

# Pact Series

## MasterPact NT/NW and PowerPact™ P- and R-Frame – Modbus Communication

### User Guide

Pact Series offers world-class circuit breakers and switches.

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07/2022



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# Safety Information

## Important Information

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



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



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

### **DANGER**

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

### **WARNING**

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

### **CAUTION**

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

### **NOTICE**

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

## Please Note

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

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

## Cybersecurity Safety Notice

### **⚠ WARNING**

#### **POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY**

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

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

## 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 designated 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.

# About the Book

## Document Scope

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 4 ranges of circuit breakers and switches:

- PowerPact™ P-frame circuit breaker 250-1200 A
- PowerPact™ R-frame circuit breaker 600-3000 A
- MasterPact™ NT circuit breaker 250-1200 A (800 A in ANSI circuit breakers and 1600 A in UL489 fixed circuit breaker only)
- MasterPact™ NW circuit breaker 250-6000 A

## Validity Note

This document is valid for MasterPact NT/NW and PowerPact P- and R-frame circuit breakers with a BCM ULP circuit breaker communication module embedded, and connected:

- either to an RS 485 serial line Modbus network using an IFM Modbus-SL interface for one circuit breaker
- or to an Ethernet network using an IFE Ethernet interface for one circuit breaker or an IFE Ethernet switchboard server.

This document describes the registers and commands available for the IMU modules with the following firmware version

IMU module	Part number	Firmware version
MicroLogic A trip unit	–	≥ V01.029
MicroLogic E trip unit	–	≥ V1.016
MicroLogic P/H trip unit	–	≥ 2014AQ or 8.284
BCM ULP module	–	≥ V4.1.9
IO module	LV434063	≥ V003.004.005
IFM interface	LV434000	≥ V003.001.012
IFE Ethernet interface	LV434001	≥ V004.007.000
	LV434010	
IFE Server	LV434002	≥ V003.009.010
	LV434011	

You can update the firmware of the IMU modules by using the latest version of EcoStruxure Power Commission.

Refer to the *MasterPact Modbus Legacy User Guide* , page 11 for communication architectures using:

- the Modbus legacy port of the BCM ULP module
- the IFM interface with the Modbus legacy firmware

**NOTE:** All BCM breaker communication module are BCM ULP module since week 45 of 2010.

## Online Information

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

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

## Related Documents

Title of Documentation	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 Circuit Breakers - Installation Guide	48049-148-05 (EN, ES, FR)
PowerPact Drawout P-Frame Circuit Breakers - Installation Guide	48049-336-02 (EN, ES, FR)
PowerPact R-Frame Circuit Breakers - Installation Guide	48049-243-04 (EN, ES, FR)
MicroLogic A Trip Units - User Guide	48049-136-05 (EN, ES, FR)
MicroLogic P Trip Units - User Guide	48049-137-05 (EN, ES, FR)
MicroLogic H Trip Units - User Guide	48049-330-03 (EN, ES, FR)
MasterPact NT/NW, PowerPact M-, P-, and R-Frame, PowerPact P- and R-Frame Communication Option - Installation Manual	EAV3608000 (EN, ES, FR)
ULP (Universal Logic Plug) System - User Guide	0602IB1503
MasterPact Modbus Legacy - User Guide	0613IB1201

You can download these technical publications and other technical information from our website at <https://www.se.com/en/download>.

# Modbus Communication with MasterPact NT/NW and PowerPact P- and R-Frame Circuit Breakers

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# Introduction

## What's in This Chapter

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## Pact Series Master Range

Future-proof your installation with Schneider Electric's low-voltage and medium-voltage Pact Series. Built on legendary Schneider Electric innovation, the Pact Series comprises world-class circuit breakers, switches, residual current devices and fuses, for all standard and specific applications. Experience robust performance with Pact Series within the EcoStruxure-ready switchgear, from 16 to 6300 A in low-voltage and up to 40.5 kV in medium-voltage.

## Description

### Modbus Communication

The Modbus communication option enables Schneider Electric low voltage circuit breakers to be connected to a supervisor or to any other device with a master Modbus communication channel.

The circuit breakers can be connected to an RS-485 serial line network with Modbus protocol or an Ethernet network with Modbus TCP/IP protocol using dedicated interfaces like:

- the IFM Modbus-SL interface for one circuit breaker to connect the circuit breaker to an RS-485 serial line network or,
- the IFE Ethernet interface for one circuit breaker or the IFE Ethernet switchboard server to connect the circuit breaker to an Ethernet network.

### Access to Functions

The Modbus communication option provides access to many functions, including:

- read metering and diagnostic data
- read status conditions and remote operations
- transfer of time-stamped events
- display protection settings
- read the circuit breakers identification and configuration data
- remote control of the circuit breaker
- time-setting and synchronization

This list depends on the composition of the intelligent modular unit (IMU) (type of circuit breaker, of MicroLogic trip unit, and so on) and the enabled functions.

# Intelligent Modular Unit

## Definition

A modular unit is a mechanical and electrical assembly containing one or more products to perform a function in a switchboard (incoming protection, motor command, and control).

The circuit breaker with its internal communicating components (MicroLogic control unit or MicroLogic trip unit) and external ULP modules (IO module) connected to one communication interface is called an intelligent modular unit (IMU).

An IMU is composed around a circuit breaker from the following ranges:

- MasterPact MTZ circuit breakers
- MasterPact NT/NW circuit breakers
- ComPact NS 1600b-3200 circuit breakers
- ComPact NS 630b-1600 circuit breakers
- PowerPact P- and R- frame circuit breakers
- ComPact NSX circuit breakers
- PowerPact H-, J-, and L- frame circuit breakers

## ULP Modules Per Circuit Breaker Range

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

ULP Module	Part Number	MasterPact MTZ with ULP Port Module and MicroLogic Control Unit	MasterPact NT/NW or PowerPact M-, P-, and R-Frame or PowerPact P- and R-Frame with BCM ULP Module and MicroLogic Trip Unit	ComPact NSX or PowerPact H-, J-, and L-Frame with BSCM Module and/or MicroLogic Trip Unit
IFE Ethernet interface for one circuit breaker	LV434001 LV434010	✓	✓	✓
IFE Ethernet switchboard server	LV434002 LV434011	✓	✓	✓
EIFE Embedded Ethernet interface for one MasterPact MTZ drawout circuit breaker	LV851001	✓	–	–
Spare part kit EIFE for one MasterPact MTZ1 drawout circuit breaker	LV851100SP	✓	–	–
Spare part kit EIFE for one MasterPact MTZ2/MTZ3 drawout circuit breaker	LV851200SP	✓	–	–
IFM Modbus-SL interface for one circuit breaker	TRV00210 STRV00210	–	✓	✓
IFM Modbus-SL interface for one circuit breaker	LV434000	✓	✓	✓
FDM121 front display module for one circuit breaker	TRV00121 STRV00121	–	✓	✓

For more information on the ULP System and its components, refer to the *ULP System User Guides*.

[illegible]

- A** FDM128 Ethernet display for eight devices
- B** FDM121 front display module for one circuit breaker
- C** IFE Ethernet interface for one circuit breaker
- D** IFE Ethernet switchboard server
- E** IFM Modbus-SL interface for one circuit breaker
- F** IO input/output application module for one circuit breaker
- G** MasterPact MTZ1 or MTZ2/MTZ3 drawout circuit breaker
- H** MasterPact MTZ1 or MTZ2/MTZ3 fixed circuit breaker
- I** MasterPact NT/NW circuit breaker
- J** ComPact NS/PowerPact M-,P-, and R-frame circuit breaker
- K** ComPact NSX/PowerPact H-, J-, and L-frame circuit breaker
- L** ULP port module
- M** EIFE Embedded Ethernet Interface for one MasterPact MTZ drawout circuit breaker
- N** ULP line termination
- O** RJ45 ULP cord
- P** Circuit breaker BCM ULP cord
- Q** NSX cord

## Remote Controller

A remote controller is a device that is able to communicate with an IMU using a communication interface, such as the IFE Ethernet interface. For example, FDM128 Ethernet display for eight devices, supervisor, PLC, BMS, SCADA system, and so on, are remote controllers.

For the description of Modbus registers and commands, refer to the *Modbus Communication Guides*.

# EcoStruxure Power Commission Software

## Overview

EcoStruxure™ Power Commission is the new name of Ecoeach software.

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

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

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

Circuit breaker ranges	Modules	Accessories
MasterPact MTZ circuit breakers	<ul style="list-style-type: none"> <li>MicroLogic X control unit</li> <li>Communication interface modules: IFM interface, IFE interface, IFE server, and EIFE interface</li> <li>ULP modules: IO module</li> </ul>	M2C output module
<ul style="list-style-type: none"> <li>MasterPact NT/NW circuit breakers</li> <li>PowerPact P- or R-Frame circuit breakers</li> <li>PowerPact P- and R-frame circuit breakers</li> </ul>	<ul style="list-style-type: none"> <li>MicroLogic trip units</li> <li>Communication interface modules: BCM module, CCM module, BCM ULP module, IFM interface, IFE interface, IFE server</li> <li>ULP modules: IO module, FDM121 display</li> </ul>	M2C and M6C output modules
<ul style="list-style-type: none"> <li>PowerPact H-, J-, and L-frame circuit breakers</li> <li>PowerPact H-, J- and L-frame circuit breakers</li> </ul>	<ul style="list-style-type: none"> <li>MicroLogic trip units</li> <li>Communication interface modules: BSCM module, IFM interface, IFE interface, IFE server</li> <li>ULP modules: IO module, FDM121 display</li> </ul>	SDTAM and SDx output modules
(1) For FDM121 display, only the firmware and language download are supported.		

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

EcoStruxure Power Commission software is available at [www.se.com](http://www.se.com)

## Key Features

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

- Create projects by device discovery
- Save the project in the EcoStruxure Power Commission cloud for reference
- Upload settings to the device and download settings from the device
- Compare the settings between the project and the device
- Perform control actions in a secured way
- Generate and print the device settings report
- Perform a communication wiring test on the entire project and generate and print test report

- View the communication architecture between the devices in a graphical representation
- View the measurements, logs, and maintenance information
- Export Waveform Capture on Trip Event (WFC)
- View the status of device and IO module
- View the alarm details
- Buy, install, remove, or retrieve the Digital Modules
- Check the system firmware compatibility status
- Update to the latest device firmware
- Perform force trip and automatic trip curve tests

# IFM Interface

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# Introduction

## Overview

The IFM Modbus-SL interface for one circuit breaker enables an intelligent modular unit (IMU) with a ComPact, PowerPact or MasterPact circuit breaker, to be connected to a two-wire Modbus-SL RS-485 serial line Modbus network. Each circuit breaker has its own IFM interface and a corresponding Modbus address.

## Types of IFM Interface

The part number of the IFM interface is LV434000. The IFM interface part number LV434000 completely replaces the IFM interface with part number TRV00210 or STRV00210.

**NOTE:**

- The IFM interface data for the IFM interface with part number LV434000 is the same as for the IFM interface with part number TRV00210 or STRV00210.
- The IFM interfaces with part number TRV00210 or STRV00210 are not compatible with MasterPact MTZ circuit breakers.

