7[..]
4340	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 3 of I_A. —N/A in 400 Hz systems.	I_Phi3[0]
4341	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 3 of I_B. —N/A in 400 Hz systems.	I_Phi3[1]
4342	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 3 of I_C. —N/A in 400 Hz systems.	I_Phi3[2]
4343	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 3 of I_N. —N/A in 400 Hz systems. —N/A with type 31.	I_Phi3[3]
4344	4	R	x 10	Deg	INT	0..3600	—	H	Same as above harmonic 5.	I_Phi5[..]
4348	4	R	x 10	Deg	INT	0..3600	—	H	Same as above harmonic 7.	I_Phi7[..]
4352	4	R	x 10	Deg	INT	0..3600	—	H	Same as above harmonic 9.	I_Phi9[..]

Table 75 – Spectral Components (Even Rank)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
4400	1	R	x 10	%	INT	0..1200	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 2 of V_{AB}. —N/A in 400 Hz systems.	V_h2[0]
4401	1	R	x 10	%	INT	0..1200	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 2 of V_{BC}. —N/A in 400 Hz systems.	V_h2[1]
4402	1	R	x 10	%	INT	0..1200	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 2 of V_{CA} —N/A in 400 Hz systems.	V_h2[2]
4403	1	R	x 10	%	INT	0..1200	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 2 of V_{AN}. —N/A in 400 Hz systems. —N/A with type 31.	V_h2[3]
4404	1	R	x 10	%	INT	0..1200	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 2 of V_{BN}. —N/A in 400 Hz systems. —N/A with type 31.	V_h2[4]
4405	1	R	x 10	%	INT	0..1200	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 2 of V_{CN}. —N/A in 400 Hz systems. —N/A with type 31.	V_h2[5]
4406	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 4.	V_h4[..]
4412	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 6.	V_h6[..]
4418	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 8.	V_h8[..]
4424	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 10.	V_h10[..]
4430	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 12.	V_h12[..]
4436	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 14.	V_h14[..]
4442	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 16.	V_h16[..]
4448	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 18.	V_h18[..]
4454	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 20.	V_h20[..]
4460	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 22.	V_h22[..]
4466	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 24.	V_h24[..]
4472	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 26.	V_h26[..]
4478	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 28.	V_h28[..]
4484	6	R	x 10	%	INT	0..1200	—	H	Same as above harmonic 30.	V_h30[..]
4490	1	R	x 10	%	INT	0..32767	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 2 of I_A. —N/A in 400 Hz systems.	I_h2[0]
4491	1	R	x 10	%	INT	0..32767	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 2 of I_B. —N/A in 400 Hz systems.	I_h2[1]
4492	1	R	x 10	%	INT	0..32767	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 2 of I_C. —N/A in 400 Hz systems.	I_h2[2]
4493	1	R	x 10	%	INT	0..32767	—	H	% value (in respect with the fundamental) of the amplitude of harmonic 2 of I_N. —N/A in 400 Hz systems. —N/A with type 31.	I_h2[3]

Continued on next page

Table 75 – Spectral Components (Even Rank) *(continued)*

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
4494	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 4.	I_h4[..]
4498	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 6.	I_h6[..]
4502	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 8.	I_h8[..]
4506	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 10.	I_h10[..]
4510	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 12.	I_h12[..]
4514	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 14.	I_h14[..]
4518	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 16.	I_h16[..]
4522	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 18.	I_h18[..]
4526	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 20.	I_h20[..]
4530	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 22.	I_h22[..]
4534	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 24.	I_h24[..]
4538	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 26.	I_h26[..]
4542	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 28.	I_h28[..]
4546	4	R	x 10	%	INT	0..32767	—	H	Same as above harmonic 30.	I_h30[..]
4550	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 2 of V_{AB}. —N/A in 400 Hz systems.	V_Phi2[0]
4551	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 2 of V_{BC}. —N/A in 400 Hz systems.	V_Phi2[1]
4552	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 2 of V_{CA}. —N/A in 400 Hz systems.	V_Phi2[2]
4553	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 2 of V_{AN}. —N/A in 400 Hz systems. —N/A with type 31.	V_Phi2[3]
4554	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 2 of V_{BN}. —N/A in 400 Hz systems. —N/A with type 31.	V_Phi2[4]
4555	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 2 of V_{CN}. —N/A in 400 Hz systems. —N/A with type 31.	V_Phi2[5]
4556	6	R	x 10	Deg	INT	0..3600	—	H	Same as above harmonic 4.	V_Phi4[..]
4562	6	R	x 10	Deg	INT	0..3600	—	H	Same as above harmonic 6.	V_Phi6[..]
4568	6	R	x 10	Deg	INT	0..3600	—	H	Same as above harmonic 8.	V_Phi8[..]
4640	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 2 of I_A. —N/A in 400 Hz systems.	I_Phi2[0]
4641	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 2 of I_B. —N/A in 400 Hz systems.	I_Phi2[1]
4642	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 2 of I_C. —N/A in 400 Hz systems.	I_Phi2[2]
4643	1	R	x 10	Deg	INT	0..3600	—	H	Phase of harmonic 2 of I_N. —N/A in 400 Hz systems. —N/A with type 31.	I_Phi2[3]
4644	4	R	x 10	Deg	INT	0..3600	—	H	Same as above harmonic 4.	I_Phi4[..]
4648	4	R	x 10	Deg	INT	0..3600	—	H	Same as above harmonic 6.	I_Phi6[..]
4652	4	R	x 10	Deg	INT	0..3600	—	H	Same as above harmonic 8.	I_Phi8[..]

Table 76 – Analog Pre-Defined Alarms

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
5700	1	R	—	—	Bitmap	0.0xFFFF	—	H	Pre-Defined Alarms Status Bitmap. Alarms 48 through 63. Bit 0 represents status of Pre-Defined. Alarm N°48. If set, Alarm is active. Status tracks the actual alarm status.	PDefAlStatus[0]
5701	1	R	—	—	Bitmap	0.0xFFFF	—	H	Pre-Defined Alarms Status Bitmap. Alarms 32 through 47. Bit 0 represents status of Pre-Defined Alarm N°32. If set, Alarm is active. Status tracks the actual alarm status.	PDefAlStatus[1]
5702	1	R	—	—	Bitmap	0.0xFFFF	—	H	Pre-Defined Alarms Status Bitmap. Alarms 16 through 31. Bit 0 represents status of Pre-Defined Alarm N°16. If set, Alarm is active. Status tracks the actual alarm status.	PDefAlStatus[2]
5703	1	R	—	—	Bitmap	0.0xFFFF	—	H	Pre-Defined Alarms Status Bitmap. Alarms 0 through 15. Bit 0 represents status of Pre-Defined Alarm N°1. If set, Alarm is active. Status tracks the actual alarm status.	PDefAlStatus[3]
6000	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 1 Setting. Over Current Phase A.	Nv_pDefAlCfg[0]
6000	1	R / W	—	—	INT	See Text	—	H	MSB: 0=ON, 1=OFF, LSB: Priority set to 0, 1, 2 or 3. When set to 0, MM will not log event into MM event log (file N°10) and MM will not log event into MM Wave Form capture (file N°5). Default value: 0x0101.	___.Status
6001	1	Read Only	—	—	INT	1016	—	H	Register number which content gets compared to the pickup setpoint and to the dropout setpoint. Default value: 1016.	___.CompReg
6002	1	Read Only	—	—	INT	1	—	H	Comparison mode. MSB indicates Pickup mode. LSB indicates Dropout mode. MSB can be set to 1, 2 or 4. LSB can be set to 1, 2 or 4. 1 selects Immediate mode: register PuValue contains the numerical value to which the monitored register is compared. No percentage is applied. Default value is 0x0101.	___.Mode
6003	1	R / W	See Text	See Text	INT	—	—	H	Alarm Actuation set point. When Immediate mode is selected, care must be taken to set this register with the same units and scale factors then the Compare Register CompReg. Default value: 0x8000.	___.PuValue
6004	1	Read Only	100	%	INT	—	—	H	This register contains a numerical value that is multiplied to the content of the pickup register, when Direct Mode is selected. Otherwise, register is not used. Default value: 0x8000.	___.PuPercentage
6005	1	R / W	x 1	s	INT	—	—	H	Actuation time delay Time delay must be set in seconds. Default value: 0x8000.	___.StatusPuDelay

Continued on next page

Table 76 – Analog Pre-Defined Alarms *(continued)*

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
6006	1	R / W	See Text	See Text	INT	—	—	H	Release set point. When Immediate mode is selected, care must be taken to set this register with the same units and scale factors then the Compare Register CompReg. Default value: 0x8000.	___.DoValue
6007	1	Read Only	100	%	INT	—	—	H	This register contains a numerical value that is multiplied to the content of the dropout register, when Direct Mode is selected. Otherwise, register is not used. Default value: 0x8000.	___.DoPercentage
6008	1	R / W	x 1	s	INT	—	—	H	Release time delay. Time delay must be set in seconds. Default value: 0x8000.	___.DoDelay
6009	1	Read Only	—	—	INT	0, 1, 2, 3	—	H	Alarm Type. 0 indicates “Over”, 1 indicates “Under”, 2 indicates “Equal to”, 3 indicates “Different from”, 5 is used for all other alarms. Default is: 1.	___.AlarmType
6010	1	R / W	—	—	INT	Bitmap	—	H	Action associated with overrunning of the set point after the time delay has run out. Log into the Wave Form Capture file (file N° 5). 0x0200 ⟶ action activated. Default value is 0x0000.	___.LogAction
6011	1	R / W	—	—	—	—	—	H	Reserved.	___.
6012	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 2** Setting. **Over Current Phase B.**	nv_pDefAlCfg[1]
6024	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 3** Setting. **Over Current Phase C.**	nv_pDefAlCfg[2]
6036	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 4** Setting. **Over Neutral Current.**	nv_pDefAlCfg[3]
6048	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 5** Setting. **Over Ground Current.**	nv_pDefAlCfg[4]
6060	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 6** Setting. **Under Current Phase A.**	nv_pDefAlCfg[5]
6072	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 7** Setting. **Under Current Phase B.**	nv_pDefAlCfg[6]
6084	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 8** Setting. **Under Current Phase C.**	nv_pDefAlCfg[7]
6096	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 9** Setting. **Over Current Unbalance Phase A.**	nv_pDefAlCfg[8]
6108	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 10** Setting. **Over Current Unbalance Phase B.**	nv_pDefAlCfg[9]
6120	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 11** Setting. **Over Current Unbalance Phase C.**	nv_pDefAlCfg[10]
6132	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 12** Setting. **Over Voltage Phase A.**	nv_pDefAlCfg[11]
6144	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 13** Setting. **Over Voltage Phase B.**	nv_pDefAlCfg[12]
6156	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 14** Setting. **Over Voltage Phase C.**	nv_pDefAlCfg[13]

Continued on next page

Table 76 – Analog Pre-Defined Alarms *(continued)*

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
6168	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 15** Setting. **Under Voltage Phase A.**	nv_pDefAlCfg[14]
6180	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 16** Setting. **Under Voltage Phase B.**	nv_pDefAlCfg[15]
6192	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 17** Setting. **Under Voltage Phase C.**	nv_pDefAlCfg[16]
6204	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 18** Setting. **Over Voltage Unbalance Phase A.**	nv_pDefAlCfg[17]
6216	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 19** Setting. **Over Voltage Unbalance Phase B.**	nv_pDefAlCfg[18]
6228	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 20** Setting. **Over Voltage Unbalance Phase C.**	nv_pDefAlCfg[19]
6240	12	—	—	—	—	Template	—	—	Pre-Defined Alarm **N° 21** Setting. **Over kVA 3-ph Total.**	nv_pDefAlCfg[20]
6252	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 22 Setting. Over kW Into The Load 3-ph Total.	nv_pDefAlCfg[21]
6264	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 23 Setting. Over kW Out Of The Load 3-ph Total.	nv_pDefAlCfg[22]
6276	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 24 Setting. Over kVAR Into The Load 3-ph Total.	nv_pDefAlCfg[23]
6288	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 25 Setting. Over kVAR Out of The Load 3-ph Total.	nv_pDefAlCfg[24]
6300	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 26 Setting. Under kVA 3-ph Total.	nv_pDefAlCfg[25]
6312	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 27 Setting. Under kW Into The Load 3-ph Total.	nv_pDefAlCfg[26]
6324	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 28 Setting. Under kW Out Of The Load 3-ph Total.	nv_pDefAlCfg[27]
6336	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 29 Setting. Under kVAR Into The Load 3-ph Total.	nv_pDefAlCfg[28]
6348	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 30 Setting. Under kVAR Into The Load 3-ph Total.	nv_pDefAlCfg[29]
6360	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 31 Setting. Lagging True Power Factor 3-ph Total.	nv_pDefAlCfg[30]
6372	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 32 Setting. Leading True Power Factor 3-ph Total.	nv_pDefAlCfg[31]
6384	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 33 Setting. Lagging Displacement Power Factor 3-ph Total.	nv_pDefAlCfg[32]
6396	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 34 Setting. Leading Displacement Power Factor 3-ph Total.	nv_pDefAlCfg[33]
6408	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 35 Setting. Over Value THD Current Phase A.	nv_pDefAlCfg[34]
6420	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 36 Setting. Over Value THD Current Phase B.	nv_pDefAlCfg[35]
6432	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 37 Setting. Over Value THD Current Phase C.	nv_pDefAlCfg[36]
6444	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 38 Setting. Over Value THD Voltage V_{AB}.	nv_pDefAlCfg[37]
6456	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 39 Setting. Over Value THD Voltage V_{BC}.	nv_pDefAlCfg[38]

Continued on next page

Table 76 – Analog Pre-Defined Alarms *(continued)*

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
6468	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 40 Setting. Over Value THD Voltage V_{CA}.	nv_pDefAlCfg[39]
6480	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 41 Setting. Over Value THD Voltage V_{AN}.	nv_pDefAlCfg[40]
6492	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 42 Setting. Over Value THD Voltage V_{BN}	nv_pDefAlCfg[41]
6504	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 43 Setting. Over Value THD Voltage V_{CN}	nv_pDefAlCfg[42]
6516	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 44 Setting. Over Predicted kVA Demand.	nv_pDefAlCfg[43]
6528	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 45 Setting. Over Predicted kW Demand into the Load 3-ph Total	nv_pDefAlCfg[44]
6540	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 46 Setting. Over Predicted kW Demand out of the Load 3-ph Total.	nv_pDefAlCfg[45]
6552	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 47 Setting. Over Predicted kVAR Demand into the Load 3-ph Total	nv_pDefAlCfg[46]
6564	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 48 Setting. Over Predicted kVAR Demand out of the Load 3-ph Total	nv_pDefAlCfg[47]
6576	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 49 Setting. Under Predicted kVA Demand	nv_pDefAlCfg[48]
6588	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 50 Setting. Under Predicted kW Demand into the Load 3-ph Total	nv_pDefAlCfg[49]
6600	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 51 Setting. Under Predicted kW Demand out of the Load 3-ph Total	nv_pDefAlCfg[50]
6612	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 52 Setting. Under Predicted kVAR Demand into the Load 3-ph Total	nv_pDefAlCfg[51]
6624	12	—	—	—	—	Template	—	—	Pre-Defined Alarm N° 53 Setting. Under Predicted kVAR Demand out of the Load 3-ph Total	nv_pDefAlCfg[52]

Wave Form Capture

Registers 7132 to 7157 file N° 5
(see “Access to Files” on page 35).