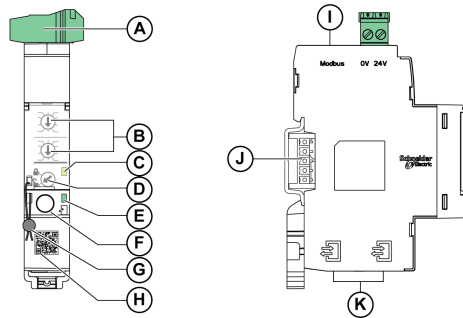
## IFM Interface Features

The main features of IFM interface are:

- Single Modbus serial line interface provided in
  - RJ45 connector interface
  - Stacking connection interface
- HMI rotary dials for address settings and padlock option
- Pushbutton for test functionality

# Hardware Description

## General Description



**A** 24 Vdc power supply terminal block

**B** Modbus address rotary switches

**C** Modbus traffic status LED

**D** Modbus locking pad

**E** ULP status LED

**F** Test button

**G** Mechanical lock

**H** QR code to product information

**I** RJ45 Modbus-SL port

**J** Stacking accessory connection (TRV00217, optional)

**K** 2 RJ45 ULP ports

For information on installation, consult the instruction sheet available on Schneider Electric website: [NVE85393](#).

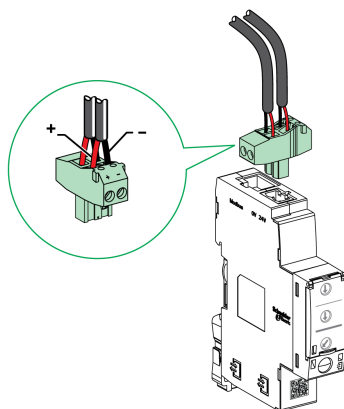
## Mounting

The IFM interface is a DIN rail mounting device. The stacking accessory enables the interconnection of several IFM interfaces without additional wiring.

## 24 Vdc Power Supply

The IFM interface must always be supplied with 24 Vdc:

- IFM interfaces stacked to an IFE server are supplied by the IFE server and it is not necessary to supply them separately.
- If IFM interfaces are stacked without IFE server, only one of the IFM interfaces must be supplied with 24 Vdc.
- A single IFM interface must be supplied with 24 Vdc.



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

**NOTE:** For 24 Vdc power supply connection, use copper conductors only.

## Modbus Address Rotary Switches

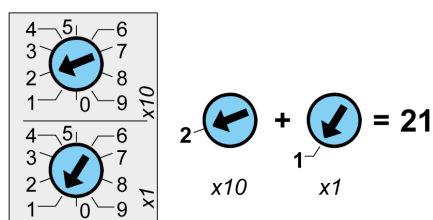
The IFM interface bears the Modbus address of the IMU to which it is connected. See the *ULP System User Guide* for more information regarding the IMU.

Define the Modbus address using the two address rotary switches on the front panel of the IFM interface.

The address range is 1 to 99. Do not use the address 0, because it is reserved for broadcasting commands.

The IFM interface is initially configured with address 99.

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



## Modbus Traffic Status LED

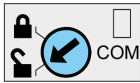
The Modbus traffic status LED provides information about the traffic transmitted or received by the IMU over the Modbus network.

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

## Modbus Locking Pad

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

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



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



The only remote control commands that are enabled even if the arrow points to the closed padlock are the Set Absolute Time and Get Current Time commands , page 274.

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

## Test Button

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




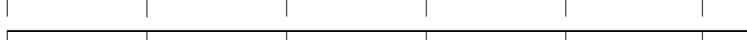
Pressing the test button launches the connection test for 15 seconds.

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

## ULP Status LED

The yellow ULP status LED describes the mode of the ULP module.

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

ULP status LED	Mode	Action
	Critical firmware discrepancy	Use EcoStruxure Power Commission software to check the firmware and hardware compatibility and follow the recommended actions.
	Critical hardware discrepancy	
	Stop	Replace IFM.
	Power off	Check power supply

# Schematics with MasterPact NT/NW and PowerPact P- and R-Frame Circuit Breakers

## General Description

Depending on the type of circuit breaker used, the IFM interface must be connected to the circuit breaker by using one of the following configurations:

- Connect the IFM interface to a fixed manually-operated PowerPact P- or R-frame circuit breaker with a BCM ULP module.
- Connect the IFM interface to a fixed electrically-operated MasterPact NT/NW or PowerPact P- or R-frame circuit breaker with a BCM ULP module.
- Connect the IFM interface to a drawout MasterPact NT/NW or PowerPact P- or R-frame circuit breaker with a BCM ULP module and their respective IO module.

For more information, refer to the *ULP System User Guide*.

## ULP Connection

### NOTICE

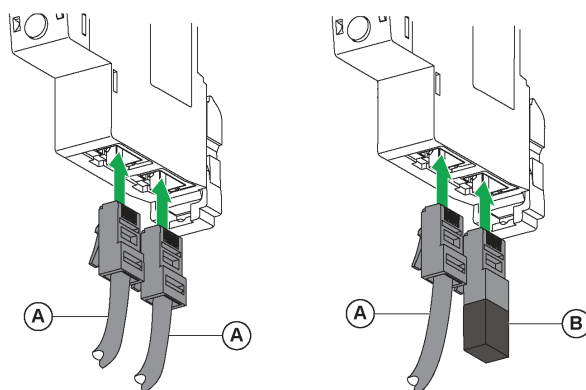
#### HAZARD OF EQUIPMENT DAMAGE

- Never connect a Modbus-SL device to an RJ45 ULP port.
- The RJ45 ULP ports of IFM interface are for ULP modules only.
- Any other use can damage the IFM interface or the device connected to the IFM interface.
- To check if an ULP module is compatible with the RJ45 ULP ports of IFM interface, refer to the *ULP System User Guide*.

**Failure to follow these instructions can result in equipment damage.**

All the connection configurations require the circuit breaker BCM ULP cord. The insulated NSX cord is mandatory for system voltages greater than 480 Vac.

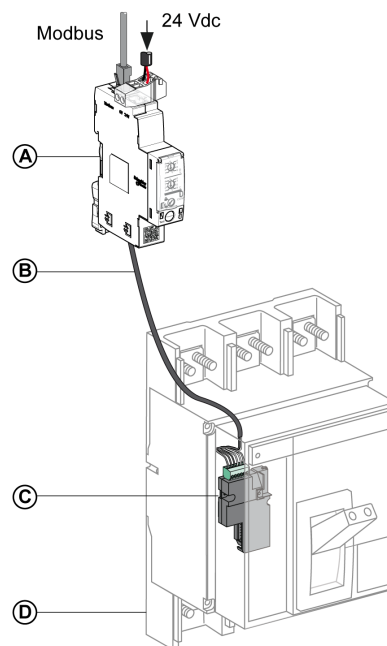
When the second RJ45 ULP port is not used, it must be closed with an ULP line termination:



**A** Circuit breaker BCM ULP cord or RJ45 ULP cord

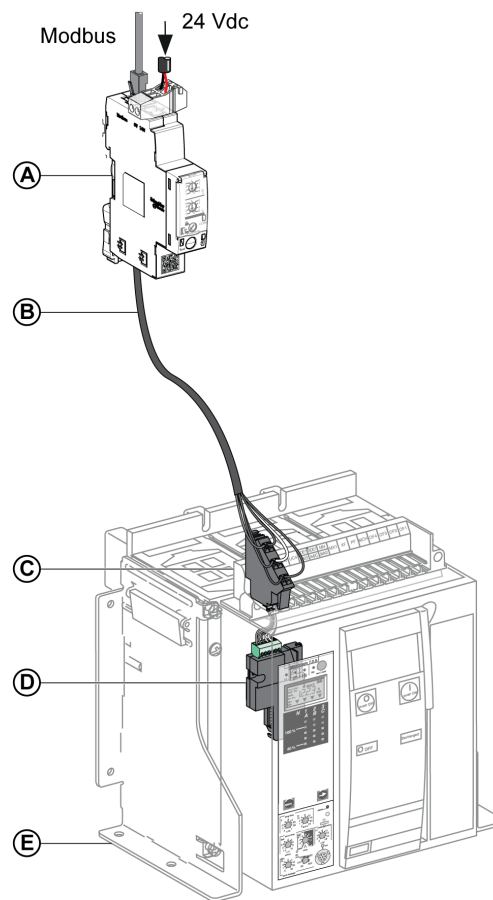
**B** ULP line termination

## Connection of the IFM Interface to a Fixed Manually-Operated PowerPact P- or R-Frame Circuit Breaker



- A** IFM Modbus-SL interface for one circuit breaker
- B** Circuit breaker BCM ULP cord
- C** BCM ULP circuit breaker communication module
- D** Fixed manually-operated PowerPact P- and R-frame circuit breaker

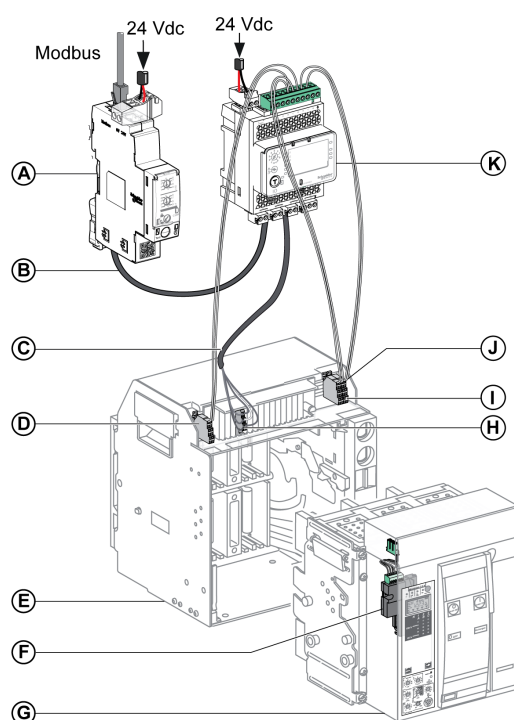
## Connection of the IFM Interface to a Fixed Electrically-Operated MasterPact NT/NW or PowerPact P- or R-Frame Circuit Breaker



- A** IFM Modbus-SL interface for one circuit breaker
- B** Circuit breaker BCM ULP cord
- C** Fixed terminal block
- D** BCM ULP circuit breaker communication module
- E** Fixed electrically-operated circuit breaker



## Connection of the IFM Interface to a Drawout MasterPact NT/NW or PowerPact P- or R-Frame Circuit Breaker



- A** IFM Modbus-SL interface for one circuit breaker
- B** RJ45 ULP cord ULP cord
- C** Circuit breaker BCM ULP cord
- D** Circuit breaker disconnected position contact (CD)
- E** Circuit breaker cradle
- F** BCM ULP circuit breaker communication module
- G** Drawout circuit breaker
- H** Drawout terminal block
- I** Circuit breaker connected position contact (CE)
- J** Circuit breaker test position contact (CT)
- K** IO input/output application module for one circuit breakers (IO module)

## Configuration

### General Description

Two configurations of the IFM interface are available:

- Automatic configuration (Auto-Speed sensing ON, factory setting): when connected to the Modbus network, the IFM interface automatically detects the network parameters.
- Personalized configuration (Auto-Speed sensing OFF): the network parameters can be personalized using the *EcoStruxure Power Commission* software, page 18.

## Automatic Configuration

The Modbus slave address is defined by the two address rotary switches on the front panel of the IFM interface. When connected to the Modbus serial line network, the IFM interface automatically detects the network speed and parity. The Auto-Speed sensing algorithm tests the available Baud rates and parities and automatically detects the Modbus communication network parameters. The Modbus master must send at least 25 frames on the Modbus network in order to allow the Auto-Speed sensing algorithm to work.

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

If the Auto-Speed sensing algorithm does not detect the network parameters, it is recommended to follow this procedure:

Step	Action
1	Set up the IFM interface to Modbus address 1, page 23.
2	Send a read multiple register request (function code 0x03) to slave 1, at any address and for any number of registers.
3	Send this request at least 25 times.

**NOTE:** If the network speed or parity is changed after the IFM interface has automatically detected these settings, the IFM interface must be restarted (power off/power on) in order to detect the new network parameters.

## Personalized Configuration

The Modbus slave address is defined by the two address rotary switches on the front panel of the IFM interface.

Disable the Auto-Speed sensing option and set the following Modbus communication network parameters with the *EcoStruxure Power Commission software*, page 18:

- Baud rate: 4800, 9600, 19200 and 38400 Baud.
- parity: even, odd, and none (it is possible to select one stop bit or two stop bits in case of no parity).

**NOTE:** It is not possible to change the Modbus address or the status of the locking pad with the *EcoStruxure Power Commission software*.

## IFM Interface with Legacy Application Firmware

The IFM interface is shipped with the standard firmware. This standard firmware responds to one unique Modbus slave address, set between 1 and 99 by the two rotary switches on the front panel of the IFM interface.

The IFM interface with the standard firmware is not compatible with legacy applications using four Modbus slave addresses:

- 1 address x from 1 to 47 for the circuit breaker manager
- 1 address x+50 for the chassis manager
- 1 address x+100 for the metering manager
- 1 address x+200 for the protection manager

The IFM interface is compatible with legacy applications using four Modbus slave addresses after replacement of the standard firmware by the legacy firmware. To replace the IFM firmware, contact your Schneider Electric customer support, with indication of the IFM part number, TRV00210 or LV434000.

**NOTE:**

- Do not mix IFM interfaces with standard firmware with IFM interfaces with legacy firmware on the same Modbus-SL network.
- When an IFM interface with legacy firmware is connected to a BCM ULP module, its Modbus traffic status LED is steady ON.
- The IO module can be connected to an IFM interface with legacy firmware to perform the cradle management application.

# Communication Test

## Introduction

The use of the *EcoStruxure Power Commission* software, page 18 is recommended to test the serial line communication on the various circuit breakers.

If the laptop or PC installed with the *EcoStruxure Power Commission* software and connected on the Modbus network is able to read data from the IMU, the communication is established. Refer to the *EcoStruxure Power Commission Online Help*.

# IFE Interface

## What's in This Chapter

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Hardware Description .....	35
Schematics with MasterPact NT/NW and PowerPact P- and R-Frame Circuit Breakers.....	40

# Introduction

## Overview

The IFE interface enables an intelligent modular unit (IMU) with a ComPact, PowerPact or MasterPact circuit breaker to be connected to an Ethernet network. Each circuit breaker has its own IFE interface and a corresponding IP address.

## Types of IFE Interface

There are two types of the IFE interface:

- IFE Ethernet interface for one circuit breaker, with part number LV434001

This type of IFE interface is an Ethernet interface for ComPact, PowerPact and MasterPact circuit breakers.

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

- IFE Ethernet switchboard server, with part number LV434002

This type of IFE interface is an Ethernet interface for ComPact, PowerPact, and MasterPact circuit breakers and a server for Modbus-SL (serial line) connected devices.

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

## IFE Interface Features

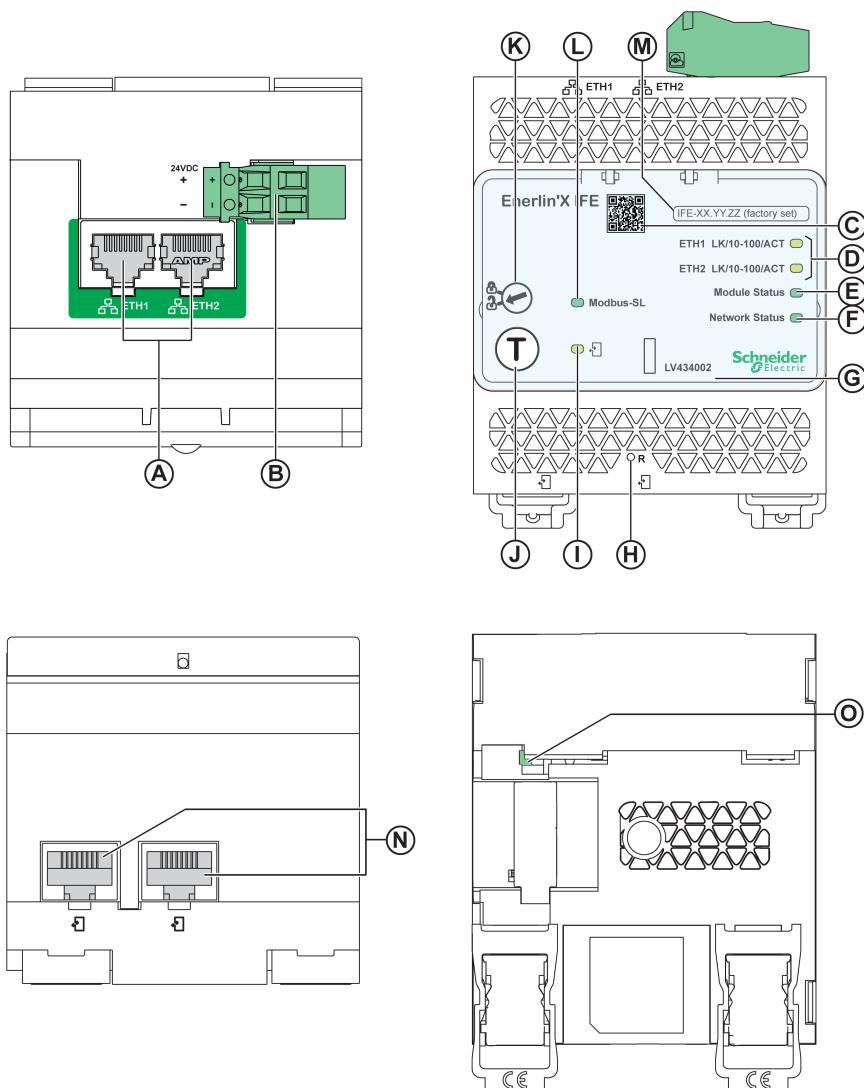
The main features of IFE interface are:

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

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

# Hardware Description

## Description



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

For information on installation, consult the instruction sheet available on the Schneider Electric website: [QGH13473](#).

## Mounting

The IFE interface mounts on a DIN rail. The stacking accessory enables the connection of several IFM interfaces to an IFE server without additional wiring.

**NOTE:** The stacking feature is available only for the IFE server with the part number LV434002.

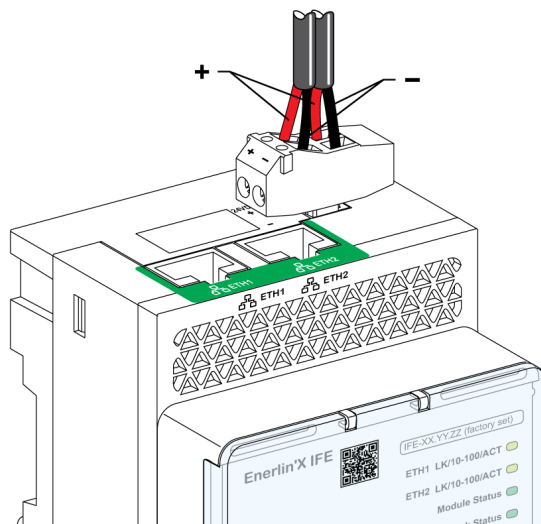
## 24 Vdc Power Supply

The IFE interface must always be supplied with 24 Vdc. The power to the IFM interfaces stacked to an IFE server are supplied by the IFE server and it is not necessary to supply power to them separately.

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

**NOTE:** For 24 Vdc power supply connection, use copper conductors only.





## Ethernet Communication LEDs

The Ethernet communication dual color LEDs, indicate the status of the Ethernet ports **ETH1** and **ETH2**.

LED Indication	Status Description
OFF	No power or no link
Steady yellow	10 Mbps, link established, and no activity
Blinking yellow	10 Mbps, ongoing activity
Steady green	100 Mbps, link established, and no activity
Blinking green	100 Mbps, ongoing activity

## Module Status LED

The module status dual color LED, indicates the IFE interface status.

LED Indication	Status Description	Action
OFF	No power	None
Steady green	IFE interface operational	None
Blinking green (250 ms ON, 250 ms OFF)	Hidden control webpage available	None
Blinking green (500 ms ON, 500 ms OFF)	IFE interface firmware corrupted	Contact your local Schneider Electric service team for support.
Blinking red (500 ms ON, 500 ms OFF)	IFE interface in degraded mode	Replace ULP module at the next maintenance operation.
Steady red	IFE interface out of service	None
Blinking green/red (1 s green, 1 s red)	Firmware update in progress	None
Blinking green/red (250 ms green, 250 ms red)	Self-test in progress	None

## Network Status LED

The network status dual color LED, indicates the Ethernet network status.

LED Indication	Status Description
OFF	No power or no IP address
Steady green	Valid IP address
Steady red	Duplicated IP address
Blinking green/red (250 ms green, 250 ms red)	Self-test in progress
Steady amber	Error in IP configuration

## Modbus Serial Line Traffic LED

The Modbus serial line traffic yellow LED, indicates that the traffic is being transmitted or received over the Modbus serial line network through the IFE server.

The LED is ON during the transmission and reception of the messages. The LED is OFF otherwise.

**NOTE:** The LED is OFF on the IFE interface (part number LV434001).

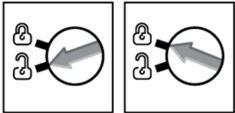
## Modbus Address

The IFE interface accepts the Modbus address of the IMU to which it is connected.

The Modbus address is 255 and cannot be changed.

## Locking Pad

The locking pad on the front panel of the IFE interface enables or disables the ability to send the remote control commands over the Ethernet network to the IFE interface, and to the other modules of the IMU.



- If the arrow points to the open padlock (factory setting), remote control commands are enabled.
  - If the arrow points to the closed padlock, remote control commands are disabled.
- The only remote control command that is enabled even if the arrow points to the closed padlock, is the set absolute time command.

## Test Button

The test button has two functions, according to the duration of the button pressed.

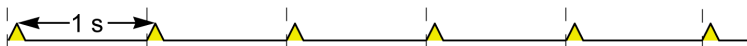

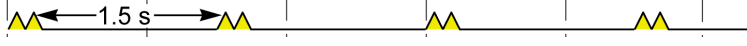


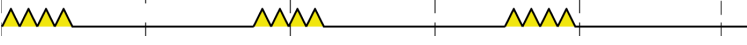
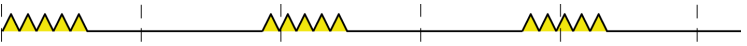




Time Range	Function
1–5 s	Tests the connection between all the ULP modules for 15 s.
10–15 s	Activates the hidden configuration mode. <b>NOTE:</b> The hidden configuration is not activated if the button is pressed for more than 15 s.

## Reset Button

When the reset button is pressed for 1–5 s, it forces the IP acquisition mode to the factory default setting (DHCP).

## ULP Status LED

The yellow ULP status LED describes the mode of the ULP module.