Event Log

Registers 7164 to 7188 file N° 10
(see “Access to Files” on page 35).

Min-Max Event Log

Registers 7196 to 7220 file N° 11
(see “Access to Files” on page 35).

Maintenance EventLog

Registers 7228 to 7252 file N° 12
(see “Access to Files” on page 35).

Protection Module @ Address xx + 100

Table 77 – Characteristics of the Protection Module

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
8700	4	R	1	—	ASCII	—	A	P / H	Serial number encoded in ASCII.	EeSerialNumber
8710	1	R	1	—	INT	—	A	P / H	Protection module firmware version.	EeFWVersion
8716	1	R	1	—	INT	—	A	P / H	Square D Identification number. 15131 = MicroLogic A (PM). 15133 = MicroLogic P (PM). 15135 = MicroLogic H (PM). Default value = 0x8000.	EeSQD_Prod_ID
8740	1	R	1	—	ASCII	20, 30, 40 50, 60, 70	A	P / H	Control unit model. 20 = MicroLogic 2.0,... 70 = MicroLogic 7.0.	EeUnitModelNum
8741	1	R	1	—	ASCII	A, P, H	A	P / H	Type of control unit: A, P or H.	EeUnitType
8742	1	R	1	—	INT	0..15	A	P / H	Type of long time rating plug. 0 = missing 1= IEC standard 2 = IEC low 3 = IEC High 10 = OFF 7 = UL-A 8 = UL-B 9 = UL-C 11= UL-D 12 = UL-E 13 = UL-F 14 = UL-G 15 = UL-H	HwLT_PlugType
8750	1	R	x 1	A	INT	0..8000	A	P / H	Rated circuit breaker current. Default value: 100 A (circuit breaker sensor plug not present).	HwBrNominalCurrent
8753	1	R / W[1]	x 1	Notch	INT	0..3	A	P / H	Type of neutral protection. • 0: OFF. • 1: N / 2. • 2: N. • 3: N x 1.6.	EeNeutralProtType

[1] Write access only with MicroLogic P / H.

Table 78 – Basic Protections Settings (Long-Time Protection-Alarm N° 1000 Ir)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
8754	1	R	—	—	INT	0x0001	A	P / H	0x0001 (protection active).	LongTime_Status
8755	1	R / W[1]	—	—	INT	Bitmap 16	A	P / H	Type of Idmtl curve. • Bit 0: standard long-time curve I²t. (default value). • Bit 1: SIT curve. • Bit 2: VIT curve. • Bit 3: EIT (#I²t on) curve. • Bit 4: HVF curve. • Bit 5: constant time (#I²t off).	LongTime_Config
8756	2	R / W[1]	x 1	A	MOD 10000	40..8000	A	P / H	Ir pickup for the long-time protection.	LongTime_PuValue
8758	1	R / W[1]	x 1	ms	INT	500.. 24000	A	P / H	tr tripping delay for the long-time protection.	LongTime_PuDelay
8762	1	R / W[1]	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	LongTime_LogAction
8763	1	R / W[1]	—	—	INT	Bitmap 16	—	P / H	List of “pickup” actions linked to overrun of set point at the end of the delay. Bit set to 1: action activated. • Bit 0: always set to 1 (trip action). • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0001—(trip action).	LongTime_ActuAction

[1] Write access only with MicroLogic P / H.

Table 79 – Basic Protections Settings (Short-Time Protection-Alarm N° 1000 Isd)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
8764	1	R	—	—	INT	0x0001	A	P / H	0x0001 (protection active).	ShortTime_Status
8765	1	R / W[1]	—	—	INT	0, 1	A	P / H	Type of protection. • 0: type I^2t on. • 1: type I^2t off.	ShortTime_Config
8766	2	R / W[1]	x 1	A	MOD 10000	60..80000	A	P / H	Isd pickup for the short-time protection.	ShortTime_PuValue
8768	1	R / W[1]	x 1	ms	INT	0..400	A	P / H	tsd tripping delay for the short-time protection. 0 s valid only for the I^2t off position. 100 to 400 ms: valid for the I^2t on and I^2t off positions.	ShortTime_PuDelay
8772	1	R / W[1]	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	ShortTime_LogAction
8773	1	R / W[1]	—	—	INT	Bitmap 16	—	P / H	List of “pickup” actions linked to overrun of set point at the end of the delay. Bit set to 1: action activated. • Bit 0: always set to 1 (trip action). • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0001—(trip action).	ShortTime_ActuAction

[1] Write access only with MicroLogic P / H.

Table 80 – Basic Protections Settings (Instantaneous Protection-Alarm N° 1000 II)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
8774	1	R	—	—	INT	0x0001 0x0101	A	P / H	• 0x0001 (protection active). • 0x0101 (protection OFF). Default value = 0x0001.	Instant_Status
8775	1	R / W[1]	—	—	INT	—	—	P / H	Reserved.	Instant_Config
8776	2	R / W[1]	x 1	A	MOD 10000	200.. 120000	A	P / H	I pickup for the instantaneous protection.	Instant_PuValue
8778	1	R / W[1]	—	—	—	—	—	—	Reserved.	Instant_PuDelay
8782	1	R / W[1]	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	Instant_LogAction
8783	1	R / W[1]	—	—	INT	Bitmap 16	—	P / H	List of “pickup” actions linked to overrun of set point at the end of the delay. Bit set to 1: action activated. • Bit 0: always set to 1 (trip action). • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0001—(trip action).	Instant_ActuAction

[1] Write access only with MicroLogic P / H.

Table 81 – Basic Protections Settings (Ground-Fault Protection-Alarm N° 1003 Ig)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
8784	1	R / W[1]	—	—	INT	0x0001 0x0101	A	P / H	• 0x0001 (protection active). • 0x0101 (protection OFF). Default value = 0x0001	Res_Status
8785	1	R / W[1]	—	—	INT	0, 1	A	P / H	Type of protection. • 0: I^2t on. • 1: I^2t off.	Res_Config
8786	2	R / W[1]	x 1	A	MOD 10000	30..1200	A	P / H	Ig pickup for the ground-fault protection.	Res_PuValue
8788	1	R / W[1]	x 1	ms	INT	0..400	A	P / H	tg tripping delay for the ground-fault protection. • 0 s valid only for the I^2t off position. • 100 to 400 ms: valid for the I^2t on and I^2t off positions actions.	Res_PuDelay
8792	1	R / W[1]	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	Res_LogAction
8793	1	R / W[1]	—	—	INT	Bitmap 16	—	P / H	List of “pickup” actions linked to overrun of set point at the end of the delay. Bit set to 1: action activated. • Bit 0: always set to 1 (trip action). • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0001—(trip action).	Res_ActuAction

1 Write access only with MicroLogic P / H.

Table 82 – Basic Protections Settings (Earth-Leakage Protection-Alarm N° 1004 Idelta n)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
8794	1	R	—	—	INT	0x0001	A	P / H	0x0001 (protection active).	Vigi_Status
8795	1	R / W[1]	—	—	INT	—	A	P / H	Reserved.	Vigi_Config
8796	2	R / W[1]	x 1	mA	MOD 10000	5..300	A	P / H	I∆N pickup for the earth-leakage protection.	Vigi_PuValue
8798	1	R / W[1]	x 1	ms	INT	0..1000	A	P / H	∆t tripping delay for the earth-leakage protection.	Vigi_PuDelay
8802	1	R / W[1]	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	Vigi_LogAction
8803	1	R / W[1]	—	—	INT	Bitmap 16	—	P / H	List of “pickup” actions linked to overrun of set point at the end of the delay. Bit set to 1: action activated. • Bit 0: always set to 1 (trip action). • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0001—(trip action).	Vigi_ActuAction
8804	1	R	—	—	UINT	0.0xFFFF	—	P / H	PM configuration change counter. This counter is incremented each time a PM setting change is applied through HMI (keyboard or switches) or COM. If switches were changed during power off, this counter is incremented at power up.	EePMCfgChangeCnt r

1 Write access only with MicroLogic P / H.

Table 83 – Protection Module Measurements

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
8833	1	R	x 10	% In	INT	0..16000	—	P / H	Maximum fault current (trip) recorded on phase A since last reset.[1] Default value: 0x8000 (no fault recorded or circuit breaker type not entered).	eeMaxFaultI[0]
8834	1	R	x 10	% In	INT	0..16000	—	P / H	Maximum fault current (trip) recorded on phase B since last reset.[1] Default value: 0x8000 (no fault recorded or circuit breaker type not entered).	eeMaxFaultI[1]
8835	1	R	x 10	% In	INT	0..16000	—	P / H	Maximum fault current (trip) recorded on phase C since last reset.[1] Default value: 0x8000 (no fault recorded or circuit breaker type not entered).	eeMaxFaultI[2]
8836	1	R	x 10	% In	INT	0..16000	—	P / H	Maximum fault current (trip) recorded on the neutral phase since last reset.[1] Default value: 0x8000 (no fault recorded or circuit breaker code not supplied).	eeMaxFaultI[3]
8837	1	R	x 1	% Ir	INT	0..32767	A	P / H	rms current on phase A expressed as a % of the Ir long-time set point.	I_RMSRelIr[0]
8838	1	R	x 1	% Ir	INT	0..32767	A	P / H	rms current on phase B expressed as a % of the Ir long-time set point.	I_RMSRelIr[1]
8839	1	R	x 1	% Ir	INT	0..32767	A	P / H	rms current on phase C expressed as a % of the Ir long-time set point.	I_RMSRelIr[2]
8840	1	R	x 1	% Ir	INT	0..32767	A	P / H	rms current on the neutral expressed as a % of the rated current In x the selected neutral setting (x 1, x 2 or x 0.5).[2]	I_RMSRelIr[3]
8841	1	R	x 1	% Ig	INT	0..32767	A	P / H	"Residual" ground-fault current expressed as a % of the Ig ground fault protection set point.[3]	I_RMSGndRelIr
8842	1	R	x 0.01	% Idn	INT	0..32767	A	P / H	Earth-leakage current expressed as a % of the I∆N earth-leakage protection set point.[4]	I_RMSVigiRelIr

1 Auxiliary power is required to calculate the fault currents. Calculation is effective only when the circuit breaker selection code has been supplied (see the MicroLogic user manual).

2 Value not accessible when configuration register 9618 returns "no external CT"

3 Accessible only with MicroLogic 6.0.

4 Accessible only with MicroLogic 7.0.

Table 84 – Status of the Protection Module

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
8843	1	R	x 1	%	INT	0..100	A	P / H	Battery-charge indicator.	BatteryIndic
8857	1	R	—	—	INT	Bitmap 16	—	P / H	Status word for the contacts on the M2C or M6C module. • Bit set to 1: contact latched. • Bit set to 0: contact unlatched. Reset not possible. Automatic update. • Bit 0: contact 1 on an M2C or M6C module. • Bit 1: contact 2 on an M2C or M6C module. • Bit 2: contact 3 on an M6C module. • Bit 3: contact 4 on an M6C module. • Bit 4: contact 5 on an M6C module. • Bit 5: contact 6 on an M6C module.	RlyStatus
8862	1	R	—	—	INT	Bitmap 16	—	P / H	Status word for overrun of current-protection set points. This condition is reached as soon as the protection set point is overrun, even if the time delay has not expired. • Bit 0: long-time and LT IDMTL protection. If the bit is set to: • 0: set-point overrun = False. • 1: set-point overrun = True.	BasProtPickupStatus
8863	1	R	—	—	INT	Bitmap 16	—	P / H	Status word for overrun of protection set points. • Bit 0: current unbalance. • Bit 1: maximum current on phase A. • Bit 2: maximum current on phase B. • Bit 3: maximum current on phase C. • Bit 4: maximum current on the neutral. • Bit 5: minimum voltage. • Bit 6: maximum voltage. • Bit 7: voltage unbalance. • Bit 8: maximum power. • Bit 9: reverse power. • Bit 10: minimum frequency. • Bit 11: maximum frequency. • Bit 12: phase rotation. • Bit 13: load shedding based on current. • Bit 14: load shedding based on power.	AdvProtPickupStatus
8864	—	—	—	—	INT	Bitmap 16	—	—	Continuation of status word for overrun of advanced protection set points. • Bit 0: ground-fault alarm. • Bit 1: earth-leakage alarm.	AdvXtedProtTripStatus
8865	2	R	x 0.1	s	MOD 10000	—	—	P / H	Time remaining before long-time tripping.	TimeLeftUntilLT_Trip
8892	1	R	—	—	—	0..1	—	P / H	Phase rotation. 0: A_{BC} 1: A_{CB}	RotatePhase

Table 85 – Time Stamping and Trip / Alarm History

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9000	4	R	—	—	XDATE	—	—	P / H	Current date of the protection module.	XtedDateTime
9010	3	R	—	—	DATE	—	—	P / H	Date of last reset of the maximum phase, ground-fault and earth-leakage currents.	NvLastMaxI_Reset
9070	3	R	—	—	DATE	—	—	P / H	Date of last reset of the trip history (last ten faults).	NvLast10TripReset
9073	3	R	—	—	DATE	—	—	P / H	Date of last reset of the alarm history (last ten alarms).	NvLast10AlarmReset

Table 86 – Trip History

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9094	4	R	1	%	INT	0..32767	—	P / H	Contact wear indicator per phase. Default value = 0x8000. The contacts must be inspected each time the counter reaches a hundred mark. The message "Not available or circuit breaker type not defined" is displayed if the type of the circuit breaker has not been defined. (See "Breaker selection" in the MicroLogic set-up menu and see register 9846.)	PhaseContactWear
9098	1	R	—	—	INT	0..10	—	P / H	Number of faults recorded in the trip history (FIFO).	NvTotalTripQ_Entries
9099	1	R	—	—	INT	0..9	—	P / H	Value of the pointer for the last fault recorded in the trip history. The last fault recorded is in nvLastTripQ_Entry. The next to last fault is in nvLastTripQ_Entry-1 modulo 10.	NvLastTripQ_Entry
9100	20	R	—	—	TRIP RECORD	—	—	P / H	Record 0 in the FIFO.	TripRecord[0]
9120	20	R	—	—	TRIP RECORD	—	—	P / H	Record 1 in the FIFO.	TripRecord[1]
9140	20	R	—	—	TRIP RECORD	—	—	P / H	Record 2 in the FIFO.	TripRecord[2]
9160	20	R	—	—	TRIP RECORD	—	—	P / H	Record 3 in the FIFO.	TripRecord[3]
9180	20	R	—	—	TRIP RECORD	—	—	P / H	Record 4 in the FIFO.	TripRecord[4]
9200	20	R	—	—	TRIP RECORD	—	—	P / H	Record 5 in the FIFO.	TripRecord[5]
9220	20	R	—	—	TRIP RECORD	—	—	P / H	Record 6 in the FIFO.	TripRecord[6]
9240	20	R	—	—	TRIP RECORD	—	—	P / H	Record 7 in the FIFO.	TripRecord[7]
9260	20	R	—	—	TRIP RECORD	—	—	P / H	Record 8 in the FIFO.	TripRecord[8]
9280	20	R	—	—	TRIP RECORD	—	—	P / H	Record 9 in the FIFO.	TripRecord[9]

For further details see “Trip / Alarm History” on page 82.