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

# Schematics with MasterPact NT/NW and PowerPact P- and R-Frame Circuit Breakers

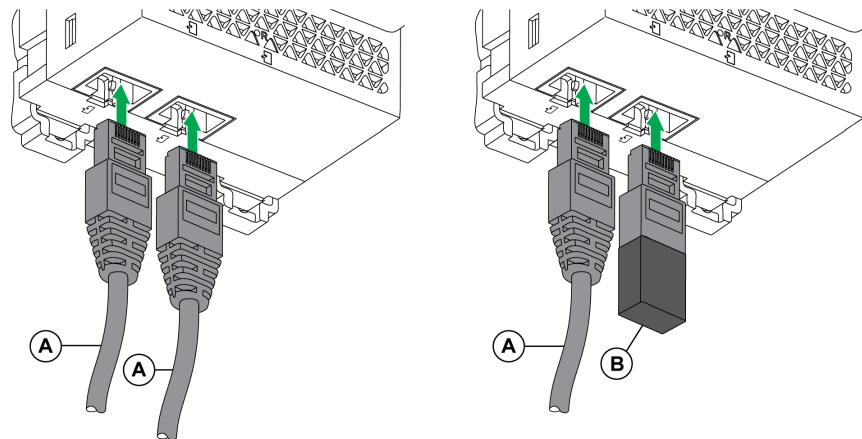
## Description

For more information, refer to the *ULP System User Guide*.

## ULP Connection

All connection configurations require the BCM ULP cord.

When the second RJ45 ULP port is not used, it must be closed with a ULP line termination.



**A** Circuit breaker BCM ULP cord or RJ45 male/male ULP cord

**B** ULP line termination

# Modbus Protocol with MasterPact NT/NW and PowerPact P- and R-Frame Circuit Breakers

## What's in This Part

Modbus Master-Slave Principle .....	42
Modbus Programming Recommendations.....	45
Modbus Functions.....	47
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# Modbus Master-Slave Principle

## Overview

The Modbus protocol exchanges information using a request-reply mechanism between a master (client) and a slave (server). The master-slave principle is a model for a communication protocol in which one device (the master) controls one or more other devices (the slaves). In a standard Modbus network, there is 1 master and up to 31 slaves.

A detailed description of the Modbus protocol is available at [www.modbus.org](http://www.modbus.org).

## Characteristics of the Master-Slave Principle

The master-slave principle is characterized as follows:

- Only 1 master is connected to the network at a time.
- Only the master can initiate communication and send requests to the slaves.
- The master can address each slave individually using its specific address or all slaves simultaneously using address 0.
- The slaves can only send replies to the master.
- The slaves cannot initiate communication, either to the master or to other slaves.

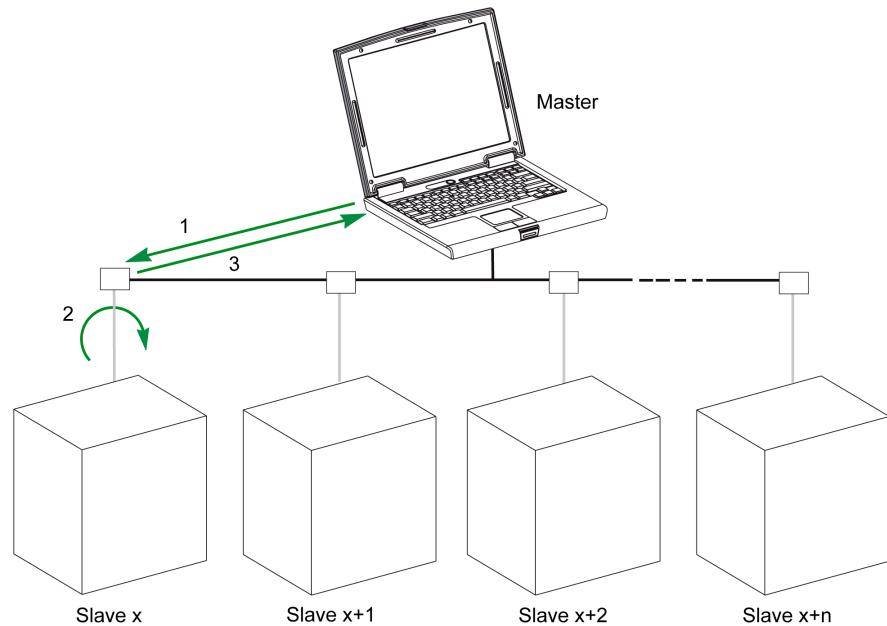
## Master-Slave Communication Modes

The Modbus protocol can exchange information using 2 communication modes:

- unicast mode
- broadcast mode

## Unicast Mode

In unicast mode, the master addresses a slave using the specific address of the slave. The slave processes the request then replies to the master.



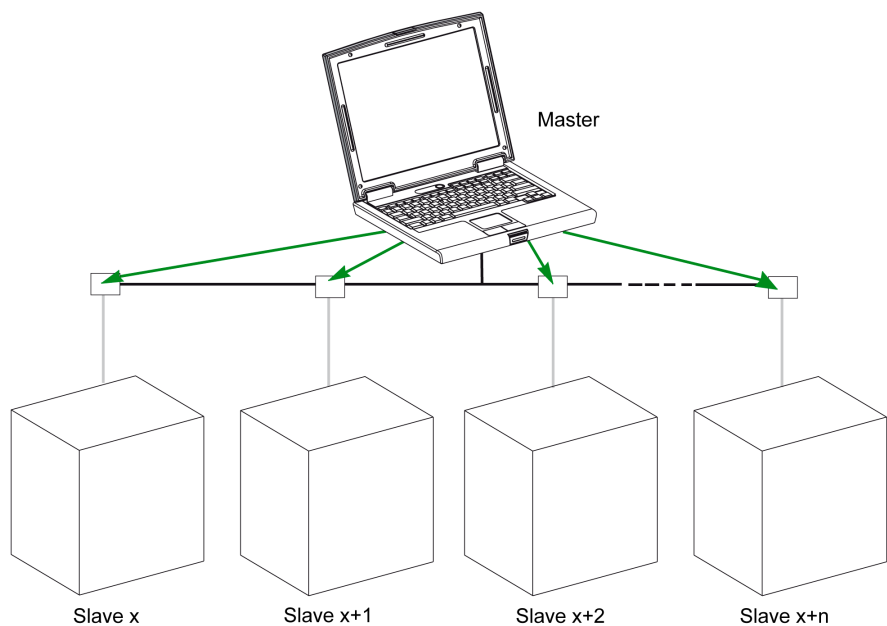
**1 Request**

**2 Process**

**3 Reply**

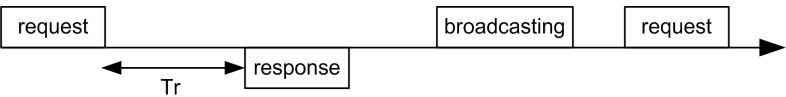
## Broadcast Mode

The master can also address all slaves using address 0. This type of exchange is called broadcasting. The slaves do not reply to broadcasting messages.



## Response Time

The response time  $T_r$  is the time needed by a slave to respond to a request sent by the master:



Values with the Modbus protocol:

- Typical value < 10 ms for 90% of the exchanges
- Maximum value is around 700 ms, so it is recommended to implement a 1 second time out after sending a Modbus request.

## Data Exchange

The Modbus protocol uses 2 types of data:

- Single bit
- Register (16 bits)

MasterPact MTZ, MasterPact NT/NW, PowerPact P- and R-Frame, and PowerPact H-, J-, and L-Frame circuit breakers support registers only.

Each register has a register number. Each type of data (bit or register) has a 16-bit address.

The messages exchanged with the Modbus protocol contain the address of the data to be processed.

## Registers and Addresses

The address of register number  $n$  is  $n-1$ . The tables detailed in the following parts of this document provide both register numbers (in decimal format) and corresponding addresses (in hexadecimal format). For example, the address of register number 12000 is 0x2EDF (11999).

## Frames

All the frames exchanged with the Modbus protocol have a maximum size of 256 bytes and are composed of 4 fields:

Field	Definition	Size	Description
1	Slave number	1 byte	Destination of the request <ul style="list-style-type: none"><li>• 0: broadcasting (all slaves concerned)</li><li>• 1–247: unique destination</li></ul>
2	Function codes	1 byte or 2 bytes	Refer to function codes description, page 47
3	Data	$n$ registers	Request or reply data <p><b>NOTE:</b> Number of registers <math>n</math> is limited to 52 with MasterPact MicroLogic E trip unit.</p>
4	Check	2 bytes	CRC16 (to check transmission errors)



# Modbus Programming Recommendations

## Read Register Recommendations

The registers of the IMU modules are available through Modbus communication in:

- dataset registers (standard and/or legacy datasets)
- device registers:
  - MicroLogic registers
  - IO module registers
  - IFM interface registers
  - IFE interface registers

To read the registers:

- First read the registers that are available in datasets.
  - Standard dataset is recommended because it contains more data in a data format that allows a better accuracy.
  - Legacy dataset is used only for legacy equipments.
- Then read the data that is not available in datasets in the device registers.

The benefit of datasets is that the most useful information of each IMU module is collected in one table that can be read with two or three read requests. Each module updates the values in the dataset registers on a regular basis.

The response time of requests to dataset registers is shorter than the response time of requests to device registers. Therefore, it is recommended to read the dataset registers instead of device registers, to improve the overall performance of the communication system.

## Register Update

The values in the registers are updated in two different ways:

- The measurement values are updated periodically, with a fixed refreshment rate.
- The other values are updated when the value is changed.

Type of Registers	Register Update
Identification	Triggered by device replacement
Settings	Triggered by setting change
Measurement	Periodically, with fixed refreshment rate
• Real-time measurements	Every 1 s
• Demand values of real-time measurements	Every 1 s
• Harmonic values	Every 3 s
• Energy measurements	Every 5 s
• Peak values of demand values of real-time measurements	Every 5 s
• Minimum and maximum values of real-time measurements	Every 5 s
Maintenance and diagnostic	Triggered by data change
Events	Triggered by event detection
IO status	Triggered by status change

The refreshment rate of values is the same for the dataset registers and the device registers.

Use the refreshment rate to optimize the performance of the communication between the remote controller and the IMU modules.

# Modbus Functions

## General Description

The Modbus protocol offers a number of functions that are used to read or write data over the Modbus network. The Modbus protocol also offers diagnostic and network-management functions.

Only the Modbus functions handled by the circuit breaker are described here.

## Read Functions

The following read functions are available:

Function Code	Subfunction Code	Name	Description
3 (0x03)	–	Read holding registers	Read n output or internal registers
4 (0x04)	–	Read input registers	Read n input registers
43 (0x2B)	14 (0x0E)	Read device identification	Read the identification data of the slave
43 (0x2B)	15 (0x0F)	Get date and time	Read the date and time of the slave

**NOTE:** Number of registers n is limited to 52 with MasterPact MicroLogic E trip unit.

## Read Register Example

The following table shows how to read the rms current on phase A ( $I_A$ ) in register 1016. The address of register 1016 is  $1016 - 1 = 1015 = 0x03F7$ . The Modbus address of the Modbus slave is  $47 = 0x2F$ .

Master Request		Slave Reply	
Field Name	Example	Field Name	Example
Modbus slave address	0x2F	Modbus slave address	0x2F
Function code	0x03	Function code	0x03
Address of the register to read (MSB)	0x03	Data length in bytes	0x02
Address of the register to read (LSB)	0xF7	Register value (MSB)	0x02
Number of registers (MSB)	0x00	Register value (LSB)	0x2B
Number of registers (LSB)	0x01	CRC (MSB)	0xFF
CRC (MSB)	0xFF	CRC (LSB)	0xFF
CRC (LSB)	0xFF	–	

The content of register 1016 (address 0x03F7) is  $0x022B = 555$ . Therefore, the rms current on phase A ( $I_A$ ) is 555 A.

## Get Date and Time Example

The following table shows how to get the date and time of a Modbus slave. The Modbus address of the Modbus slave is  $47 = 0x2F$ .

Master Request		Slave Reply	
Field Name	Example	Field Name	Example
Modbus slave address	0x2F	Modbus slave address	0x2F
Function code	0x2B	Function code	0x2B

Master Request		Slave Reply	
Field Name	Example	Field Name	Example
Subfunction code	0x0F	Subfunction code	0x0F
Reserved	0x00	Reserved	0x00
–	–	Date and time	Refer to the DATETIME data type

## Set Date and Time Example

The following table shows how to set date and time of a Modbus slave. The Modbus address of the Modbus slave is 47 = 0x2F, the new date is October 2, 2014, and the new time is 2:32:03:500 p.m.

**NOTE:** Use the broadcast mode (with Modbus slave address = 0) to set the date and time of all Modbus slaves.

Master Request		Slave Reply	
Field Name	Example	Field Name	Example
Modbus slave address	0x2F	Modbus slave address	0x2F
Function code	0x2B	Function code	0x2B
Subfunction code	0x10	Subfunction code	0x10
Reserved1	0x00	Reserved1	0x00
Not used	0x00	Not used	0x00
Year = 2014	0x0E	Year = 2014	0x0E
Month = October	0x0A	Month = October	0x0A
Day Of Month = 2	0x02	Day Of Month = 2	0x02
Hour = 14	0x0E	Hour = 14	0x0E
Minutes = 32	0x20	Minutes = 32	0x20
3 sec. 500 ms	0x0DAC	3 sec. 502 ms	0x0DAE

The normal response is an echo of the request, returned after the date-time has been updated in the remote device. If the date-time structure content is not consistent with a true date-time (that is, an invalid date-time), the value returned in the Date-Time field is set to 0 by the device.

In case of 24 Vdc power loss, the date and time of the Modbus slaves without battery is not refreshed anymore. It is therefore mandatory to set date and time for all Modbus slaves after recovering the 24 Vdc power supply.

Furthermore, due to the clock drift of each Modbus slave, it is mandatory to set date and time for all Modbus slaves periodically. Recommended period is at least every 15 minutes.

## Scattered Holding Register Read Function

The scattered holding register read function is available:

Function Code	Subfunction Code	Name	Description
100 (0x64)	4 (0x04)	Read scattered holding register	Read n non-contiguous registers

The maximum value for n is 100 but when using a MasterPact MicroLogic A or E trip unit, it is recommended to have n lower or equal to 21.

The scattered holding register read function enables the user to:

- avoid reading a large block of contiguous registers when only few registers are needed

- avoid multiple use of functions 3 and 4 in order to read non-contiguous registers

## Read Scattered Holding Register Example

The following table shows how to read the addresses of the register 664 (address 0x0297) and register 666 (address 0x0299) of a Modbus slave. The Modbus address of the Modbus slave is 47 = 0x2F.

Master Request		Slave Reply	
Field Name	Example	Field Name	Example
Modbus slave address	0x2F	Modbus slave address	0x2F
Function code	0x64	Function code	0x64
Data length in bytes	0x06	Data length in bytes	0x06
Subfunction code	0x04	Subfunction code	0x04
Transmission number <sup>(1)</sup>	0xXX	Transmission number <sup>(1)</sup>	0xXX
Address of first register to read (MSB)	0x02	Value of the first register read (MSB)	0x12
Address of first register to read (LSB)	0x97	Value of the first register read (LSB)	0x0A
Address of second register to read (MSB)	0x02	Value of the second register read (MSB)	0x74
Address of second register to read (LSB)	0x99	Value of the second register read (LSB)	0x0C
CRC (MSB)	0xXX	CRC (MSB)	0xXX
CRC (LSB)	0xXX	CRC (LSB)	0xXX
(1) The master gives the transmission number in the request. The slave returns the same number in the reply.			

## Write Functions

The following write functions are available:

Function Code	Subfunction Code	Name	Description
6 (0x06)	–	Preset single register	Write 1 register
16 (0x10)	–	Preset multiple registers	Write n registers
43 (0x2B)	16 (0x10)	Set date and time	Write the date and time of the slave

**NOTE:** Number of registers n is limited to 52 with MasterPact MicroLogic E trip units.

## Diagnostic Functions

The following diagnostic functions are available:

Function Code	Subfunction Code	Name	Description
8 (0x08)	–	Diagnostic	Manage diagnostic counters
8 (0x08)	10 (0x0A)	Clear counters and diagnostic register	Reset all diagnostic counters
8 (0x08)	11 (0x0B)	Return bus message counter	Read the counter of correct bus messages managed by the slave
8 (0x08)	12 (0x0C)	Return bus communication error counter	Read the counter of incorrect bus messages managed by the slave
8 (0x08)	13 (0x0D)	Return bus exception error counter	Read the counter of exception responses managed by the slave
8 (0x08)	14 (0x0E)	Return slave message counter	Read the counter of messages sent to the slave

Function Code	Subfunction Code	Name	Description
8 (0x08)	15 (0x0F)	Return slave no response counter	Read the counter of broadcast messages
8 (0x08)	16 (0x10)	Return slave negative acknowledge counter	Read the counter of messages sent to the slave but not answered because of the Negative Acknowledge exception code 07
8 (0x08)	17 (0x11)	Return slave busy counter	Read the counter of messages sent to the slave but not answered because of the Slave Device Busy exception code 06
8 (0x08)	18 (0x12)	Return bus overrun counter	Read the counter of incorrect bus messages due to overrun errors
11 (0x0B)	–	Get communication event counter	Read Modbus event counter

## Diagnostic Counters

Modbus uses diagnostic counters to enable performance and error management. The counters are accessible using the Modbus diagnostic functions (function codes 8 and 11). The Modbus diagnostic counters and the Modbus event counter are described in the following table:

Counter Number	Counter Name	Description
1	Bus message counter	Counter of correct bus messages managed by the slave
2	Bus communication error counter	Counter of incorrect bus messages managed by the slave
3	Slave exception error counter	Counter of exception responses managed by the slave and incorrect broadcast messages
4	Slave message counter	Counter of messages sent to the slave
5	Slave no response counter	Counter of broadcast messages
6	Slave negative acknowledge counter	Counter of messages sent to the slave but not answered because of the Negative Acknowledge exception code 07
7	Slave busy count	Counter of messages sent to the slave but not answered because of the Slave Device Busy exception code 06
8	Bus character overrun counter	Counter of incorrect bus messages due to overrun errors
9	Comm. event counter	Modbus event counter (this counter is read with function code 11)

## Counters Reset

The diagnostic counters are reset to 0 when:

- the maximum value 65535 is reached,
- they are reset by a Modbus command (function code 8, sub-function code 10),
- the power supply is lost,
- the communication parameters are modified.

# Modbus Exception Codes

## Exception Responses

Exception responses from either the master (client) or a slave (server) can result from data processing errors. One of the following events can occur after a request from the master (client):

- If the slave (server) receives the request from the master (client) without a communication error and can handle the request correctly, it returns a normal response.
- If the slave (server) does not receive the request from the master (client) due to a communication error, it does not return a response. The master program eventually processes a timeout condition for the request.
- If the slave (server) receives the request from the master (client) but detects a communication error, it does not return a response. The master program eventually processes a timeout condition for the request.
- If the slave (server) receives the request from the master (client) without a communication error, but cannot handle it (for example, the request is to read a register that does not exist), the slave returns an exception response to inform the master of the nature of the error.

## Exception Frame

The slave sends an exception frame to the master to report an exception response. An exception frame is composed of 4 fields:

Field	Definition	Size	Description
1	Slave number	1 byte	Destination of the request <ul style="list-style-type: none"> <li>• 1–247: unique destination</li> </ul>
2	Exception function code	1 byte	Request function code + 128 (0x80)
3	Exception code	n bytes	See next paragraph
4	Check	2 bytes	CRC16 (to check transmission errors)

## Exception Codes

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

- The exception function code of the exception response is equal to the function code of the original request plus 128 (0x80).
- The exception code depends on the communication error that the slave encounters.

The following table describes the exception codes handled by the circuit breaker:

Exception Code	Name	Description
01 (0x01)	Illegal function	The function code received in the request is not an authorized action for the slave. The slave may be in the wrong state to process a specific request.
02 (0x02)	Illegal data address	The data address received by the slave is not an authorized address for the slave.
03 (0x03)	Illegal data value	The value in the request data field is not an authorized value for the slave.
04 (0x04)	Slave device failure	The slave fails to perform a requested action because of an unrecoverable error.
05 (0x05)	Acknowledge	The slave accepts the request but needs a long time to process it.
06 (0x06)	Slave device busy	The slave is busy processing another command. The master must send the request once the slave is available.

Exception Code	Name	Description
07 (0x07)	Negative acknowledgment	The slave cannot perform the programming request sent by the master.
08 (0x08)	Memory parity error	The slave detects a parity error in the memory when attempting to read extended memory.
10 (0x0A)	Gateway path unavailable	The gateway is overloaded or not correctly configured.
11 (0x0B)	Gateway target device failed to respond	The slave is not present on the network.

## Illegal Data Address

This guide describes the registers available for each IMU module with the latest firmware revision. When a register described in the guide is not implemented in an IMU module that has an old firmware revision, an exception response is returned with the exception code 02 (0x02), illegal data address.

You can upgrade the firmware of the IMU modules by using the EcoStruxure Power Commission software.



# Write Protection

## General Description

### **⚠ WARNING**

#### **HAZARD OF NUISANCE TRIPPING OR FAILURE TO TRIP**

Protection setting adjustments must be done by qualified electrical personnel.

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

Remote modifications of Modbus registers can either be dangerous to personnel near the circuit breaker or can cause equipment damage if the protection settings are altered. Therefore, remote control commands are hardware protected , page 24 and software protected.

## Software Protection

To prevent an inadvertent change to the MicroLogic configuration, remote modifications of the Modbus registers are protected by both of the following:

- a robust data structure and a set of dedicated Modbus registers
- a user profile password scheme

This combination is called the command interface. Failure to conform to these results in an error code and the operation is not performed. The hardware protection has always precedence over the software protection.

# Password Management

## General Description

Remote access to data on MicroLogic trip units and the ULP modules of the IMU is protected by password. Remote access includes:

- The communication network
- EcoStruxure Power Commission software
- FDM128 display
- IFE webpages

The following four profiles are defined for remote access. Each IMU has a different password for each user profile.


- Administrator
- Services
- Engineer
- Operator

The Administrator password is required to write the settings to the MicroLogic trip unit and the ULP modules of the IMU using the EcoStruxure Power Commission software , page 18.

Each intrusive command via the command interface is assigned to one or several user profiles, and protected by the corresponding user profile password. The password for each intrusive command is indicated in the description of the command.

No password is required for non-intrusive commands through the command interface.

## Default Passwords

 **WARNING**

**POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY**  
  
Change default passwords at first use to help prevent unauthorized access to device settings, controls, and information.  
  
**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

The default password for each user profile is as follows:

User profile	Default password
Administrator	'0000' = 0x30303030
Services	'1111' = 0x31313131
Engineer	'2222' = 0x32323232
Operator	'3333' = 0x33333333

## Changing a Password

A password can be changed with the EcoStruxure Power Commission software, page 18.

Entering the current password for a given user profile is required to change the password of this user profile. Entering the Administrator password enables you to change the password of any user profile.

A password is composed of exactly 4 ASCII characters. It is case-sensitive and the allowed characters are:

- Digits from 0 to 9
- Letters from a to z
- Letters from A to Z

## Passwords of the IMU

The MicroLogic trip unit and the ULP modules of the IMU must be protected by the same passwords for each user profile.