Table 87 – Alarm History

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9300	1	R	—	—	INT	0..10	—	P / H	Number of alarms recorded in the alarm history (FIFO) nvLast10AlarmQ[].	NvTotalAlarmQ_Entrie s
9301	1	R	—	—	INT	0..9	—	P / H	Value of the pointer for the last alarm recorded in the alarm history. The last alarm recorded is in nvLastAlarmQ_Entry. The next to last alarm is in nvLastAlarmQ_Entry-1 modulo 10.	NvLastAlarmQ_Entry
9302	15	R	—	—	ALARM RECORD	—	—	P / H	Record 0 in the FIFO.	AlarmRecord[0]
9317	15	R	—	—	ALARM RECORD	—	—	P / H	Record 1 in the FIFO.	AlarmRecord[1]
9332	15	R	—	—	ALARM RECORD	—	—	P / H	Record 2 in the FIFO.	AlarmRecord [2]
9347	15	R	—	—	ALARM RECORD	—	—	P / H	Record 3 in the FIFO.	AlarmRecord [3]
9362	15	R	—	—	ALARM RECORD	—	—	P / H	Record 4 in the FIFO.	AlarmRecord [4]
9377	15	R	—	—	ALARM RECORD	—	—	P / H	Record 5 in the FIFO.	AlarmRecord [5]
9392	15	R	—	—	ALARM RECORD	—	—	P / H	Record 6 in the FIFO.	AlarmRecord [6]
9407	15	R	—	—	ALARM RECORD	—	—	P / H	Record 7 in the FIFO.	AlarmRecord [7]
9422	15	R	—	—	ALARM RECORD	—	—	P / H	Record 8 in the FIFO.	AlarmRecord [8]
9437	15	R	—	—	ALARM RECORD	—	—	P / H	Record 9 in the FIFO.	AlarmRecord [9]

For further details see “Trip / Alarm History” on page 82.

Table 88 – MicroLogic Configuration

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9600	1	R	—	—	INT	0..32767	—	P / H	Control word for the protection module. This control word may not be user set. It is randomly modified and must be read before sending certain commands to the protection module.	ControlWord
9604	2	R / W	—	—	ASCII	0x00..0x7F	—	P / H	Short identifier of the protection module, coded over four ASCII characters. Default value: “set!”	eeBrLabel
9606	8	R / W	—	—	ASCII	0x00..0x7F	—	P / H	Long identifier of the protection module, coded over 16 ASCII characters. Default value: “please set me up”.	eeBrNamePlate
9614	1	R / W	—	—	INT	Bitmap 16	—	P / H	Language used by the control unit. May be modified via the control-unit keypad. Default value: “English” (but may be factory set if necessary). • Bit 0: French. • Bit 1: US English. • Bit 2: UK English. • Bit 3: German. • Bit 4: Spanish. • Bit 5: Italian. • Bit 6: optional language available on order from Schneider Electric.	eeUnitLanguage
9615	1	R / W	—	—	INT	Bitmap 16	—	—	Rated circuit breaker operating frequency. Required by the protection module to disable phase-rotation protection for 400 Hz distribution system. Default value: 50 / 60 Hz, other possible value: 400 Hz. • Bit 0: 50 / 60 Hz. • Bit 3: 400 Hz.	eEeNominalFreq
9616	1	R / W	x 1	V	INT	100..1150	—	P / H	Rated primary voltage on the voltage transformer. Default value: 690 V.	eePT_RatioPri
9617	1	R / W	x 1	V	INT	100..1150	—	P / H	Rated secondary voltage on the voltage transformer. Default value: 690 V.	eePT_RatioSec
9618	1	R / W	—	—	INT	0,1, 2	—	P / H	• 0: no neutral CT (3-pole circuit breaker without external CT). • 1: internal Ct (4-pole circuit breaker). • 2: external CTs connected (3-pole circuit breaker with external CT). Default value: 0.	eeNeutralCTType

Advanced Protection Settings

The concerned protection functions are listed below.

- Ground-Fault or Earth-Leakage Alarm
- Current Unbalance I_{unbal}
- Maximum Current $I_{A\ max}$, $I_{B\ max}$, $I_{C\ max}$, and $I_{N\ max}$
- Minimum and Maximum Voltage V_{min} and V_{max}
- Voltage Unbalance V_{unbal}
- Reverse Power rP_{max}
- Minimum and Maximum Frequency F_{min} and F_{max}
- Phase Rotation
- Load Shedding and Reconnection Based on Current and Power

Table 89 – Ground-Fault Alarm—Alarm N°1014 (I_g Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9629	1	R / W	—	—	INT	0x0001 0x0101	—	P / H	0x0001 (alarm active). 0x0101 (OFF). Default value: 0x0101.	AlarmTerreRes_Status
9631	2	R / W[1]	x 1	A	MOD 10000	20..1200	—	P / H	Pickup for the ground-fault protection alarm. Minimum limited to 5% of In. Default value: 1200 A.	AlarmTerreRes_PuValue
9633	1	R / W[1]	x 0.1	s	INT	10..100	—	P / H	Pickup delay for the ground-fault protection alarm. Default value: 100 (10 s).	AlarmTerreRes_PuDelay
9634	2	R / W[1]	x 1	A	MOD 10000	20..1200	—	P / H	Dropout for the ground-fault protection alarm. Maximum limited to AlarmTerreRes_PuValue. Minimum limited to 5% of In. Default value: 1200 A.	AlarmTerreRes_DoValue
9636	1	R / W[1]	x 0.1	s	INT	10..100	—	P / H	Dropout delay for the ground-fault protection alarm. Default value: 10 (1s).	AlarmTerreRes_DoDelay
9637	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	AlarmTerreRes_LogAction
9638	1	R / W[1]	—	—	INT	Bitmap 16	—	P / H	List of pick-up actions linked to overrun of set point at the end of the delay. • Bit 0: always set to 0 (trip disabled for this type of alarm). • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	AlarmTerreRes_ActuAction

[1] Accessible only with MicroLogic 5.0 P, 6.0 P, 5.0 H, 6.0 H.

Table 90 – Earth-Leakage Alarm—Alarm N°1015 (IΔn Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9639	1	R / W[1]	—	—	INT	0x0001 0x0101	—	P / H	0x0001 (alarm active). 0x0101 (OFF). Default value: 0x0101.	AlarmTerreVigi_Status
9641	2	R / W[1]	x 0.1	A	MOD 10000	5..300	—	P / H	Pickup for the earth-leakage protection alarm. Default value: 300 (30 A).	AlarmTerreVigi_PuValue
9643	1	R / W[1]	x 0.1	s	INT	10..100	—	P / H	Pickup delay for the earth-leakage protection alarm. Default value: 100 (10 s).	AlarmTerreVigi_PuDelay
9644	2	R / W[1]	x 0.1	A	MOD 10000	5..300	—	P / H	Dropout for the earth-leakage protection alarm. Maximum limited to AlarmTerreVigi_PuValue. Default value: 300 (30 A).	AlarmTerreVigi_DoValue
9646	1	R / W[1]	x 0.1	s	INT	10..100	—	P / H	Dropout delay for the earth-leakage protection alarm. Default value: 10 (1 s).	AlarmTerreVigi_DoDelay
9647	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	AlarmTerreVigi_LogAction
9648	1	R / W[1]	—	—	INT	Bitmap 16	—	P / H	List of pick-up actions linked to overrun of set point at the end of the delay. • Bit 0: always set to 0 (trip disabled for this type of alarm). • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	AlarmTerreVigi_Actu Action

[1] Accessible only with MicroLogic 7.0 P, 7.0 H.

Table 91 – Current Unbalance—Alarm N°1016 (I_{unbal} Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9649	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm or protection active). 0x0101 (OFF). Default value: 0x0101.	Unball_Status
9651	2	R / W	x 1	%	MOD 10000	5..60	—	P / H	Pickup for the current unbalance on phase A. Default value: 60%.	Unball_PuValue
9653	1	R / W	x 0.1	s	INT	10..400	—	P / H	Pickup delay for the current unbalance on phase A. Default value: 400 (40 s).	Unball_PuDelay
9654	2	R / W	x 1	%	MOD 10000	5..60	—	P / H	Dropout for the current unbalance on phase A. Default value: 60%.	Unball_DoValue
9656	1	R / W	x 0.1	s	INT	100..360 0	—	P / H	Dropout delay for the current unbalance on phase A. Default value: 10 (1 s).	Unball_DoDelay
9657	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	Unball_LogAction
9658	1	R / W	—	—	INT	Bitmap 16	—	P / H	List of pick-up actions linked to overrun of set point at the end of the delay. • If bit 0 is set to1, the circuit breaker trips. • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000 —no action.	Unball_ActuAction

Table 92 – Maximum Current—Alarm N°1017 ($I_{A\ max}$ Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9659	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm or protection active). 0x0101 (OFF). Default value: 0x0101.	Overl$_A$_Status
9661	2	R / W	x 1	A	MOD 10000	20..8000 0	—	P / H	Pickup for the maximum current $I_{A\ max}$. • Maximum limited to 1 x hwNominalCurrent. • Minimum limited to 0.2 x hwNominalCurrent. • Default value: 1 x hwNominalCurrent.	Overl$_A$_PuValue
9663	1	R / W	x 1	s	INT	15..1500	—	P / H	Pickup delay for the maximum current $I_{A\ max}$. Default value: 1500 s.	Overl$_A$_PuDelay
9664	2	R / W	x 1	A	MOD 10000	20..8000 0	—	P / H	Dropout for the maximum current $I_{A\ max}$. • Maximum limited to Overla_PuValue. • Minimum limited to 0.2 x hwNominalCurrent. • Default value: 1 x hwNominalCurrent.	Overl$_A$_DoValue
9666	1	R / W	x 1	s	INT	15..3000	—	P / H	Dropout delay for the maximum current $I_{A\ max}$. Default value: 15 s.	Overl$_A$_DoDelay
9667	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	Overl$_A$_LogAction
9668	1	R / W	—	—	INT	Bitmap 16	—	P / H	List of pick-up actions linked to overrun of set point at the end of the delay. • If bit 0 is set to1, the circuit breaker trips. • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	Overl$_A$_ActuAction

Table 93 – Maximum Current—Alarm N°1018 ($I_{B\ max}$ Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9669	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm or protection active). 0x0101 (OFF). Default value: 0x0101.	Overl$_B$_Status
9671	2	R / W	x 1	A	MOD 10000	20..80000	—	P / H	Pickup for the maximum current $I_{B\ max}$. • Maximum limited to 1 x hwNominalCurrent. • Minimum limited to 0.2 x hwNominalCurrent. • Default value: 1 x hwNominalCurrent.	Overl$_B$_PuValue
9673	1	R / W	x 1	s	INT	15..1500	—	P / H	Pickup delay for the maximum current $I_{B\ max}$. Default value: 1500 s.	Overl$_B$_PuDelay
9674	2	R / W	x 1	A	MOD 10000	20..80000	—	P / H	Dropout for the maximum current $I_{B\ max}$. • Maximum limited to Overlb_PuValue. • Minimum limited to 0.2 x hwNominalCurrent. • Default value: 1 x hwNominalCurrent.	Overl$_B$_DoValue
9676	1	R / W	x 1	s	INT	15..3000	—	P / H	Dropout delay for the maximum current $I_{B\ max}$. Default value: 15 s.	Overl2_DoDelay
9677	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	Overl$_B$_LogAction
9678	1	R / W	—	—	INT	Bitmap 16	—	P / H	List of pick-up actions linked to overrun of set point at the end of the delay. • If bit 0 is set to1, the circuit breaker trips. • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	Overl$_B$_ActuAction

Table 94 – Maximum Current—Alarm N°1019 ($I_{C\ max}$ Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9679	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm or protection active). 0x0101 (OFF). Default value: 0x0101.	Overl$_C$_Status
9682	2	R / W	x 1	A	MOD 10000	20..8000 0	—	P / H	Pickup for the maximum current $I_{C\ max}$. • Maximum limited to 1 x hwNominalCurrent. • Minimum limited to 0.2 x hwNominalCurrent. • Default value: 1 x hwNominalCurrent.	Overl$_C$_PuValue
9683	1	R / W	x 1	s	INT	15..1500	—	P / H	Pickup delay for the maximum current $I_{C\ max}$. Default value: 1500 s	Overl$_C$_PuDelay
9685	2	R / W	x 1	A	MOD 10000	20..8000 0	—	P / H	Dropout for the maximum current $I_{C\ max}$. • Maximum limited to Overlc_PuValue. • Minimum limited to 0.2 x hwNominalCurrent. • Default value: 1 x hwNominalCurrent.	Overl$_C$_DoValue
9686	1	R / W	x 1	s	INT	15..3000	—	P / H	Dropout delay for the maximum current $I_{C\ max}$. Default value: 15 s.	Overl$_C$_DoDelay
9687	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	Overl$_C$_LogAction
9688	1	R / W	—	—	INT	Bitmap 16	—	P / H	List of pick-up actions linked to overrun of set point at the end of the delay. • If bit 0 is set to1, the circuit breaker trips. • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	Overl$_C$_ActuAction

Table 95 – Maximum Current—Alarm N°1020 ($I_{N\ max}$ Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9689	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm or protection active). 0x0101 (OFF). Default value: 0x0101.	OverIn_Status
9692	2	R / W	x 1	A	MOD 10000	20..80000	—	P / H	Pickup for the maximum current $I_{N\ max}$. • Maximum limited to 1 x hwNominalCurrent. • Minimum limited to 0.2 x hwNominalCurrent. • Default value: 1 x hwNominalCurrent.	OverIn_PuValue
9693	1	R / W	x 1	s	INT	15..1500	—	P / H	Pickup delay for the maximum current $I_{N\ max}$. Default value: 1500 s.	OverIn_PuDelay
9695	2	R / W	x 1	A	MOD 10000	20..80000	—	P / H	Dropout for the maximum current $I_{N\ max}$. • Maximum limited to OverIn_PuValue. • Minimum limited to 0.2 x hwNominalCurrent. • Default value: 1 x hwNominalCurrent.	OverIn_DoValue
9696	1	R / W	x 1	s	INT	15..3000	—	P / H	Dropout delay for the maximum current $I_{N\ max}$. Default value: 15 s.	OverIn_DoDelay
9697	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	OverIn_LogAction
9698	1	R / W	—	—	INT	Bitmap 16	—	P / H	Actions linked to overrun of set point at the end of the delay. • If bit 0 is set to 1, the circuit breaker trips. • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	OverIn_ActuAction

Table 96 – Minimum Voltage—Alarm N°1021 (V_{min} Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9699	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm or protection active). 0x0101 (OFF). Default value: 0x0101.	UnderV_Status
9701	2	R / W	x 1	V	MOD 10000	100..1200	—	P / H	Pickup for the minimum voltage V_{min}. • Maximum limited to OverV.PuValue. • Default value: 100 V.	UnderV_PuValue
9703	1	R / W	x 0.01	s	INT	20..500	—	P / H	Pickup delay for the minimum voltage V_{min}. Default value: 500 (5 s).	UnderV_PuDelay
9704	2	R / W	x 1	V	MOD 10000	100..1200	—	P / H	Dropout for the minimum voltage V_{min}. • Minimum limited to UnderV_PuValue. • Default value: 100 V.	UnderV_DoValue
9706	1	R / W	x 0.01	s	INT	20..3600	—	P / H	Dropout delay for the minimum voltage V_{min}. Default value: 20 (0.02 s).	UnderV_DoDelay
9707	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	UnderV_LogAction
9708	1	R / W	—	—	INT	Bitmap 16	—	P / H	Actions linked to overrun of set point at the end of the delay. • If bit 0 is set to 1, the circuit breaker trips. • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	UnderV_ActuAction

Table 97 – Maximum Voltage—Alarm N°1022 (V_{max} Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9709	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm or protection active). 0x0101 (OFF). Default value: 0x0101.	OverV_Status
9711	2	R / W	x 1	V	MOD 10000	100..1200	—	P / H	Pickup for the maximum voltage V_{max}. • Minimum limited to the pickup value. • Default value: +5% above eePT_RatioPri (primary voltage on the voltage transformer).	OverV_PuValue
9713	1	R / W	x 0.01	s	INT	20..500	—	P / H	Pickup delay for the maximum voltage V_{max}. Default value: 500 (5 s).	OverV_PuDelay
9714	2	R / W	x 1	V	MOD 10000	100..1200	—	P / H	Dropout for the maximum voltage V_{max}. • Maximum limited to OverV_PuValue. • Default value: +5 % above de eePT_RatioPri (primary voltage on the voltage transformer).	OverV_DoValue
9716	1	R / W	x 0.01	s	INT	20..3600	—	P / H	Dropout delay for the maximum voltage V_{max}. Default value: 20 (0.02 s).	OverV_DoDelay
9717	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	OverV_LogAction
9718	1	R / W	—	—	INT	Bitmap 16	—	P / H	Actions linked to overrun of set point at the end of the delay. • If bit 0 is set to 1, the circuit breaker trips. • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	OverV_ActuAction

Table 98 – Voltage Unbalance—Alarm N°1023 (V_{unbal} Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9719	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm or protection active). 0x0101 (OFF). Default value: 0x0101.	UnbalV_Status
9721	2	R / W	x 1	%	MOD 10000	2..30	—	P / H	Pickup for the voltage unbalance V_{unbal}. Default value: 30%.	UnbalV_PuValue
9723	1	R / W	x 0.1	s	INT	10..400	—	P / H	Pickup delay for the voltage unbalance V_{unbal}. Default value: 400 (4 s).	UnbalV_PuDelay
9724	2	R / W	x 1	%	MOD 10000	2..30	—	P / H	Dropout for the voltage unbalance V_{unbal}. • Maximum limited to UnbalV_PuValue. • Default value: 30%.	UnbalV_DoValue
9726	1	R / W	x 0.1	s	INT	100..3600	—	P / H	Dropout delay for the voltage unbalance V_{unbal}. Default value: 100 (10 s).	UnbalV_DoDelay
9727	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	UnbalV_LogAction
9728	1	R / W	—	—	INT	Bitmap 16	—	P / H	Actions linked to overrun of set point at the end of the delay. • If bit 0 is set to 1, the circuit breaker trips. • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	UnbalV_ActuAction

Table 99 – Reverse Power—Alarm N°1025 (rP_{max} Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9739	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm or protection active). 0x0101 (OFF). Default value: 0x0101.	RevPwr_Status
9740	1	R / W	—	—	INT	—	—	P / H	Direction of active-power flow. • Bit 0 set to 0: “standard” - power connections made to the lower terminals of the circuit breaker. • Bit set to 1: “reverse” - power connections made to the upper terminals of the circuit breaker. The direction may be modified by the control unit or by directly writing to the register after obtaining the right (using a command). Default value: 0x0000.	RevPwr_Config
9741	2	R / W	x 1	kW	MOD 10000	5..500	—	P / H	Pickup for the maximum reverse power rP_{max}. Default value: 500 kW.	RevPwr_PuValue
9743	1	R / W	x 0.1	s	INT	2..200	—	P / H	Pickup delay for the maximum reverse power rP_{max}. Default value: 200 (20 s).	RevPwr_PuDelay
9744	2	R / W	x 1	kW	MOD 10000	5..500	—	P / H	Dropout for the maximum reverse power rP_{max}. • Maximum limited to RevPwr_PuValue. • Default value: 500 kW.	RevPwr_DoValue
9746	1	R / W	x 0.1	s	INT	10..3600	—	P / H	Dropout delay for the maximum reverse power rP_{max}. Default value: 10 (1 s).	RevPwr_DoDelay
9747	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	RevPwr_LogAction
9748	1	R / W	—	—	INT	Bitmap 16	—	P / H	Actions linked to overrun of set point at the end of the delay. • If bit 0 is set to 1, the circuit breaker trips. • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	RevPwr_ActuAction

Table 100 – Minimum Frequency—Alarm N°1026 (F_{min} Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9749	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm or protection active). 0x0101 (OFF). Default value: 0x0101.	UnderFreq_Status
9751	2	R / W	x 0.1	Hz	MOD 10000	450..5400	—	P / H	Pickup for the minimum frequency F_{min}. • Maximum limited to OverFreq.PuValue. • Default value: 450 (45 Hz).	UnderFreq_PuValue
9753	1	R / W	x 0.01	s	INT	20..500	—	P / H	Pickup delay for the minimum frequency F_{min}. Default value: 500 (5 s).	UnderFreq_PuDelay
9754	2	R / W	x 0.1	Hz	MOD 10000	450..4400	—	P / H	Dropout for the minimum frequency F_{min}. • Minimum limited to UnderFreq_PuValue. • Default value: 450 (45 Hz).	UnderFreq_DoValue
9756	1	R / W	x 0.01	s	INT	100..3600	—	P / H	Dropout delay for the minimum frequency F_{min}. Default value: 100 (1 s).	UnderFreq_DoDelay
9757	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	UnderFreq_LogAction
9758	1	R / W	—	—	INT	Bitmap 16	—	P / H	Actions linked to overrun of set point at the end of the delay. • If bit 0 is set to 1, the circuit breaker trips. • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	UnderFreq_ActuAction

Table 101 – Maximum Frequency—Alarm N°1027 (F_{max} Protection)

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9759	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm or protection active). 0x0101 (OFF). Default value: 0x0101.	OverFreq_Status
9761	2	R / W	x 0.1	Hz	MOD 10000	450..540 0	—	P / H	Pickup for the maximum frequency F_{max}. • Minimum limited to UnderFreq.PuValue. • Default value: 650 (65 Hz).	OverFreq_PuValue
9763	1	R / W	x 0.01	s	INT	20..500	—	P / H	Pickup delay for the maximum frequency F_{max}. Default value: 500 (5 s).	OverFreq_PuDelay
9764	2	R / W	x 0.1	Hz	MOD 10000	450..4400	—	P / H	Dropout for the maximum frequency F_{max}. • Maximum limited to OverFreq_PuValue. • Default value: 650 (65 Hz).	OverFreq_DoValue
9766	1	R / W	x 0.01	s	INT	100..3600	—	P / H	Dropout delay for the maximum frequency F_{max}. Default value: 100 (1 s).	OverFreq_DoDelay
9767	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	OverFreq_LogAction
9768	1	R / W	—	—	INT	Bitmap 16	—	P / H	Actions linked to overrun of set point at the end of the delay. • If bit 0 is set to 1, the circuit breaker trips. • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	OverFreq_ActuAction

Table 102 – Phase Rotation Alarm—Alarm N° 1028

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9769	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm active). 0x0101 (OFF). Default value: 0x0101.	PhaRot _Status
9771	2	R / W	—	—	MOD 10000	0, 1	—	P / H	• 0: pickup if the detected rotation is Phase A, Phase B, Phase C. • 1: pickup if the detected rotation is Phase A, Phase C, Phase B. Default value: 0.	PhaRot_PuValue
9777	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	PhaRot_LogAction
9778	1	R / W	—	—	INT	Bitmap 16	—	P / H	List of pick-up actions linked to overrun of set point at the end of the delay. • Bit 0: always set to 0 (trip disabled for this type of alarm). • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	PhaRot_ActuAction

Table 103 – Load Shedding and Reconnection Based on Current—Alarm N°1029

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9779	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm active). 0x0101 (OFF). Default value: 0x0101.	ShedI_Status
9781	2	R / W	x 1	%	MOD 10000	50..100	—	P / H	Pickup for load shedding and reconnection based on current, expressed as a % of the long-time Ir set point. Default value: 100%.	ShedI_PuValue
9783	1	R	x 1	%Tr	INT	20..80	—	P / H	Pickup delay for load shedding and reconnection based on current, expressed as a % of the long-time delay tr set point (20 to 80%). Default value: 80%.	ShedI_PuDelay
9784	2	R	x 1	%	MOD 10000	30..100	—	P / H	Dropout for load shedding and reconnection based on current, expressed as a % of the long-time Ir set point. Default value: 100%.	ShedI_DoValue
9786	1	R	x 1	S	INT	10..600	—	P / H	Dropout delay for load shedding and reconnection based on current. Default value: 10 s.	ShedI_DoDelay
9787	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	ShedI_LogAction
9788	1	R / W	—	—	INT	Bitmap 16	—	P / H	List of pick-up actions linked to overrun of set point at the end of the delay. • Bit 0: always set to 0 (trip disabled for this type of alarm). • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	ShedI_ActuAction

Table 104 – Load Shedding and Reconnection Based on Power—Alarm N°1030

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9789	1	R / W	—	—	INT	0x0001 & 0x0101	—	P / H	0x0001 (Alarm active). 0x0101 (OFF). Default value: 0x0101.	ShedPwr_Status
9790	1	R / W	—	—	INT	—	—	—	Direction of active-power flow. • Bit set to 0: “standard”—power connections made to the lower terminals of the circuit breaker. • Bit set to 1: “reverse”—power connections made to the upper terminals of the circuit breaker. The direction may be modified by the command interface or by directly writing to the register after obtaining the right (using a command). Default value: 0x0000.	ShedPwr_Config
9791	2	R / W	x 1	kW	MOD 10000	200.. 10000	—	P / H	Pickup for load shedding and reconnection based on power. Default value: 10 MW.	ShedPwr_PuValue
9793	1	R / W	x 1	s	INT	10..3600	—	P / H	Pickup delay for load shedding and reconnection based on power. Default value: 3600 s.	ShedPwr_PuDelay
9794	2	R / W	x 1	kW	MOD 10000	100.. 10000	—	P / H	Dropout for load shedding and reconnection based on power. Default value: 10 MW.	ShedPwr_DoValue
9796	1	R / W	x 1	s	INT	10..3600	—	P / H	Dropout delay for load shedding and reconnection based on power. Default value: 10 s.	ShedPwr_DoDelay
9797	1	R / W	—	—	INT	Bitmap 16	—	H	Actions linked to overrun of set point at the end of the delay. Register set to 0x0100 will Log the Wave Form into the Fault Wave Form Capture file (file N°22).	ShedPwr_LogAction
9798	1	R / W	—	—	INT	Bitmap 16	—	P / H	List of pick-up actions linked to overrun of set point at the end of the delay. • Bit 0: always set to 0 (trip disabled for this type of alarm). • If bit 8 is set to 1, contact No. 1 on an M2C or M6C module is closed. • If bit 9 is set to 1, contact No. 2 on an M2C or M6C module is closed. • If bit 10 is set to 1, contact No. 3 on an M6C module is closed. • If bit 11 is set to 1, contact No. 4 on an M6C module is closed. • If bit 12 is set to 1, contact No. 5 on an M6C module is closed. • If bit 13 is set to 1, contact No. 6 on an M6C module is closed. Default value: 0x0000—no action.	ShedPwr_ActuAction

Table 105 – Relay Configuration M2C/M6C

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9800	1	R	—	—	INT	0, 1		P / H	• Bit set to 1: indicates that remote access for configuration was authorized via the menu using the keypad on the control unit. • Bit set to 0: indicates that remote access for configuration was not authorized via the menu using the keypad on the control unit. Default value: 0.	EeRemoteAccess
9801	1	R / W	—	—	INT	0,1,2,3,4	—	P / H	• 0: normal (non-latching) mode, contact activated each time for as long as the alarm remains active. • 1: latching mode, contact activated for each alarm and remains activated until the alarm is reset by the user (via the command interface or by a reset on the control unit). • 2: time-delay mode, contact activated for a set time for each alarm. It is deactivated at the end of the time delay, whether the alarm is still active or not. The alarm must change status at least once to activate the contact again. • 3: forced to 1, the contact remains closed and is not controlled by the alarm status. • 4: forced to 0, the contact remains open and is not controlled by the alarm status. Default value: 0x0001 (latching mode).	EeRelay[0]_Mode
9802	1	R / W	x 0.1	s	INT	10..3600	—	P / H	Contact activation delay for time-delay mode. Default value: 3600 (360 s).	EeRelay[0]_Duration
9803	4	R / W	—	—	ASCII	0x00.. 0x7F	—	P / H	Contact name in ASCII (A..Z and 0..9) using four characters. Update via the control unit not possible. Default value: “set up!”.	EeRelay[0]_Label
9807	1	R / W	—	—	INT	1000, ..1031	—	P / H	Owner alarm number for the contact of the first relay. See alarm number in the trip/alarm history, pages 124 and 125. Default value: 0x8000 (no owner).	EeRelay[0]_Owner
9808	7	—	—	—	—	—	—	P / H	Register configuration identical to registers 9801 to 9807 for contact 2.	EeRelay[1]_Owner
9815	7	—	—	—	—	—	—	P / H	Register configuration identical to registers 9801 to 9807 for contact 3.	EeRelay[2]_Owner
9822	7	—	—	—	—	—	—	P / H	Register configuration identical to registers 9801 to 9807 for contact 4.	EeRelay[3]_Owner
9829	7	—	—	—	—	—	—	P / H	Register configuration identical to registers 9801 to 9807 for contact 5.	EeRelay[4]_Owner
9836	7	—	—	—	—	—	—	P / H	Register configuration identical to registers 9801 to 9807 for contact 6.	EeRelay[5]_Owner

Continued on next page

Table 105 – Relay Configuration M2C/M6C *(continued)*

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label
9843	1	R	—	—	INT	0,2,6	—	P / H	Type of output module. • 0: none. • 2: M2C. • 6: M6C. Selection is automatic, depending on the type of module installed. Data always supplied.	HwRelayModuleType
9846	8	R	—	—	—	—	—	P / H	Circuit breaker characteristics. The data may be supplied: • by the user via the circuit breaker selection menu using the keypad on the MicroLogic control unit, • by downloading the characteristics using the test kit. The following registers then contain the circuit breaker description in a comprehensible format: • BrCharacteristic[0] = standard: 0 = UL, 1 = IEC, 2 = ANSI, • BrCharacteristic[1] = type: 0 = MasterPacT, 1 = ComPacT NS, 2 = PowerPacT, • BrCharacteristic[2..7] = ASCII character strings (e.g. “NT08N”). Default value: 0X8000.	BrCharacteristic

Event Log

Registers 9900 to 9924 file N° 20 (see “Access to Files” on page 35).

Maintenance Event Log

Registers 9932 to 9956 file N° 12 (see “Access to Files” on page 35).

Fault Wave Form Capture

Registers 9964 to 9989 file N° 22 (see “Access to Files” on page 35).