When using EcoStruxure Power Commission software to modify a password, the password gets modified in the MicroLogic trip unit and the ULP modules of the IMU.

It is compulsory to assign the current IMU passwords to the new module in the IMU, in case of:

- addition of a new ULP module in the IMU.
- replacement of the MicroLogic trip unit or one of the ULP module of the IMU.

Use EcoStruxure Power Commission software to modify the passwords of the new module to the current IMU passwords.

**Example:** Addition of an IO module in an IMU with a MicroLogic trip unit and an IFE interface.

- The IMU has user-defined passwords for each user profile.
- The IO module has the default passwords for each user profile.

Use EcoStruxure Power Commission software to replace the default passwords of the IO module by the user-defined passwords of the IMU for each user profile.

## Password Reset

In case that the Administrator password of the (IMU) is lost or forgotten, the password can be reset to the default password with EcoStruxure Power Commission software, page 18 and the support of the Schneider Electric Customer Care Center.

# Command Interface

## General Description

The command interface is used to:

- send remote commands
- send remote control commands

Remote commands are non-intrusive commands. They are not password-protected and always enabled.

Remote control commands are intrusive commands and can either be dangerous to personnel near the circuit breaker or can cause equipment damage if the protection settings are altered. Therefore, remote control commands are:

- protected by password where a password is required in the command
- protected by configuration:
  - with the IFM interface, the remote control commands are enabled when the locking pad on the IFM interface is in the open position.
  - with the IFE interface, the remote control commands are enabled when the locking pad on the IFE interface is in the open position.
  - with the EIFE interface, the remote control commands are enabled when the intrusive command mode is unlocked by EIFE configuration using the EcoStruxure Power Commission software, page 18.

Each command has a specific code. For example, command code 904 defines the command to open the circuit breaker.

## Executing a Command

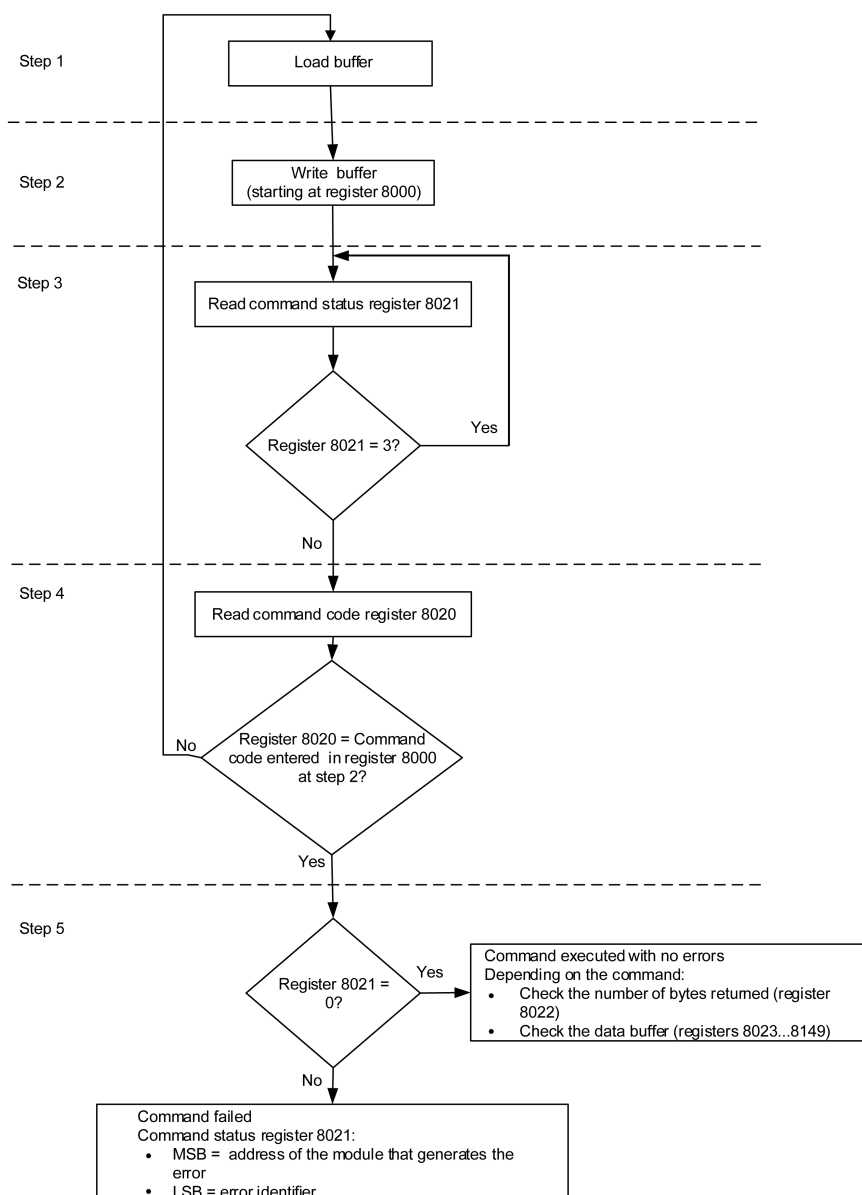
Follow these steps to execute a command:

Step	Action
1	Load a buffer.
2	Write this buffer with a write request (Modbus function 16) starting at register 8000.
3	Read the command status register 8021, and wait while its content shows that the command is still in progress (0x0003).
4	Read the command code register 8020: <ul style="list-style-type: none"><li>• If content of register 8020 is the command code entered in register 8000 at step 2, go to next step.</li><li>• If content of register 8020 is different from the command code entered in register 8000 at step 2, restart at step 1.</li></ul>
5	Read the error code in the LSB of register 8021: <ul style="list-style-type: none"><li>• If LSB ≠ 0, then the command failed. Check the error code to understand the cause (see next paragraph). For example, if register 8021 returns 4609 (0x1201), then the error code is 1, which means that the password is not correct (insufficient user rights).</li><li>• If LSB = 0, then the command is executed with no errors.</li></ul>

**NOTE:** The Modbus application will wait for the complete execution of one command before sending its next command. In case of no response, the Modbus application can resend the command. In this case, the first command will be aborted automatically.

## Command Diagram

The following diagram shows the steps to follow in order to execute a command:



## Command Data Structure

The command interface uses registers 8000 to 8149:

- The input parameters of a command are written in registers 8000 to 8015. The registers 8016 to 8019 are reserved.
- The data returned after command execution are written in registers 8020 to 8149.

The input parameters of a command are detailed in the following table:

Address	Register	Description	Comments
0x1F3F	8000	Command code	Writing at this register triggers the command using the parameters in the following registers.
0x1F40	8001	Parameter length	Number of bytes used for the parameters including this one (from 10 to 30). This value is provided for each command.
0x1F41	8002	Destination	A constant value provided for each command. Factory setting: 0x0000

Address	Register	Description	Comments
0x1F42	8003	Security type	A constant value provided for each command: <ul style="list-style-type: none"> <li>0 for non-intrusive commands not protected by password</li> <li>1 for intrusive commands protected by a password</li> </ul>
0x1F43	8004	Password	The password is composed of 4 ASCII bytes.
0x1F44	8005		The password to use depends on the command. This information is provided for each command.
0x1F45–0x1F4E	8006–8015	Additional parameters	Additional parameters define how the command is performed. Some commands have no additional parameters.
0x1F4F	8016	Reserved	Must be set to 0 (factory setting).
0x1F50	8017	Reserved	Must be set to 8019 (factory setting).
0x1F51	8018	Reserved	Must be set to 8020 (factory setting).
0x1F52	8019	Reserved	Must be set to 8021 (factory setting).

The data returned after command execution are detailed in the following table:

Address	Register	Description	Comments
0x1F53	8020	Last command code	When the command has been executed, it holds the last command code.
0x1F54	8021	Command status	When the command exits the busy state, it holds the completion code.
0x1F55	8022	Data buffer size	Number of bytes returned.
0x1F56–0x1FD4	8023–8149	Data buffer	Returned values. It is empty if the previous register is 0.

## Command Status

When the command is successful, the command status is 0.

When the command is in progress, the command status is 3.

When the command generates an error, the command status register contains:

- LSB: the error code
- MSB: the address of the module that generates the error

## Module Returning the Command Result

The following table lists the addresses of the modules:

Module Address	Module
1 (0x01)	UTA maintenance module
2 (0x02)	FDM121 ULP display for one circuit breaker
3 (0x03)	IFM Modbus-SL interface for one circuit breaker
17 (0x11)	BSCM circuit breaker status control module for PowerPact H-, J-, and L-frame
18 (0x12)	BCM ULP circuit breaker communication module for MasterPact NT/NW and PowerPact P- and R-frame
20 (0x14)	MicroLogic trip unit of PowerPact H-, J-, and L-frame
21 (0x15)	MicroLogic control unit of MasterPact MTZ
32 (0x20)	IO input/output application module 1 for one circuit breaker
33 (0x21)	IO input/output application module 2 for one circuit breaker
34 (0x22)	<ul style="list-style-type: none"> <li>• IFE Ethernet interface for one circuit breaker</li> <li>• IFE Ethernet switchboard server</li> </ul>

**NOTE:** The MicroLogic trip units of MasterPact NT/NW and PowerPact P- and R-frame circuit breakers do not have an IMU module address.

## Result of the Command

The following table lists the codes corresponding to the result of the command.

Code	Description
0 (0x00)	Successful command
1 (0x01)	Insufficient user rights (incorrect password)
2 (0x02)	Access violation (IFM locking pad is locked, page 24 or, IFE locking pad is locked, page 38 or intrusive command mode is locked).
3 (0x03)	Unable to perform a read access
4 (0x04)	Unable to perform a write access
5 (0x05)	Unable to execute service (IFM locking pad locked)
6 (0x06)	Not enough memory
7 (0x07)	Allocated memory is too small
8 (0x08)	Resource is not available
9 (0x09)	Resource does not exist
10 (0x0A)	Resource already exists
11 (0x0B)	Resource is out of order
12 (0x0C)	Access out of available memory
13 (0x0D)	String is too long
14 (0x0E)	Buffer is too small
15 (0x0F)	Buffer is too big
16 (0x10)	Input argument is out of range
17 (0x11)	Requested security level is not supported
18 (0x12)	Requested component is not supported
19 (0x13)	Command is not supported
20 (0x14)	Input argument has an unsupported value
21 (0x15)	Internal error during command
22 (0x16)	Timeout during command
23 (0x17)	Checksum error during command
24 (0x18)	Unsupported destination
151 (0x97)	Circuit breaker tripped, reset before commands
152 (0x98)	Circuit breaker already closed
153 (0x99)	Circuit breaker already open
154 (0x9A)	Circuit breaker already reset
155 (0x9B)	Actuator in manual mode
156 (0x9C)	Actuator not present
157 (0x9D)	Bad ASIC configuration
158 (0x9E)	Previous command in progress
159 (0x9F)	Reset command forbidden
160 (0xA0)	Inhibit mode on
169 (0xA9)	Already in asked state

Code	Description
170 (0xAA)	Unable to preset counters
171 (0xAB)	Output command rejected, already assigned
172 (0xAC)	Emitter not allowed to perform the command
173 (0xAD)	Mode not relevant with requested command
174 (0xAE)	Session key is invalid
175 (0xAF)	Out of session scope
176 (0xB0)	Session is already opened
177 (0xB1)	No session is open
178 (0xB2)	No valid setting was submitted
180 (0xB4)	Wireless component not started
190 (0xBE)	Read and get an invalid value
191 (0xBF)	License is not installed

## Command Not Supported

The guide describes the commands available for each IMU module with the latest firmware version. When a command described in the guide is not implemented in an IMU module that has an old firmware version, the command status is returned with the error code 19 (0x13), command is not supported.