Communication Profile @ Address xx

Activation of the Communication Profile

Following registers are available only with a Breaker Communication Module firmware version greater or equal to V2.0 (register 577 must be greater or equal to 02000) and only if the communication profile has been activated. In order to activate the communication profile, it is necessary to set the register 800 to 1. Per default, the communication profile is not activated (register = 0). When the communication profile is not activated, the content of the registers are not refreshed and therefore equal to 0x8000.

IO Status

Table 106 – Circuit Breaker

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12000	1	R	—	—	Bitmap 16	—	A	P / H	Bitmap that indicates the validity of each bit in the BrStatus register. Default value = 0x7F	BrStatusMask	New
12001	1	R	—	—	Bitmap 16	—	A	P / H	Circuit breaker status: (see details below)	BrStatus	661

BrStatus Bitmap Detail:

Bit 0 (0x01): OF; indication contacts

For ComPacT and MasterPacT:
0 = circuit breaker is opened
1 = circuit breaker is closed

Bit 1 (0x02): SD; trip indication contact

For ComPacT:
0 = no trip
1 = circuit breaker has tripped due to electrical fault, shunt trip, or push-to-trip
For MasterPacT:
always 0

Bit 2 (0x04): SDE; fault trip indication contact

For ComPacT and MasterPacT:
0 = no trip
1 = circuit breaker has tripped due to electrical fault (including ground-fault test and earth-leakage test)

Bit 3 (0x08): CH; charged (used only with motor mechanism)

For ComPacT:
always 0
For MasterPacT:
0 = spring discharged
1 = Spring loaded

Bit 4 (0x10): reserved (internal use only)

Bit 5 (0x20): PF; ready to close

For ComPacT:
always 0
For MasterPacT:
0 = not ready to close
1 = ready to close

Bit 6 (0x40): ComPacT / MasterPacT differentiation

0 = ComPacT NS
1 = MasterPacT

Bit 7-15: reserved

Note: A bitmap mask should be used to test the circuit breaker status.
If a value test is used, the following values should be used for MasterPacT:
0x44 tripped discharged not RTC
0x4C tripped charged not RTC
0x50 OFF discharged not RTC
0x51 ON discharged not RTC
0x59 ON charged RTC
0x78 OFF charged RTC

Table 107 – Input

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12002	1	R	—	—	Bitmap 16	—	A	P / H	Reserved	I_Mask	—
12003	1	R	—	—	Bitmap 16	—	A	P / H	Reserved	I_Status	—

Table 108 – Tripping Cause

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12004	1	R	—	—	INT	0..65535	A	P / H	Bitmap indicating cause of tripping for basic protection functions: Bit 0: Long-time protection. Bit 1: Short-time protection Bit 2: Instantaneous protection Bit 3: Ground-fault protection Bit 4: Earth-leakage protection Bit 5: Integrated instantaneous protection Bit 6: Self-protection (temperature)[1] Bit 7: Self-protection (overvoltage)[1] Bit 8: Other protection detailed in register 12005[1] Bits 9 to 14: Reserved Bit 15: If this bit is set to 1 then bits 0 to 14 are not valid	MitopBasActCause	650
12005	1	R	—	—	INT	0..65535	—	P / H	Bitmap indicating cause of tripping for advanced protection functions with MicroLogic P/H: Bit 0: Current unbalance Bit 1: Over current phase A Bit 2 Over current phase B Bit 3: Over current phase C Bit 4: Over current on neutral Bit 5: Under voltage Bit 6: Over voltage Bit 7: Voltage unbalance Bit 8: Over power Bit 9: Reverse power Bit 10: Under frequency Bit 11: Over frequency Bit 12: Phase rotation Bit 13: Load shedding based on current Bit 14: Load shedding based on power Bit 15: If this bit is set to 1 then bits 0 to 14 are not valid	MitopAdvActCause	651
12006	1	R	—	—	Bitmap 16	—	A	P / H	Reserved		
12007	1	R	—	—	Bitmap 16	—	A	P / H	Reserved	I_Status	—

[1] This value is only available for MicroLogic P or H trip units.

Table 109 – Alarm Setpoint

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12008	1	R	—	—	INT	Bitmap 16	—	P / H	Status word for overrun of current protection set points. This condition is reached as soon as the protection set point is overrun, even if the time delay has not expired. Bit 0: long-time and LT IDMTL protection. If the bit is set to: 0: Set-point overrun = false 1: Set-point overrun = true	BasProtPickupStatus	8862
12009	1	R	—	—	INT	Bitmap 16	—	P / H	Status word for overrun of protection set points This condition is reached as soon as the protection set point is overrun, even if the time delay has not expired. Bit 0: Current unbalance Bit 1: Maximum current on phase A Bit 2: Maximum current on phase B Bit 3: Maximum current on phase C Bit 4: Maximum current on the neutral Bit 5: Minimum voltage Bit 6: Maximum voltage Bit 7: Voltage unbalance Bit 8: Maximum power Bit 9: Reverse power Bit 10: Minimum frequency Bit 11: Maximum frequency Bit 12: Phase rotation Bit 13: Load shedding based on current Bit 14: Load shedding based on power Bit 15: If this bit is set to 1, then bits 0 to 14 are not valid.	AdvProtPickupStatus	8863
12010	1	R	—	—	INT	Bitmap 16	—	—	Continuation of status word for overrun of advanced protection set points. Bit 0: Ground-fault alarm Bit 1: Earth-leakage alarm	AdvXtedProtTripStatus	8864
12011	1	R	—	—	Bitmap 16	—	A	P / H	Reserved	—	—
12012	1	R	—	—	Bitmap 16	—	A	P / H	Reserved	—	—
12013	1	R	—	—	Bitmap 16	—	A	P / H	Reserved	—	—
12014	1	R	—	—	Bitmap 16	—	A	P / H	Reserved	—	—
12015	1	R	—	—	Bitmap 16	—	A	P / H	Reserved	—	—

Metering

Table 110 – Currents

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12016	1	R	x 1	A	INT	0..32767	A	P / H	Maximum rms current on phase A	I_RMS[0]	1016
12017	1	R	x 1	A	INT	0..32767	A	P / H	Maximum rms current on phase B	I_RMS[1]	1017
12018	1	R	x 1	A	INT	0..32767	A	P / H	Maximum rms current on phase C	I_RMS[2]	1018
12019	1	R	x 1	A	INT	0..32767	A	P / H	Maximum rms current on the neutral[1]	I_RMS[3]	1019
12020	1	R	x 1	A	INT	0..32767	A	P / H	Maximum rms current in registers 816, 817, 818 and 819.	I_Max	1020
12021	1	R	x 1	A	INT	0..32767	A	P / H	Ground-fault current. If this current exceeds 32767 A, the register blocks at 32767.[2]	I_RMSGnd	1021
12022	1	R	x 1	mA	INT	0..32767	A	P / H	Earth-leakage current. If this current exceeds 32767 A, the register blocks at 32767.[3]	I_RMSVigi	1022

1 Value not accessible when the configuration register 3314 returns type 31 or 40.

2 Accessible only with MicroLogic 5.0 P/H and 6.0 A/P/H.

3 Accessible only with MicroLogic 7.0 A/P/H.

Table 111 – Maximum Values of Currents

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12023	1	R	x 1	A	INT	0..32767	A	P / H	Maximum rms current on phase A	Max_I_RMS[0]	1616
12024	1	R	x 1	A	INT	0..32767	A	P / H	Maximum rms current on phase B	Max_I_RMS[1]	1617
12025	1	R	x 1	A	INT	0..32767	A	P / H	Maximum rms current on phase C	Max_I_RMS[2]	1618
12026	1	R	x 1	A	INT	0..32767	A	P / H	Maximum rms current on the neutral[1]	Max_I_RMS[3]	1619
12027	1	R	x 1	A	INT	0..32767	A	P / H	Maximum rms current in registers 12023, 12024, 12025 and 12026.	Max_I_Max	1620
12027	1	R	x 1	A	INT	0..32767	A	P / H	Maximum ground-fault current. If this current exceeds 32767 A, the register blocks at 32767.[2]	Max_I_RMSGnd	1621
12029	1	R	x 1	mA	INT	0..32767	A	P / H	Maximum earth-leakage current. If this current exceeds 32767 A, the register blocks at 32767.[3]	Max_I_RMSVigi	1622

1 Value not accessible when the configuration register 3314 returns type 31 or 40.

2 Accessible only with MicroLogic 5.0 P/H and 6.0 A/P/H.

3 Accessible only with MicroLogic 7.0 A/P/H.

Table 112 – Voltages

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12030	1	R	x 1	V	INT	0..1200	—	P / H	RMS phase-to-phase voltage V_{AB}	V_RMS[0]	1000
12031	1	R	x 1	V	INT	0..1200	—	P / H	RMS phase-to-phase voltage V_{BC}	V_RMS[1]	1001
12032	1	R	x 1	V	INT	0..1200	—	P / H	RMS phase-to-phase voltage V_{CA}	V_RMS[2]	1002
12033	1	R	x 1	V	INT	0..1200	—	P / H	RMS phase-to-neutral voltage V_{AN}[1]	V_RMS[3]	1003
12034	1	R	x 1	V	INT	0..1200	—	P / H	RMS phase-to-neutral voltage V_{BN}[1]	V_RMS[4]	1004
12035	1	R	x 1	V	INT	0..1200	—	P / H	RMS phase-to-neutral voltage V_{CN}[1]	V_RMS[5]	1005

1 Value not accessible when the configuration register 3314 returns type 31 or 40.

Table 113 – Frequency

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12036	1	R	x 10	Hz	INT	0..4000	—	P / H	System frequency.	Frequency	1054
12037	1	R	x 10	Hz	INT	0..4000	—	P / H	Maximum value of frequency.	Max Frequency	1654

Table 114 – Power

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12038	1	R	x 1	kW	INT	0..32767	—	P / H	Active power on phase A.[1, 2]	ActivePwr[0]	1034
12039	1	R	x 1	kW	INT	0..32767	—	P / H	Active power on phase B.[1, 2]	ActivePwr[1]	1035
12040	1	R	x 1	kW	INT	0..32767	—	P / H	Active power on phase C.[1, 2]	ActivePwr[2]	1036
12041	1	R	x 1	kW	INT	0..32767	—	P / H	Total active power.[2]	ActivePwr[3]	1037
12042	1	R	x 1	kVAR	INT	0..32767	—	P / H	Reactive power on phase A.[1, 2]	ReactivePwr[0]	1038
12043	1	R	x 1	kVAR	INT	0..32767	—	P / H	Reactive power on phase B.[1, 2]	ReactivePwr[1]	1039
12044	1	R	x 1	kVAR	INT	0..32767	—	P / H	Reactive power on phase C.[1, 2]	ReactivePwr[2]	1040
12045	1	R	x 1	kVAR	INT	0..32767	—	P / H	Total reactive power.[2]	ReactivePwr[3]	1041
12046	1	R	x 1	kVA	INT	0..32767	—	P / H	Apparent power on phase A with 3 wattmeters.[1]	ApparentPwr[0]	1042
12047	1	R	x 1	kVA	INT	0..32767	—	P / H	Apparent power on phase B with 3 wattmeters.[1]	ApparentPwr[1]	1043
12048	1	R	x 1	kVA	INT	0..32767	—	P / H	Apparent power on phase C with 3 wattmeters.[1]	ApparentPwr[2]	1044
12049	1	R	x 1	kVA	INT	0..32767	—	P / H	Total apparent power	ApparentPwr[3]	1045

1 Value not accessible when the configuration register 3314 returns type 31 or 40.

2 The sign of the active and reactive power depends on configuration register 3316

Table 115 – Energy

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12050	2	R	x 1	kWh	INT	+ - 0..32767	—	P / H	Active energy.	EeActiveEnergy	2000
12052	2	R	x 1	kVARh	INT	+ - 0..32767	—	P / H	Reactive energy.	EeReactiveEnergy	2004
12054	2	R	x 1	kWh	INT	0..32767	—	P / H	Active energy positively incremented: unsigned value.	EeActiveEnergyIn	2008
12056	2	R	x 1	kWh	INT	0..32767	—	P / H	Active energy negatively incremented: unsigned value.	EeActiveEnergyOut	2012
12058	2	R	x 1	kVARh	INT	0..32767	—	P / H	Reactive energy positively incremented: unsigned value.	EeReactiveEnergy In	2016
12060	2	R	x 1	kVARh	INT	0..32767	—	P / H	Reactive energy negatively incremented: unsigned value.	EeReactiveEnergy Out	2020
12062	2	R	x 1	kVAh	INT	0..32767	—	P / H	Total apparent energy.	EeApparentEnergy	2024
12064	2	R	x 1	kWh	INT	0..32767	—	—	Non-resetable active energy positively incremented (reserved).	—	2028
12066	2	R	x 1	kWh	INT	0..32767	—	—	Non-resetable active energy negatively incremented (reserved).	—	2032
12068	1	R	x 1	kWh	INT	0..32767	—	—	Reserved	—	—
12069	1	R	x 1	kWh	INT	0..32767	—	—	Reserved	—	—
12070	1	R	x 1	kWh	INT	0..32767	—	—	Reserved	—	—
12071	1	R	x 1	kWh	INT	0..32767	—	—	Reserved	—	—
12072	1	R	x 1	kWh	INT	0..32767	—	—	Reserved	—	—
12073	1	R	x 1	kWh	INT	0..32767	—	—	Reserved	—	—
12074	1	R	x 1	kWh	INT	0..32767	—	—	Reserved	—	—
12075	1	R	x 1	kWh	INT	0..32767	—	—	Reserved	—	—
12076	1	R	x 1	kWh	INT	0..32767	—	—	Reserved	—	—
12077	1	R	x 1	kWh	INT	0..32767	—	—	Reserved	—	—
12078	1	R	x 1	kWh	INT	0..32767	—	—	Reserved	—	—
12079	1	R	x 1	kWh	INT	0..32767	—	—	Reserved	—	—

Table 116 – Current Demand

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12080	1	R	x 1	A	INT	0..32767	—	P / H	Current demand on phase A.	I_Dmd[0]	2200
12081	1	R	x 1	A	INT	0..32767	—	P / H	Current demand on phase B.	I_Dmd[1]	2201
12082	1	R	x 1	A	INT	0..32767	—	P / H	Current demand on phase C.	I_Dmd[2]	2202
12083	1	R	x 1	A	INT	0..32767	—	P / H	Current demand on the neutral.[1]	I_Dmd[3]	2203

1 Value is not accessible when the configuration register 3314 selects type 31 or 40.

Table 117 – Power Demand

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12084	1	R	x 1	kW	INT	0..32767	—	P / H	Total active-power demand.[1]	ActivePwrDmd	2224
12085	1	R	x 1	kVAR	INT	0..32767	—	P / H	Total reactive-power demand.[1]	ReactivePwrDmd	2230
12086	1	R	x 1	kVA	INT	0..32767	—	P / H	Total apparent power demand.[1]	ApparentPwrDmd	2236
12087	—	—	—	—	—	—	—	—	Available	—	—
12088	—	—	—	—	—	—	—	—	Available	—	—
12089	—	—	—	—	—	—	—	—	Available	—	—

1 Value updated at end of window for the "block" mode. For the "sliding" mode, the value is updated every 15 seconds.

Table 118 – Maximum Values of Voltages

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12090	1	R	x 1	V	INT	0..1200	—	P / H	Max rms phase-to-phase voltage V_{AB}.	Max_V_RMS[0]	1600
12091	1	R	x 1	V	INT	0..1200	—	P / H	Max rms phase-to-phase voltage V_{BC}.	Max_V_RMS[1]	1601
12092	1	R	x 1	V	INT	0..1200	—	P / H	Max rms phase-to-phase voltage V_{CA}.	Max_V_RMS[2]	1602
12093	1	R	x 1	V	INT	0..1200	—	P / H	Max rms phase-to-neutral voltage V_{AN}. [1]	Max_V_RMS[3]	1603
12094	1	R	x 1	V	INT	0..1200	—	P / H	Max rms phase-to-neutral voltage V_{BN}. [1]	Max_V_RMS[4]	1604
12095	1	R	x 1	V	INT	0..1200	—	P / H	Max rms phase-to-neutral voltage V_{CN}. [1]	Max_V_RMS[5]	1605

1 Value not accessible when the configuration register 3314 returns type 31 or 40

Table 119 – Power Factor

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12096	1	R	x 1000	None	INT	-1000.. +1000	—	P / H	Power factor on phase A (absolute value equal to |P|/S). [1, 2]	PF[0]	1046
12097	1	R	x 1000	None	INT	-1000.. +1000	—	P / H	Power factor on phase B (absolute value equal to |P|/S). [1, 2]	PF[1]	1047
12098	1	R	x 1000	None	INT	-1000.. +1000	—	P / H	Power factor on phase C (absolute value equal to |P|/S). [1, 2]	PF[2]	1048
12099	1	R	x 1000	None	INT	-1000.. +1000	—	P / H	Total power factor (absolute value equal to |Ptotal|/Stotal).	PF[3]	1049
12100	1	R	x 1000	None	INT	-1000.. +1000	—	H	Fundamental power factor on phase A (its absolute value is equal to |FundP|/FundS). Sign convention the same as the one for the real power factor. N/A if type 31 network.	FundPF[0]	1050
12101	1	R	x 1000	None	INT	-1000.. +1000	—	H	Same as above phase B.	FundPF[1]	1051
12102	1	R	x 1000	None	INT	-1000.. +1000	—	H	Same as above phase C.	FundPF[2]	1052
12103	1	R	x 1000	None	INT	-1000.. +1000	—	H	Total fundamental power factor (its absolute value is equal to |FundPtot|/FundStot). Sign convention the same as the one for the real power factor.	FundPF[3]	1053

1 Value not accessible when the configuration register 3314 returns type 31 or 40.

2 The sign of the active and reactive power depends on configuration register 3316.

Table 120 – Total Harmonic Distortion

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12104	1	R	x 10	%	INT	0..5000	—	H	Total harmonic distortion of V_{AB} voltage compared to the fundamental.	THD_V[0]	1092
12105	1	R	x 10	%	INT	0..5000	—	H	Same as above V_{BC}	THD_V[1]	1093
12106	1	R	x 10	%	INT	0..5000	—	H	Same as above V_{CA}.	THD_V[2]	1094
12107	1	R	x 10	%	INT	0..5000	—	H	Total harmonic distortion of V_{AN} voltage compared to the fundamental. – N/A with type 31 or 40 network.	THD_V[3]	1095
12108	1	R	x 10	%	INT	0..5000	—	H	Same as above V_{BN}	THD_V[4]	1096
12109	1	R	x 10	%	INT	0..5000	—	H	Same as above V_{CN}.	THD_V[5]	1097
12110	1	R	x 10	%	INT	0..5000	—	H	Total harmonic distortion of phase A current compared to the fundamental.	THD_I[0]	1098
12111	1	R	x 10	%	INT	0..5000	—	H	Same as above phase B.	THD_I[1]	1098
12112	1	R	x 10	%	INT	0..5000	—	H	Same as above phase C.	THD_I[2]	1099
12113	1	R	x 10	%	INT	0..5000	—	H	same as above neutral – N/A with type 31 networks. Measured with type 41, calculated with type 40.	THD_I[3]	1100

Table 121 – Available and Reserved Registers

12114 to 12145 are available.
12146 to 12160 are reserved.
12170 to 12145 are available.

Table 122 – Basic Protection Settings

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12180	2	R	x 1	A	MOD 10000	40..8000	A	P / H	Ir pickup for the long-time protection.	LongTime_PuValue	8756
12182	1	R	x 1	ms	INT	500. 24000	A	P / H	tr tripping delay for the long-time protection.	LongTime_PuDelay	8758
12183	2	R	x 1	A	MOD 10000	60.. 80000	A	P / H	Isd pickup for the short-time protection.	ShortTime_PuValue	8766
12185	1	R	x 1	ms	INT	0.400	A	P / H	tsd tripping delay for the short-time protection. 0 s valid only for the I²t off position 100 to 400 ms: valid for the I²t on and I²t off positions.	ShortTime_PuDelay	8768
12186	1	R	x 1	—	INT	0x0001 0x0101	A	P / H	0x0001 (protection active) 0x0101 (protection OFF) Default value = 0x0001	Instant_Status	8774
12187	2	R	x 1	A	MOD 10000	200.. 120 000	A	P / H	I pickup for the instantaneous protection.	Instant_PuValue	8776
12189	2	R	x 1	A	MOD 10000	30..1200	A	P / H	Ig pickup for the ground-fault protection	Res_PuValue	8786
12191	1	R	x 1	ms	INT	0..400	A	P / H	tg tripping delay for the ground-fault protection. 0 s valid only for the I²t off position 100 to 400 ms: valid for the I²t on and I²t off positions.	Res_PuDelay	8788
12192	2	R	x 1	mA	MOD 10000	5..300	A	P / H	IΔN pickup for the earth-leakage protection.	Vigi_PuValue	8796
12194	1	R	x 1	ms	INT	0..1000	A	P / H	Δt tripping delay for the earth leakage protection.	Vigi_PuDelay	8798
12195	—	—	—	—	—	—	—	—	Available	—	—

Table 123 – Circuit Breaker ID

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12196	4	R	1	—	Ascii	—	A	P / H	Serial number encoded in Ascii.	EeSerialNumber	8700
12200	1	R	1	—	INT	—	A	P / H	Protection module firmware version.	EeFWVersion	8710
12201	1	R	1	—	INT	—	A	P / H	Square D Identification number 15131 = MicroLogic A (PM) 15133 = MicroLogic P (PM) 15135 = MicroLogic H (PM) Default value = 0x8000	EeSQD_Prod_ID	8716
12202	1	R	1	—	Ascii	20,30,40 50,60,70	A	P / H	Type of protection 20 = MicroLogic 2.0,… 70 = MicroLogic 7.0	EeUnitModelNum	8740
12203	1	R	1	—	Ascii	A, P, H	A	P / H	Type of control unit: A, P or H	EeUnitType	8741
12204	1	R	1	—	INT	0..15	A	P / H	Type of long time rating plug. 0 = missing, 1= IEC standard, 2 = IEC low, 3 = IEC High, 10 = OFF, 7 = UL-A, 8 = UL-B, 9 = UL-C, 11= UL-D, 12 = UL-E, 13 = UL-F, 14 = ULG, 15 = UL-H	HwLT_PlugType	8742
12205	1	R	x 1	A	INT	0..8000	A	P / H	Rated circuit breaker current. Default value: 100 A (circuit breaker sensor plug not present).	HwBrNominalCurrent	8750
12206	1	R / W	x 1	notch	INT	0..3	A	P / H	Type of neutral protection. 0: OFF 1: N / 2 (Ir / 2) 2: N (Ir) 3: N x 1.6 (1.6 x Ir)	EeNeutralProtType	8753
12207	1	R	—	—	INT	0..65535	A	P / H	Counter for total number of operations (OF): the counter increments when bit 0 in register 661 switches from 0 to 1.	CtrOF_OvrLife	662
12208	1	R	—	—	INT	0..65535	A	P / H	Counter for operations (OF) since last reset: the counter increments when bit 0 in register 661 switches from 0 to 1.	CtrOF	663
12209	1	R	—	—	INT	0..65535	A	P / H	Counter for operations (SD): the counter increments when bit 1 in register 661 switches from 0 to 1.	CtrSD	664
12210	1	R	—	—	INT	0..65535	A	P / H	Counter for operations (SDE): the counter increments when bit 2 in register 661 switches from 0 to 1.	CtrSDE	665

Table 124 – Miscellaneous

Register	Number of Registers	Read / Write	Scale	Unit	Format	Interval	A	P / H	Description	Label	Origin
12211	1	R	—	—	INT	1..8000	—	P / H	Number of first (oldest) record in the protection module event log (file N°20).	CurrentFirstRecord OfPM_EvtLog	623
12212	1	R	—	—	INT	1..8000	—	P / H	Number of last (most recent) record in the protection module event log (file N°20).	CurrentLarstRecord OfPM_EvtLog	624
12213	2	R	x 0.1	s	MOD 10000	—	—	P / H	Time remaining before long-time tripping.	TimeLeftUntilLT_Trip	886
12215	4	R	1	%	INT	0..32767	—	P / H	Contact wear indicator per phase (Default value = 0x8000). The contacts must be inspected each time the counter reaches a hundred mark. The message "Not available or circuit breaker type not defined" is displayed if the type of the circuit breaker has not been defined. In this case, see "Breaker Selection" in the MicroLogic set-up menu. See register 9846.	PhaseContactWear	909

List of Commands

Cradle Communication Module Commands @ Address xx + 50

Table 125 – Cradle Communication Module Commands

Cmd #	Description	Parameter(s)	Mode	Label
57856	Preset Circuit Breaker Status Counters	P1 = control word read in register 553. P2 = bitmap of counter to Preset.[1] P3 = Counter value 1.[2] P4 = Counter value 2.[2] P5 = Counter value 3.[2]	Protected	PresetBrStatCtr
61541	Set time and date for Cradle Communication Module. Year YY is 0 for 1900, 100 for 2000, 101 for 2001, etc.	P1 = MM:DD P2 = YY:HH P3 = MIN:SEC	Shared Protected	SetD_T

[1] Bitmap of counter to Preset

Bit	Circuit Breaker Counter Status	Affected Counter Registers
8 (0x0100)	CD: Disconnected position	663 @ xx + 50
9 (0x0100)	CE: Connected position	662 @ xx + 50
10 (0x0100)	CT: Test position	664 @ xx + 50

[2] Control Value 1 = Value of counter corresponding to 1st bit set when bitmap is read from LSB to MSB (0000 to reset counter).

Control Value 2 = Value of counter corresponding to next bit set when bitmap is read from LSB to MSB (0000 to reset counter).

Breaker Communication Module Commands @ Address xx

Table 126 – Breaker Communication Module Commands

Cmd #	Description	Parameter(s)	Mode	Label
57394	Enter configuration mode.	P1 = 3 [1] P2 = 4 [2] P3 = control word read in register 553 of the Breaker Communication Module.	Protected.	In_CommCfg
57395	Exit configuration mode and activate the new parameters.	P1 = 3 [1] P2 = 4 [2] P3 = control word read in register 553 of the Breaker Communication Module.	Protected.	Out_CommCfg
57400	Simplified Open/Close.	P1 = 4 [1] P2 = 4 [2] P3 = 0 or 1 (0 for Open, 1 for Close) P4 = password (default value = 0000)	Shared	Open/Close
57856	Preset circuit breaker status counters.	P1 = 5 to 10[1] P2 = 4[2] P3 = control word read in register 553 P4 = bitmap of counter to Preset[3] P5 = Counter value 1[4] P6 = Counter value 2[4] P7 = Counter value 3[4] P10 = Counter value 6[4]	Protected	PresetBrStatCtr
57857	Preset coils operation counters.	P1 = 6[1] P2 = 4[2] P3 = control word read in register 553 P4 = bitmap for coil control[5] P5 = MX Counter value (0000 to reset) P6 = XF Counter value (0000 to reset)	Protected	PresetCoilCtr
58769	Open circuit breaker using MX coil.	P1 = 4[1] P2 = 4[2] P3 = control word read in register 553 P4 = 1	Shared Protected	OpenBr
58770	Close circuit breaker using XF coil.	P1 = 4[1] P2 = 4[2] P3 = control word read in register 553 P4 = 2	Shared Protected	CloseBr
58771	Authorize activation of MX or XF coils, or both.	P1 = 4[1] P2 = 4[2] P3 = control word read in register 553 P4 = bitmap for coil-control[5]	Protected	EnCoilsactivation
58772	Disable activation of MX or XF coils, or both.	P1 = 4[1] P2 = 4[2] P3 = control word read in register 553 P4 = bitmap for coil-control[5]	Protected	EnCoilsdesactivation
59492	Release flag for access to protected mode.	P1 = 3[1] P2 = 4[2] P3 = flag active	Protected	ReleaseProt Flag

Continued on next page

Table 126 – Breaker Communication Module Commands *(continued)*

Cmd #	Description	Parameter(s)	Mode	Label
61541	Set time and date for Breaker Communication Module and the protection and measurement modules Year YY is 0 for 1900, 100 for 2000, 101 for 2001, etc.	P1 = 5[1] P2 = 4[2] P3 = MM:DD P4 = YY:HH P5 = MIN:SEC	Shared Protected	SetD_T

[1] Parameter P1 for the Breaker Communication Module command interface contains the total number of command parameters, including P1.

[2] The value “4” for parameter P2 informs the Breaker Communication Module command interface that it must run the command itself.

[3] Bitmap of counter to Preset:

Bit	Circuit Breaker Counter Status	Affected Counter Registers
0 (0x0001)	OF: ON/OFF	663
1 (0x0002)	SD: Trip indication	664
2 (0x0004)	SDE: Fault-trip indication	665

[4] Control Value 1 = Value of counter corresponding to first bit set when bitmap is read from LSB to MSB (0000 to reset counter).
Control Value 2 = Value of counter corresponding to next bit set when bitmap is read from LSB to MSB (0000 to reset counter).

[5] Bitmap for coil control:

Bit	Coil Control Status	Affected Counter Registers
1 (0x0002)	MX coil-control bit	674
2 (0x0004)	XF coil-control bit	678
3 (0x0008)	To be set to 1 in order to activate MX or XF	

Metering Module Commands @ Address xx + 200

Table 127 – Metering Module Commands

Cmd #	Description	Parameter(s)	Mode	Label
53298	Enter configuration mode.	P1 = 3[1] P2 = 8[2] P3 = control word read in register 3300 of the metering module.	Protected	In_mCfg
53299	Exit configuration mode and activate the new parameters.	P1 = 3[1] P2 = 8[2] P3 = control word read in register 3300 of the metering module.	Protected	Out_mCfg
61952	Reset minimeters / maximeters in the metering module.	P1 = 4[1] P2 = 8[2] P3 = bitmap of minimeters to reset[3] P4 = bitmap of maximeters to reset[3]	Protected	Reset_m_M
53762	Reset of current demand maximums.	P1 = 3[1] P2 = 8[2] P3 = bitmap of maximum values to reset[4]	Protected	ResetI_PeakDmd
53763	Reset of power demand maximums.	P1 = 3[1] P2 = 8[2] P3 = bitmap of maximum values to reset[5]	Protected	ResetP_PeakDmd
53760	Preset or reset the energy counters.	P1 = 3 to 32[1] P2 = 8[2] P3 = bitmap of counters to preset or reset[6] P4 to P7 = first counter to preset according to P3 P8 to P11 = second counter to preset according to P3 P28 to P32 = seventh counter to preset according P3	Protected	PresetAccEnCtr

Continued on next page

Table 127 – Metering Module Commands *(continued)*

Cmd #	Description	Parameter(s)	Mode	Label
55234	Forcelog into WFC (file N° 5).	P1 = 4[1] P2 = 8[2] P3 = bitmap of file N° 5 = 0x0000 P4 = bitmap of file N° 5 = 0x0010	Shared Protected	Forcelog

[1] Parameter P1 for the Breaker Communication Module command interface contains the total number of command parameters, including P1.