You can update the firmware of the IMU modules by using the EcoStruxure Power Commission software.



# Command Examples

## Open Circuit Breaker

The following table details the steps to perform in the master remote device to send a remote command to the BCM ULP circuit breaker communication module to open the circuit breaker. The command itself has no parameters.

Step	Action
1	Load a buffer of 20 registers, word0 to word19. <ul style="list-style-type: none"> <li>Load into word0 the value 904, the code corresponding to the open circuit breaker command.</li> <li>Load into word1 the value 10, the length of the input parameters. The command itself has no parameters, 10 is the length of the fixed part.</li> <li>Load into word2 the value 4609 (0x1201), the destination. This value is a constant for the command. It is provided in the command description.</li> <li>Load into word3 the value 1.</li> <li>Load into word4 and word5 the 4 ASCII bytes of the Administrator or Operator password. Assuming this password is 'ABcd', load 16706 (0x4142) into word #4 and 25444 (0x6364) into word #5.</li> <li>Load into word6 to word16 the value 0.</li> <li>Load into word17 the value 8019, a command setup constant.</li> <li>Load into word18 the value 8020, a command setup constant.</li> <li>Load into word19 the value 8021, a command setup constant.</li> </ul>
2	Write this buffer with a write request (Modbus function 16) of 20 registers, starting at register 8000.
3	Read the command status register 8021, and wait while its content shows that the command is still in progress (0x0003). If the command status does not change after a timeout (1 s), check the Modbus connection.
4	Read the command status register 8020: <ul style="list-style-type: none"> <li>If content of register 8020 is the command code entered in register 8000 at step 2, go to next step.</li> <li>If content of register 8020 is different from the command code entered in register 8000 at step 2, restart at step 1.</li> </ul>
5	Read the error code in the LSB of register 8021: <ul style="list-style-type: none"> <li>If LSB ≠ 0, then the command failed. Check the error code to understand the cause (see next paragraph). For example, if register 8021 returns 4609 (0x1201), then the error code is 1, which means that the password is not correct (insufficient user rights).</li> <li>If LSB = 0, then the command was executed with no errors.</li> </ul>

## Reset Energy Measurements

The following table details the steps to perform to send a command to the BCM ULP circuit breaker communication module to reset the minimum/maximum energy measurements. The command itself has one parameter.

Step	Action
1	Load a buffer of 20 registers, word0 to word19. <ul style="list-style-type: none"> <li>Load into word0 the value 46728, the code corresponding to the reset minimum/maximum command.</li> <li>Load into word1 the value 12, the length of the input parameters. The command itself has one parameter, add 2 bytes to 10 which is the length of the fixed part.</li> <li>Load into word2 the value 4609 (0x1201), the destination. This value is a constant for the command. It is provided in the command description.</li> <li>Load into word3 the value 1.</li> <li>Load into word4 and word5 the 4 ASCII bytes of the Administrator or Operator password. Assuming this password is 'Pw57', load 20599 (0x5077) into word #4 and 13623 (0x3537) into word #5.</li> <li>Load into word6 the value 512 (bit 9 set to one). This value requests that the energy measurement minimum/maximum be reset.</li> <li>Load into word7 to word16 the value 0.</li> <li>Load into word17 the value 8019, a command setup constant.</li> <li>Load into word18 the value 8020, a command setup constant.</li> <li>Load into word19 the value 8021, a command setup constant.</li> </ul>
2	Write this buffer with a write request (Modbus function 16) of 20 registers, starting at register 8000.

Step	Action
3	Read the command status register 8021, and wait while its content shows that the command is still in progress (0x0003). If the command status does not change after a timeout (1 s), check the Modbus connection.
4	Read the command status register 8020: <ul style="list-style-type: none"> <li>If content of register 8020 is the command code entered in register 8000 at step 2, go to next step.</li> <li>If content of register 8020 is different from the command code entered in register 8000 at step 2, restart at step 1.</li> </ul>
5	Read the error code in the LSB of register 8021: <ul style="list-style-type: none"> <li>If LSB ≠ 0, then the command failed. Check the error code to understand the cause (see next paragraph). For example, if register 8021 returns 4609 (0x1201), then the error code is 1, which means that the password is not correct (insufficient user rights).</li> <li>If LSB = 0, then the command was executed with no errors.</li> </ul>

## Read Date and Time

The following table details the steps to perform to send a command to the IFM interface to read the date and time. The command itself has no parameters. The date and time are returned in a buffer.

Step	Action
1	Load a buffer of 20 registers, word0 to word19. <ul style="list-style-type: none"> <li>Load into word0 the value 768, the code corresponding to the read date/time command.</li> <li>Load into word1 the value 10, the length of the input parameters. The command itself has no parameters, the length is the length of the fixed part which is 10.</li> <li>Load into word2 the value 768 (0x0300), the destination. This value is a constant for the command. It is provided in the command description.</li> <li>Load into word3 the value 0.</li> <li>Load into word4 and word5 the value 0x0000 (no password required).</li> <li>Load into word6 to word16 the value 0.</li> <li>Load into word17 the value 8019, a command setup constant.</li> <li>Load into word18 the value 8020, a command setup constant.</li> <li>Load into word19 the value 8021, a command setup constant.</li> </ul>
2	Write this buffer with a write request (Modbus function 16) of 20 registers, starting at register 8000.
3	Read the command status register 8021, and wait while its content shows that the command is still in progress (0x0003). If the command status does not change after a timeout (1 s), check the Modbus connection.
4	Read the command status register 8020: <ul style="list-style-type: none"> <li>If content of register 8020 is the command code entered in register 8000 at step 2, go to next step.</li> <li>If content of register 8020 is different from the command code entered in register 8000 at step 2, restart at step 1.</li> </ul>
5	Read the error code in the LSB of register 8021: <ul style="list-style-type: none"> <li>If LSB ≠ 0, then the command failed. Check the error code to understand the cause (see next paragraph). For example, if register 8021 returns 783 (0x030F), then the error code is 15 (0x0F), which means that the input argument is out of range (too many parameters).</li> <li>If LSB = 0, then the command was executed with no errors.</li> </ul>
6	If there were no errors, read the data buffer length in register 8022. Its value must be 8 for this command.
7	In the data buffer: <ul style="list-style-type: none"> <li>register 8023 holds the month in the MSB, the day in the LSB.</li> <li>register 8024 holds the year offset in the MSB (add 2000 to get the year) and the hour in the LSB.</li> <li>register 8025 holds the minutes in the MSB, the seconds in the LSB.</li> <li>register 8026 holds the milliseconds.</li> </ul>

# Date Management

## Introduction

Each module of the IMU uses its date to time-stamp events and history registers.

The date of the IMU modules is updated in two steps:

1. External synchronization: The Modbus master synchronizes the IFM or IFE interface.
2. Internal synchronization: The IFM or IFE interface synchronizes all ULP modules connected in the IMU.

## External Synchronization

There are three ways to externally synchronize the IFM or IFE interface:

- Manually with the EcoStruxure Power Commission software, page 18.
- By programming of the Modbus master using:
  - either the Modbus function set date and time: function code 43-16 , page 49.
  - or, the interface command set absolute time through the IFM, or IFE interface.
- Automatically:
  - With IFE interface configured as SNTP mode.

The communication interface is considered as externally synchronized if the last synchronization has occurred within the last 2 hours.

## Internal Synchronization

When the IFM or IFE interface receives the date and time, it broadcasts the date and time to all the ULP modules connected in the IMU.

# Modbus Registers Tables

## General Description

The following chapters describe the Modbus registers of the MicroLogic trip unit and the Modbus registers of the modules connected to it. These registers provide information that can be read, like electrical measures, protection configuration, and monitoring information. The command interface enables the user to modify these registers in a controlled way.

The presentation rules of the Modbus registers are as follows:

- For each module, the registers are grouped in tables of logically related information, according to the module they relate to:
  - MicroLogic trip unit, page 114
  - BCM ULP module, page 212
  - IO module, page 230
  - IFM interface, page 267
  - IFE interface, page 279
- For some modules, the files are described separately:
  - MicroLogic trip unit, page 185
  - BCM ULP module, page 223
- For each module, the commands are described separately:
  - MicroLogic trip unit, page 204
  - BCM ULP module, page 226
  - IO module, page 258
  - IFM interface, page 273
  - IFE interface, page 286

To find a register, use the ordered list of the registers with a cross reference to the page where these registers are described, page 292.

## Table Format

Register tables have the following columns:

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

- **Address:** a 16-bit register address in hexadecimal. The address is the data used in the Modbus frame.
- **Register:** a 16-bit register number in decimal (register = address + 1).
- **RW:** register read-write status
  - R: the register can be read by using Modbus functions
  - W: the register can be written by using Modbus functions
  - RW: the register can be read and written by using Modbus functions
  - RC: the register can be read by using the command interface
  - WC: the register can be written by using the command interface

- **X**: the scale factor. A scale of 10 means that the register contains the value multiplied by 10. So, the real value is the value in the register divided by 10.

**Example:**

Register 1054 contains the system frequency, page 118. The unit is Hz and the scale factor is 10.

If the register returns 503, this means that the system frequency is  
 $503/10 = 50.3$  Hz.

- **Unit**: the unit the information is expressed in.
- **Type**: the encoding data type (see data type description below).
- **Range**: the permitted values for this variable, usually a subset of what the format allows.
- **A/E/P/H**: the metering type of the MicroLogic trip unit.
  - type A (Ammeter): current measurements
  - type E (Energy): current, voltage, power, and energy measurements
  - type P (Power): current, voltage, power, energy measurements, and advanced protection
  - type H (Harmonics): current, voltage, power, energy, energy quality measurements, and advanced protection
- **Description**: provides information about the register and restrictions that apply.

## Data Types

Data Types	Description	Range
INT16U	16-bit unsigned integer	0 to 65535
INT16	16-bit signed integer	-32768 to +32767
INT32U	32-bit unsigned integer	0 to 4 294 967 295
INT32	32-bit signed integer	-2 147 483 648 to +2 147 483 647
INT64U	64-bit unsigned integer	0 to 18 446 744 073 709 600 000
INT64	64-bit signed integer	-9 223 372 036 854 775 808 to +9 223 372 036 854 775 807
SFIXPT	16-bit signed integer with a fixed point, page 66	-32768 to +32767
FLOAT32	32-bit signed integer with a floating point	$2^{-126}$ (1.0) to $2^{127}$ ( $2 - 2^{-23}$ )
OCTET STRING	Text string	1 byte per character
MOD10000	Modulo operation, page 67	–
DATE	Date and time, page 67	–
XDATE	Same as DATE with a fourth INT16U register for milliseconds information, page 67	–
DATETIME	Date and time in the IEC 60870-5 format. , page 68	–
ULP DATE	Date and time in ULP DATE format. , page 69	–

## Big-Endian Format

INT32, INT32U, INT64, and INT64U variables are stored in big-endian format: the most significant register is transmitted first, the least significant register is transmitted at last place.

INT32, INT32U, INT64, and INT64U variables are made of INT16U variables.