[2] The value “8” for parameter P2 informs the Breaker Communication Module command interface that the metering module must run the command.

[3] Bitmap for reset of minimeters / maximeters:

Bit	Minimeters / Maximeters	Affected Real-Time Measurement Registers
0 (0x0001)	Currents	1016 to 1027
1 (0x0002)	Current unbalance	1028 to 1032
3 (0x0008)	Voltages	1000 to 1007
4 (0x0010)	Voltage unbalance	1008 to 1015
6 (0x0040)	Frequency	1054
7 (0x0080)	Power, PF	1034 to 1053
11 (0x800)	Fundamental, THD	1056 to 1118
13 (0x2000)	V_Crest	1119 to 1124
14 (0x4000)	I_Crest	1125 to 1128

[4] Bitmap for reset of current demand maximums:

Bit	Maximum of Current Demand	Affected Data Registers
1 (0x0002)	Phase A	2204 + 3005 to 3007 + 3026 to 3028
2 (0x0004)	Phase B	2205 + 3008 to 3010 + 3026 to 3028
3 (0x0008)	Phase C	2206 + 3011 to 3013 + 3026 to 3028
4 (0x0010)	Neutral	2207 + 3014 to 3016 + 3026 to 3028

[5] Bitmap for reset of power demand maximums:

Bit	Maximums of Power Demand	Affected Data Registers
4 (0x0010)	Active power	2225 to 2229 + 3017 to 3019 + 3029 to 3031
8 (0x0100)	Reactive power	2230 to 2235 + 3020 to 3022 + 3029 to 3031
12 (0x1000)	Apparent power	2236 to 2241 + 3023 to 3025 + 3029 to 3031

[6] A number of counters may be preset or reset at the same time. Each counter is coded over four 16-bit registers.

The counters to be preset are indicated in the bitmap. The values to be preset are transmitted as parameters, in the same order as the bits set to one, starting with the least significant. The number of counters to be transmitted is equal to the number of bits set to one in the bitmap.

Bit	Energy Counter	Affected Data Registers
0 (0X0001)	All the counters are simply reset	—
1 (0X0002)	Total Active-Energy	2000 to 2003
2 (0X0004)	Total Reactive-Energy	2004 to 2007
3 (0X0008)	Total Active-Energy IN (positively incremented)	2008 to 2011
4 (0X0010)	Total Active-Energy OUT (negatively incremented)	2012 to 2015
5 (0X0020)	Total Reactive-Energy IN (positively incremented)	2016 to 2019
6 (0X0040)	Total Reactive-Energy OUT (negative incremented)	2020 to 2023
7 (0X0080)	Total Apparent-Energy	2024 to 2027

Protection Module Commands @ Address xx + 100

Table 128 – Protection Module Commands

Cmd #	Description	Parameter(s)	Mode	Label
49202	Enter configuration mode.	P1 = 3[1] P2 = 2[2] P3 = Password to be consulted in the menu of the control unit: Com set-up / Remote access (default is 0000).	Protected	In_pCfg
49203	Exit configuration mode and activate the new parameters.	P1 = 3[1] P2 = 2[2] P3 = Password to be consulted in the menu of the control unit: Com set-up / Remote access (default is 0000).	Protected	Out_pCfg
50579	"Unlatching" of a relay on optional M2C or M6C module, set to latching mode. Unlatching is effective if the alarm that tripped contact closing is no longer active.	P1 = 4[1] P2 = 2[2] P3 = Password to be consulted in the menu of the control unit: Com set-up / Remote access (default is 0000). P4 = bitmap of relay to reset[3]	Protected	DeactivateRly
50580	"Activate" a relay of an optional M2C or M6C module.	P1 = 4[1] maximums P2 = 2[2] P3 = Password to be consulted in the menu of the control unit: Com set-up / Remote access (default is 0000). P4 = bitmap of relay to activated[3]	Protected	RearmBr
63176	Clear the files. **NOTE:** Note: In order to clear a file, it is mandatory to disable the file before.	P1 = 4[1] P2 = 2[2] P3 = bitmap of file reference[4] P4 = bitmap of file reference[4]	Shared Protected	ClearFiles
63177	Disable access to files.	P1 = 4[1] P2 = 2[2] P3 = bitmap of file reference[4] P4 = bitmap of file reference[4]	Shared Protected	ClearFiles
63178	Read a record in the Breaker Communication Module even log (file No. 20). The contents of the record is available starting in register 7730.	P1 = 4[1] P2 = 2[2] P3 = 20 (number of the file to be read) P4 = number of event to be read	Protected	ReadFileX_RecY

Table 128 – Protection Module Commands *(continued)*

Cmd #	Description	Parameter(s)	Mode	Label
63376	Enable access to files.	P1 = 4[1] P2 = 2[2] P3 = bitmap of file reference[4] P4 = bitmap of file reference[4]	Shared Protected	EnFiles

[1] Parameter P1 for the Breaker Communication Module command interface contains the total number of command parameters, including P1.

[2] The value “2” for parameter P2 informs the Breaker Communication Module command interface that the protection module must run the command.

[3] Bit 0 corresponds to relay S1 (M2C or M6C option), bit 1 corresponds to relay S2 (M2C or M6C option), bits 2 to 5 correspond respectively to relay S3 to S6 on the M6C module.

[4] File reference:

Event log protection module.	(File N°20)	P3=0x0008	P4=0x0000
Event log metering module.	(File N°10)	P3=0x0000	P4=0x0200
Maintenance event log protection module.	(File N°21)	P3=0x0010	P4=0x0000
Maintenance event log metering module.	(File N°12)	P3=0x0000	P4=0x0800
Min-Max event log metering module.	(File N°11)	P3=0x0000	P4=0x0400
Event log of the breaker communication module.	(File N°30)	P3=0x2000	P4=0x0000
Wave form capture.	(File N°5)	P3=0x0000	P4=0x0010
Fault wave form capture.	(File N°22)	P3=0x0020	P4=0x0000

Examples of Commands

Send Commands in Shared Mode Simplified Open / Close

Command 57400
Simplified Open / Close

1. **Fill in Parameters.**

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7700	57400 (command number)
7701	P1 = 4 (total number of parameters including P1)
7702	P2 = 4 (breaker communication module)
7703	P3 = 0 for Open or P3 = 1 for Close
7704	P4 = 0000 (Password default value)

2. **Write Command**.

Write the previous registers by using function 16 of Modbus protocol.

After receiving the command, the status command register (802 for Open; 803 for Close) is set to 1 if the simplified Open/Close command has been accepted by the Breaker Communication Module.

Following table gives the values set in the Status command register.

Value	Label	Use Case
1	RES_OK	Command accepted
2	ERR_NBR_PARAM	Incorrect number of parameters
3	ERR_COIL_ID_VALUE	Incorrect coil value (must be 0 or 1)
4	ERR_COIL_PASSWORD_VALUE	Incorrect password value
5	ERR_MANU	Register 670 in MANU mode

WARNING:

Simplified OPEN/CLOSE command are available only with a Breaker Communication Module firmware version greater or equal to V2.0 (register 577 must be greater or equal to 02000). It is necessary to be in AUTO mode (see register 670).

Send Commands in Protected Mode

1. **Request the flag.**
   Read the following registers by using function 3 of Modbus protocol.

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Read**
7715[1]	Flag. The value read must be 0 to go on to the next step.
553[2]	Control word for commands.

[1] The value read in 7715 is called a "flag". If it is zero, another supervisor on a multi-supervisor system is already in configuration mode. You must wait for the flag to be different than zero before starting to configure.

[2] The control word for commands is regularly modified. It must be read once before sending commands.

2. **Fill in parameters**.

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	Command number to be written (see "List of Commands" on page 156).
7721	P1 = Number of parameters to be sent (including P1).
7722	P2 = Identification of the MicroLogic module. Protection Module = 2, Breaker Communication Module = 4, Metering Module = 8.
7723 to 7729	P3 to P9 = Specific to the command.

3. **Write command**.
   Write the previous registers by using function 16 of Modbus protocol.
4. **Wait for the command being executed**.
   Read the following registers by using function 3 of Modbus protocol.

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Read**
7717	Command is active: as long as the command is being executed, the data is **the command number**. When command execution is finished, the data is 0.
7718	Command is executed: as long as the command is being executed, the data is 0. When command execution is finished, the data is **the command number**.

Repeat readings until command execution is **finished**.

5. **Check result code**.
   Read the following registers by using function 3 of Modbus protocol.

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Read**
7719	Result code for the executed command, indicated in 7719. See the command result-code table for information on the meaning of the code. (see "Protected Mode Registers in the Command Interface" on page 30).

6. **Release the flag**.
   Write the following registers by using function 16 of Modbus protocol.

Command 59492
ReleaseProtFlag

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**59492** (command number)
7721	P1 = 3
7722	P2 = 4 (Breaker Communication Module)
7723	P3 = flag (value read in register 7715 at step 1)

Remotely OPEN the Circuit Breaker Commands

Open the Circuit Breaker

Some preliminary operations are required to send the command.

On the menu of MicroLogic P or H control unit, within <<Com set up>> menu, Remote control must be set to Auto
(Register 670 must be equal to 1).

Then circuit breaker may be remotely controlled.

NOTE: To open the circuit breaker using the COM option, the device must be equipped with an MX <<communicating>> voltage release.

NOTE: For the standard steps such as request the flag, wait for command being executed, check result code and return the flag, please refer to the first example of command “Send Commands in Protected Mode” on page 164.

1. **Request the flag. Get the control word from register 553**.
2. **Enable activation of the MX coil**.
   Write the following registers by using function 16 of Modbus protocol.

Command 58771
EnCoilactivation

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**58771** (command number)
7721	P1 = 4
7722	P2 = 4 (Breaker Communication Module)
7723	P3 = Control word for commands read in step 1 (register 553)
7724	P4 = 10 (0x000A) See bitmap for MX coil control.

3. **Wait for the command being executed**.
4. **Check result code**.
5. **Open the circuit breaker**.
   Write the following registers by using function 16 of Modbus protocol.

Command 58769
OpenBr

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**58769** (command number)
7721	P1 = 4
7722	P2 = 4 (Breaker Communication Module)
7723	P3 = Control word for commands read in step 1 (register 553)
7724	P4 = 1

6. **Wait for the command being executed**.

7. **Check result code**.
8. **Disable activation of the MX coil**.
   Write the following registers by using function 16 of Modbus protocol.

Command 58772
DisCoilactivation

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**58772** (command number)
7721	P1 = 4
7722	P2 = 4 (Breaker Communication Module)
7723	P3 = Control word for commands read in step 1 (register 553)
7724	P4 = 10 (0x000A) See Bitmap for MX Coil Control.

9. **Wait for the command being executed**.
10. **Check result code**.
11. **Return the flag**.

Remotely CLOSE the Circuit Breaker Commands

Close the Circuit Breaker

Some preliminary operations are required to send the command.

On the menu of MicroLogic P or H control unit, within <<Com set up>> menu, Remote control must be set to Auto
(Register 670 must be equal to 1).

Then circuit breaker may be remotely controlled.

NOTE: To close the circuit breaker using the COM option, the device must be equipped with an XF <<communicating>> voltage release.

NOTE: For the standard steps such as request the flag, wait for command being executed, check result code and return the flag, please refer to the first example of command “Send Commands in Protected Mode” on page 164.

1. **Request the flag. Get the control word from register 553**.
2. **Enable activation of the XF coil**.
   Write the following registers by using function 16 of Modbus protocol.

Command 58771
EnCoilactivation

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**58771** (command number)
7721	P1 = 4
7722	P2 = 4 (Breaker Communication Module)
7723	P3 = Control word for commands read in step 1 (register 553)
7724	P4 = 12 (0x000C) See bitmap for XF Coil Control.

3. **Wait for the command being executed**.
4. **Check result code**.

5. **Close the circuit breaker**.
   Write the following registers by using function 16 of Modbus protocol.

Command 58770
CloseBr

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**58770** (command number)
7721	P1 = 4
7722	P2 = 4 (Breaker Communication Module)
7723	P3 = Control word for commands read in step 1 (register 553)
7724	P4 = 1

6. **Wait for the command being executed**.
7. **Check result code**.
8. **Disable activation of the XF coil**.
   Write the following registers by using function 16 of Modbus protocol.

Command 58772
DisCoilactivation

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**58772** (command number)
7721	P1 = 4
7722	P2 = 4 (Breaker Communication Module)
7723	P3 = Control word for commands read in step 1 (register 553)
7724	P4 = 12 (0x000C) See Bitmap for XF Coil Control.

9. **Wait for the command being executed**.
10. **Check result code**.
11. **Return the flag**.

Synchronize the Clocks Commands

Set the time and synchronize the protection and metering module.

When the time is set for the COM option, it in turn automatically sets the time for the protection and metering modules.

Each time the supervision-system and COM-option clocks are synchronized, the COM option automatically synchronizes with the protection and metering modules.

NOTE: For the standard steps such as request the flag, wait for command being executed, check result code and return the flag, please refer to the first example of command “Send Commands in Protected Mode” on page 164.

Set the time and synchronize the Breaker Communication Module.

The time set for the Breaker Communication Module is automatically used for the protection and metering modules.

To set the time, proceed as follows.

1. **Request the flag**.
2. **Set date time of the Breaker Communication Module.**
   WRITE the following registers by using function 16 of Modbus protocol.

Command 61541
SetD_T

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**61541** (command number)
7721	P1 = 5
7722	P2 = 4 (Breaker Communication Module)
7723	P3: bits 15 to 8 = month (1 to 12) P3: bits 7 to 0 = day (1 to 31)
7724	P4: bits 15 to 8 = year (0 to 199, 0 represents 1900, 102represents 2002) P4: bits 7 to 0 = hours (0 to 23)
7725	P5: bits 15 to 8 = minutes (0 to 59) P5: bits 7 to 0 = minutes (0 to 59)

3. **Wait for the command being executed**.
4. **Check result code**.
5. **Return the flag**.
   Depending on the procedure used to synchronize the system clocks, it is advised to: broadcast the time-setting command.

Set the time and synchronize the Cradle Communication Module.

The time must be set for the Cradle Communication Module even if the Breaker Communication Module is already set. Follow the same procedure described for the Breaker Communication Module.

NOTE: When sending a command to the Cradle Communication Module, you do not have to fill the two first parameters (P1 = Number of parameters, P2 = ID of the module)

WRITE the following registers by using function 16 of Modbus protocol.

Command 61541
SetD_T

Modbus Secondary	Address @ [breaker communication module] + 50
Register	**Data To Be Written**
7720	**61541** (command number)
7721	P1 = 5 (total number of parameters including P1)
7722	P2 = 4 (Breaker Communication Module)
7723	P3: bits 15 to 8 = month (1 to 12) P3: bits 7 to 0 = day (1 to 31)
7724	P4: bits 15 to 8 = year (0 to 199, 0 represents 1900, 102 represents 2002) P4: bits 7 to 0 = hours (0 to 23)
7725	P5: bits 15 to 8 = minutes (0 to 59) P5: bits 7 to 0 = seconds (0 to 59)

Remotely Configure and Set Commands

Write settings of the long time protection.

By setting the protection module to configuration mode, it is possible to write the setup registers (8754 to 8803 and 9604 to 9798). The new configuration is not taken into account until after exiting configuration mode.

Some preliminary operations are required to send the command. On the MicroLogic P or H front panel, within “Com set up” menu, remote access must be set to Yes (Register 9800 must be equal to 1).

Then enter the password. The protection module configuration is protected by this password that may be programmed and viewed exclusively on the MicroLogic front panel. This password must be noted before starting. Default access code is 0000. Then you can access the configuration mode.

NOTE: For the standard steps such as request the flag, wait for command being executed, check result code and return the flag, please refer to the first example of command “Send Commands in Protected Mode” on page 164.

1. **Request the flag**.
2. **Access the configuration mode.**
   WRITE the following registers by using function 16 of Modbus protocol.

Command 49202
In_pCfg

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**49202** (command number)
7721	P1 = 3
7722	P2 = 2 (protection module)
7723	P3 = Password to be consulted in the menu of the control unit: Com set-up / Remote access (default is 0000).

3. **Wait for the command being executed**.
4. **Check result code**.
5. **Enter new settings.**
   For the fine adjustments of the long time, short time, instantaneous, ground fault, and earth leakage protection functions, you have to WRITE the following registers (8754 to 8803) at the address @+100 [Protection Module] by using function 6 or 16 of Modbus protocol. If you change the Ir setting, you have to change accordingly the Isd setting since Isd expressed in amperes = (Isd rotary switch position) x Ir.
   For example with the long-time protection settings (assuming a 1000 A circuit breaker):
   Write 850 into register 8756 and 0 into register 8757 will set 850 A as fine adjustment for Ir setting (assuming Ir rotary switch set at position .9 or higher).
   Write 1500 into register 8758 will set 1.5 s as fine adjustment for tr setting (assuming tr rotary switch set at position 2 or higher).
   Write 3400 into register 8766 and 0 into register 8767 will set 3400 A (3400 = 850 x 4) as fine adjustment for Isd setting (assuming Isd rotary switch set at position 4 or higher).
   Write 0 x 0100 into register 8762 will actuate the log of the long time protection into the Fault Wave Form capture (File N°22).

Command 49203
Out_pCfg

6. **Exit the configuration mode**.
   WRITE the following registers by using function 16 of Modbus protocol.

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**49203** (command number)
7721	P1 = 3
7722	P2 = 2 (protection module)
7723	P3 = Password to be consulted in the menu of the control unit: Com set-up / Remote access (default is 0000).

7. **Wait for the command being executed**.
8. **Check result code**.
9. Return the flag.
10. **Check new settings**.
    READ the contents of the registers (8754 to 8803) by using function 3 of Modbus protocol. The settings should be those entered in step 5.

Run Remote Resets / Preset Commands

Reset the current and Voltage maximeters in the metering module.

The minimeters / maximeters of the real-time measurements are reset using the Reset_m_M command. This operation may be carried out at the same time as the reset for other maximeters. Precise operation depends on the parameters sent with the command (see the Appendix, List of Commands, in the “Metering Module Commands @ Address xx + 200” on page 159).

NOTE: For the standard steps such as request the flag, wait for command being executed, check result code and return the flag, please refer to the first example of command “Send Commands in Protected Mode” on page 164.

1. **Request the flag**.
2. **Reset minimeters / reset maximeters for current and Voltage.**
   WRITE the following registers by using function 16 of Modbus protocol.

Command 61952
Reset_m_M

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**61952** (command number)
7721	P1 = 4
7722	P2 = 8 (metering module)
7723	P3 = 0 (bitmap of minimeters to reset)
7724	P4 = 9 (bitmap of maximeters to reset)

3. **Wait for the command being executed**.
4. **Check Result code**.
5. **Return the flag**.

Preset the total active-energy and the total apparent energy

The Energy counter values are preset using the PresetAccEnCtr command. This operation may be carried out at the same time as the preset for active, reactive or apparent energy counter values. Precise operation depends on the parameters sent with the command (see the Appendix, List of Commands, in the “Metering Module Commands @ Address xx + 200” on page 159). Follow the same procedure described for the Breaker Communication Module.

6. **Preset the total Active energy counter to 8,0364,0905,0372 kWh and preset the total Apparent energy counter to 373,0904,0365,0009 kVAh**.

   WRITE the following registers by using function 16 of Modbus protocol.

Command 53760
PresetAccEnCtr

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**53760** (command number)
7721	P1 = 11
7722	P2 = 8 (metering module)
7723	P3 = 130 (0x0082) preset active and apparent energy counter
7724	P4 = 372 (0x174) Register 2000
7725	P5 = 905 (0x0389) Register 2001
7726	P6 = 364 (0x016c) Register 2002
7727	P7 = 8 (0x0008) Register 2003
7728	P8 = 9 (0x0009) Register 2024
7729	P9 = 365 (0x016d) Register 2025
7730	P10 = 904 (0x0388) Register 2026
7731	P11 = 373 (0x175) Register 2027

Manage the Event Logs— Breaker Communication Module Commands

Read a recording in event log of the Breaker Communication Module.

The event log of the Breaker Communication Module is file No. 30.

This file is always enabled.

This file will record the events associated to the alarms (1000 to 1106).

The size of each recording and the valid recording numbers may be read in registers 718 to 743.

The event log of the Breaker Communication Module may be read using the standard read/write functions (3, 4, 6, 16, 23).

Simply follow steps. When the command is finished, the contents of the requested recording may be read starting in register 7730 (see “Event Log of the Breaker Communication Module @ Address xx” on page 36).

NOTE: For the standard steps such as request the flag, wait for command being executed, check result code and return the flag, please refer to the first example of command “Send Commands in Protected Mode” on page 164.

1. **Request the flag**.
2. **Read event log characteristics (status)**.
   Read the following registers by using function 3 of Modbus protocol.
   737 = Number of records in the file (0 = no record).
   738 = Sequence number of first record (the oldest) in the file.
   739 = Sequence number of last record (the most recent) in the file.
3. **Read event log recording**.
   Write the following registers by using function 16 of Modbus protocol.

Command 63178
ReadFileX_RecY

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**63178** (command number)
7721	P1 = 4
7722	P2 = 4 (breaker communication module)
7723	P3 = 10 (number of the file to be read)
7724	P4 = number of the recording to be read, between the numbers of the oldest (738) and most recent (739) recordings, as per results in step 2.

4. **Wait for the command being executed**.
5. **Check result code**.
   The requested recording may be read starting in registers 7730 (see “Event Log of the Breaker Communication Module @ Address xx” on page 36) by using function 3 of Modbus protocol. Repeat step 3 until all the records (737) have been read.
6. **Return the flag**.

Manage the Event Logs—Metering Module Commands

Read a recording in event log of the metering module.

The event log of the metering module is file No. 10.

This file is normally enabled (register 7164 = 0xFFFF). If not, you have to enable it by using the command 63376: EnFiles.

This file will record the events associated to the analog pre-defined alarms (1 to 53). It is therefore mandatory to configure these alarms (see the example, “Manage the Event Logs— Configure Analog Predefined Alarm n°1: Overcurrent Phase A Commands” on page 174).

The size of each recording and the valid recording numbers may be read in registers 7164 to 7189.

The event log of the metering module may be read using the standard read/write functions (3, 4, 6, 16, 23). Simply follow the steps.

When the command is finished, the contents of the requested recording may be read starting in register 7730 (see “Event Log of the Breaker Communication Module @ Address xx” on page 36).

NOTE: For the standard steps such as request the flag, wait for command being executed, check result code and return the flag, please refer to the first example of command “Send Commands in Protected Mode” on page 164.

1. **Request the flag**.
2. **Read event log characteristics (status)**.
   Read the following registers by using function 3 of Modbus protocol.
   7183 = Number of records in the file (0 = no record).
   7184= Sequence number of first record (the oldest) in the file.
   7185 = Sequence number of last record (the most recent) in the file.
3. **Read event log recording**.
   Write the following registers by using function 16 of Modbus protocol.

Command 63178
ReadFileX_RecY

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**63178** (command number)
7721	P1 = 4
7722	P2 = 4 (metering module)
7723	P3 = 10 (number of the file to be read)
7724	P4 = number of the recording to be read, between the numbers of the oldest (7184) and most recent (7185) recordings, as per results in step 2.

4. **Wait for the command being executed**.
5. **Check result code**.
   The requested recording may be read starting in registers 7730 (see “Event Log of the Breaker Communication Module @ Address xx” on page 36) by using function 3 of Modbus protocol. Repeat step 3 until all the records (7183) have been read.
6. **Return the flag**.

Manage the Event Logs— Configure Analog Predefined Alarm n°1: Overcurrent Phase A Commands

Write settings of the alarm n°1.

By setting the metering module to configuration mode, it is possible to write access the setup registers (6000 to 6624). The new configuration is not taken into account until after exiting configuration mode.

Some preliminary operations are required to send the command.

On the front panel of MicroLogic P or H, within “com set up” menu, Remote access must be set to Yes (register 9800 must be equal to 1).

Then read the control word. The metering module configuration is protected by a control word that may be read in register 3300.

Then you can access the configuration mode.

NOTE: For the standard steps such as request the flag, wait for command being executed, check result code and return the flag, please refer to the first example of command “Send Commands in Protected Mode” on page 164.

1. **Request the flag**.
2. **Get Control word**.
   Read the control word in register 3300 of the metering module.
3. **Access the configuration mode**.
   WRITE the following registers by using function 16 of Modbus protocol.

Command 53298
In_mCfg

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**53298** (command number)
7721	P1 = 3
7722	P2 = 8 (metering module)
7723	P3 = content of register 3300 read in step 2

4. **Wait for the command being executed**.
5. **Check Result code**.
6. **Enter new settings**.
   For the adjustments of the analog pre-defined Alarm n°1, you have to WRITE the following registers (6000 to 6010) at the address @+200 [Metering Module] by using function 6 or 16 of Modbus protocol.
   Write 0x0001 into register 6000 will activate the alarm n°1 (Over Current Phase A).
   Write 900 into register 6003 will set the Pick-up value to 900 A. Write 7 into register 6005 will set the Pick-up time delay to 7 s.
   Write 650 into register 6006 will set the Drop-out value to 650 Amps.
   Write 11 into register 6008 will set the Drop-out time delay to 11 s.
   Write 0x0200 into register 6010 will actuate the log of Alarm n°1 into the Wave Form capture (file N° 5).
7. **Get Control word**.
   Read the control word in register 3300 of the metering module.
8. **Exit the configuration mode**.
   WRITE the following registers by using function 16 of Modbus protocol.

Command 53299
Out_mCfg

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**53299** (command number)
7721	P1 = 3
7722	P2 = 8 (metering module)
7723	P3 = content of register 3300 read in step 7

9. **Wait for the command being executed**.
10. **Check Result code**.
11. **Return the flag**.
12. **Check new settings**.
    READ the contents of the registers (6000 to 6624) by using function 3 of Modbus protocol. The settings should be those entered in step 6.

Manage the Wave Form Capture

Read the metering module wave form capture record after a user request.

The wave form capture of the metering module is file No. 5.

This file is normally enabled (register 7132 = 0xFFFF). If not, you have to enable it by using the command 63376: EnFiles.

This file will record the wave form capture triggered either by the analog pre-defined alarms (1 to 53). It is therefore mandatory to configure these alarm (See the example, “Manage the Event Logs— Configure Analog Predefined Alarm n°1: Overcurrent Phase A Commands” on page 174) either on user request by using the command forcelog.

This file consists of a fixed number of records (29). All records are of similar size, i.e. 64 registers wide.

The record of wave form capture may be read using the standard read/write functions (3, 4, 6, 16, 23).

Simply follow steps. When the command is finished, the contents of the requested recording may be read starting in register 7730.

NOTE: For the standard steps such as request the flag, wait for command being executed, check result code and return the flag, please refer to the first example of command “Send Commands in Protected Mode” on page 164.

1. Request the flag
2. Forcelog
   Write the following registers by using function 16 of Modbus protocol.

Command 55234
Forcelog

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**55234** (command number)
7721	P1 = 4
7722	P2 = 8 (metering module)
7723	P3 = 0 (0x0000) bitmap of file N° 5
7724	P4 = 16 (0x0010) bitmap of file N° 5

3. **Read wave form capture characteristics (Status)**.
   Read the following registers by using function 3 of Modbus protocol
   7151 = Actual Number of records in the log (0 or 29).
   If 0, there is no record.
   If 29, you can read the records.
4. **Read wave form capture recording**.
   Write the following registers by using function 16 of Modbus protocol.

Command 63179
ReadFileX_RecY

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**63178** (command number)
7721	P1 = 4
7722	P2 = 8 (metering module)
7723	P3 = 5 (number of the file to be read)
7724	P4 = number of the recording to be read, between 1 and 29

5. **Wait for the command being executed**.

6. **Check Result code**.
   The requested recording may be read starting in registers 7730 (see “Format of Records in the Wave Form Capture of the Metering Module” on page 49) by using function 3 of Modbus protocol. Repeat step 4 until all the records (29) have been read.
7. **Return the flag**.

Manage the Fault Wave Form Capture

Read the protection module fault wave form capture record after a trip condition.

The fault wave form capture of the protection module is file No. 22. This file is normally enabled (register 9964 = 0xFFFF). If not, you have to enable it by using the Command 63376: EnFiles.

This file will record the fault wave form capture triggered by the alarms (1000 to 1038). It is therefore mandatory to actuate the log of these alarm into the FWFC (file N°22). See the example: remotely configure and set. This file consists of a fixed number of records (29). All records are of similar size, i.e. 64 registers wide.

The record of fault wave form capture may be read using the standard read/write functions (3, 4, 6, 16, 23).

Simply follow steps. When the command is finished, the contents of the requested recording may be read starting in register 7730.

NOTE: For the standard steps such as request the flag, wait for command being executed, check result code and return the flag, please refer to the first example of command “Send Commands in Protected Mode” on page 164.

1. **Request the flag**.
2. **Read Wave Form Capture characteristics (Status)**.
   Read the following registers by using function 3 of Modbus protocol.
   9983 = Actual Number of records in the log (0 or 29).
   If 0, there is no record.
   If 29, you can read the records.
3. **Read wave form capture recording**.
   Write the following registers by using function 16 of Modbus protocol.

Command 63178
ReadFileX_RecY

Modbus Secondary	Address @ [breaker communication module]
Register	**Data To Be Written**
7720	**63178** (command number)
7721	P1 = 4
7722	P2 = 2 (protection module)
7723	P3 = 22 (number of the file to be read)
7724	P4 = number of the recording to be read, between 1 and 29

4. **Wait for the command being executed**.
5. **Check Result code**.
   The requested recording may be read starting in registers 7730 (see “Format of Records in the Wave Form Capture of the Metering Module” on page 49) by using function 3 of Modbus protocol. Repeat step 3 until all the records (29) have been read.

Return the flag.

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