The formulas to calculate the decimal value of these variables are:

- INT32:  $(0\text{-bit}31) \times 2^{31} + \text{bit}30 \times 2^{30} + \text{bit}29 \times 2^{29} + \dots \text{bit}1 \times 2^1 + \text{bit}0 \times 2^0$
- INT32U:  $\text{bit}31 \times 2^{31} + \text{bit}30 \times 2^{30} + \text{bit}29 \times 2^{29} + \dots \text{bit}1 \times 2^1 + \text{bit}0 \times 2^0$
- INT64:  $(0\text{-bit}63) \times 2^{63} + \text{bit}62 \times 2^{62} + \text{bit}61 \times 2^{61} + \dots \text{bit}1 \times 2^1 + \text{bit}0 \times 2^0$
- INT64U:  $\text{bit}63 \times 2^{63} + \text{bit}62 \times 2^{62} + \text{bit}61 \times 2^{61} + \dots \text{bit}1 \times 2^1 + \text{bit}0 \times 2^0$

**Example 1:**

The total active energy in the standard dataset is an INT64 variable coded in registers 32096 to 32099.

If the values in the registers are:

- register 32096 = 0
- register 32097 = 0
- register 32098 = 0x0017 or 23
- register 32099 = 0x9692 or 38546 as INT16U variable and -26990 as INT16 variable (use the INT16U value to calculate the value of the total active energy).

Then the total active energy is equal to  $0 \times 2^{48} + 0 \times 2^{32} + 23 \times 2^{16} + 38546 \times 2^0 = 1545874$  Wh.

**Example 2:**

The reactive energy in the legacy dataset is an INT32 variable coded in registers 12052 to 12053.

If the values in the registers are:

- register 12052 = 0xFFFF2 = 0x8000 + 0x7FF2 or 32754
- register 12053 = 0xA96E or 43374 as INT16U variable and -10606 as INT16 variable (use the INT16U value to calculate the value of the reactive energy).

Then the reactive energy is equal to  $(0-1) \times 2^{31} + 32754 \times 2^{16} + 43374 \times 2^0 = -874130$  kVARh.

## Data Type: SFIXPT

The range value of this data type depends of the scale factor.

The following table presents examples of the range value evolution of the SFIXPT register according to the scale factor:

If the Scale Factor Is Equal to...	Then the Range Value Is Equal to...
1	-32768 to +32767
100	-327.68 to +327.67
1000	-32.768 to +32.767

## Data Type: FLOAT32

Data type FLOAT32 is represented in the single precision IEEE 754 (IEEE standard for floating-point arithmetic). A value N is calculated as indicated below:

$$N = (-1)^S \times 2^{E-127} \times (1+M)$$

Coefficient	Stands for	Description	Number of Bits
S	Sign	Defines the sign of the value: 0 = positive 1 = negative	1 bit
E	Exponent	Excess 127 binary integer added. When $0 < E < 255$ , the actual exponent is: $e = E - 127$ .	8 bits
M	Mantissa	Magnitude, normalized binary significant	23 bits

**Example:**

0 = 0 **00000000** 000000000000000000000000

-1.5 = 1 **01111111** 100000000000000000000000

with:

- S = 1
- E = **01111111** = 127
- M = 100000000000000000000000 =  $1 \times 2^{-1} + 0 \times 2^{-2} + \dots + 0 \times 2^{-23} = 0.5$
- N =  $(-1) \times 2^0 \times (1 + 0.5) = -1.5$

**Data Type: MOD10000**

MOD10000 corresponds to  $n + 1$  registers in the INT16 format. Each register contains an integer from -9999 to 9999. A value V representing  $n + 1$  registers in MOD10000 format is calculated as indicated below:

$V = \text{sum}(R[x] + R[x+1] \times 10000 + \dots + R[x+n] \times 10000^n)$ , where  $R[x]$  is the value of the register number x.

For example, to calculate the active energy  $E_p$  coded in 4 registers:

- register 2000 = 123 so  $R[x = 2000] = 123$
- register 2001 = 4567
- register 2002 = 89
- register 2003 = 0

So  $E_p = R[2000] + R[2001] \times 10000^1 + R[2002] \times 10000^2 + R[2003] \times 10000^3$   
 $= 123 + 4567 \times 10000 + 89 \times 10000^2 + 0$   
 $= 8\,945\,670\,123 \text{ kWh}$

**Data Types: DATE and XDATE**

This table presents DATE (registers 1 to 3) and XDATE (registers 1 to 4) data types:

Register	Type	Bit	Range	Description
1	INT16U	0–7	0x01–0x1F	Day
		8–14	0x01–0x0C	Month
		15	0–1	Quality of the date and time If the bit 15 is set, the date and time may be incorrect. There are 2 possibilities: <ul style="list-style-type: none"> <li>• no synchronization with the supervisor</li> <li>• loss of power</li> </ul>
2	INT16U	0–7	0x00–0x17	Hours
		8–15	0x50–0xC7	Year

Register	Type	Bit	Range	Description
				<ul style="list-style-type: none"> <li>0x50 (80) to 0x63 (99) correspond to years 1980 to 1999</li> <li>0x64 (100) to 0xC7 (199) correspond to years 2000 to 2099</li> </ul> For example, 0x70 (112) corresponds to year 2012.
3	INT16U	0–7	0x00–0x3B	Seconds
		8–15	0x00–0x3B	Minutes
4	INT16U	0–15	0x0000–0x03E7	Complement in milliseconds (available only for XDATE format)

For example, if the current date of BCM ULP coded in 4 registers is:

- register 679 = 0x0513
- register 680 = 0x700A
- register 681 = 0x222E
- register 682 = 0x0358

Then the current date and time of the BCM ULP is 19/05/2012 (May 19 2012) at 10 hours, 34 minutes, 46 seconds, and 856 milliseconds.

Because:

- 0x0513
  - 0x05 = 5 (months)
  - 0x13 = 19 (days)
- 0x700A
  - 0x70 = 112 (years)
  - 0x0A = 10 (hours)
- 0x222E
  - 0x22 = 34 (minutes)
  - 0x2E = 46 (seconds)
- 0x0358 = 856 (milliseconds)

## Data Type: DATETIME

DATETIME is a data type used to code date and time defined by the IEC 60870-5 standard.

Register	Type	Bit	Range	Description
1	INT16U	0–6	0x00–0x7F	Year: 0x00 (00) to 0x7F (127) correspond to years 2000 to 2127 For example, 0x0D (13) corresponds to year 2013.
		7–15	–	Reserved
2	INT16U	0–4	0x01–0x1F	Day
		5–7	–	Reserved
		8–11	0x00–0x0C	Month
		12–15	–	Reserved
3	INT16U	0–5	0x00–0x3B	Minutes
		6–7	–	Reserved
		8–12	0x00–0x17	Hours
		13–15	–	Reserved
4	INT16U	0–15	0x0000–0xEA5F	Milliseconds



## Quality of DATETIME Timestamps

The quality of timestamps coded with the DATETIME data type can be indicated in the register following the 4 registers of the timestamp. In this case, the timestamp quality is coded as follows:

Bit	Description
0–11	Reserved
12	Externally synchronized: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
13	Synchronized: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
14	Date and time is set: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
15	Reserved

## Quality of Bits in Registers

The quality of each bit of a register coded as INT16U data type as an enumeration of bits can be indicated in the register preceding the register.

### Example:

The quality of each bit of the register 32001, circuit breaker status, is given in the preceding register, 32000.

The quality of the data corresponding to the bit 0 of register 32001, OF status indication contact, is given in the bit 0 of register 32000:

- bit 0 of register 32000 = quality of OF status indication
- bit 0 of register 32001 = OF status indication contact

If	Then
If bit 0 of register 32000 = 1 AND bit 0 of register 32001 = 0	The OF contact indicates that the device is open
If bit 0 of register 32000 = 1 AND bit 0 of register 32001 = 1	The OF contact indicates that the device is closed
If bit 0 of register 32000 = 0	The OF contact indication is invalid

## Data Type: ULP DATE

ULP DATE is a data type used to code date and time. This table presents the ULP DATE data type.

Register	Type	Bit	Range	Description
1 2	INT32U	–	0x00000000– 0xFFFFFFFF	Number of seconds since January 1 2000
3	INT16U	–	–	Complement in milliseconds
		0–9	–	Encodes the milliseconds
		10–11	–	Not used
		12	0–1	IFM or IFE communication interface external synchronization status  0 = The communication interface has not been externally synchronized within the last 2 hours.  1 = The communication interface has been externally synchronized within the last 2 hours.

Register	Type	Bit	Range	Description
		13	0–1	ULP module internal synchronization status  0 = The ULP module has not been internally synchronized. 1 = The ULP module has been internally synchronized.
		14	0–1	Absolute date is set since last power on  0 = No 1 = Yes
		15	–	Reserved

## ULP Date Counter

The date in ULP DATE format is counted in number of seconds since January 1 2000.

In case of a power loss for an IMU module, the time counter is reset and will restart at January 1 2000.

If an external synchronization occurs after a power loss, the time counter is updated and converts the synchronization date to the corresponding number of seconds since January 1 2000.

## ULP Date Conversion Principle

To convert the date from number of seconds since January 1 2000 to current date, the following rules apply:

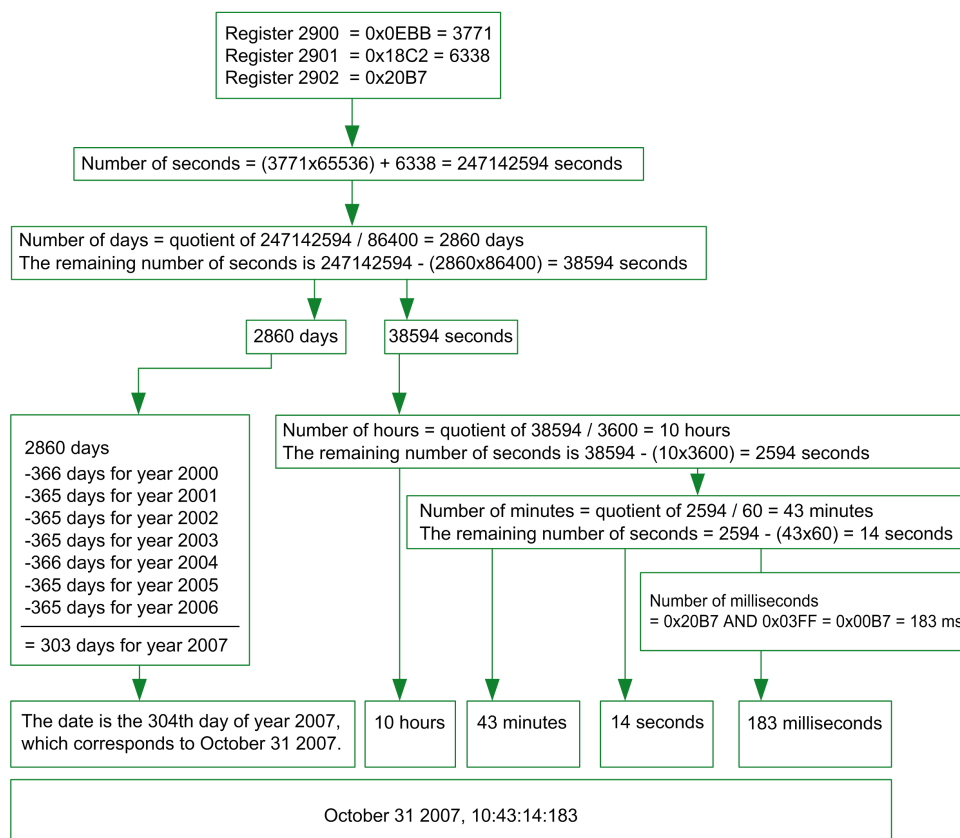
- 1 non-leap year = 365 days
- 1 leap year = 366 days  
Years 2000, 2004, 2008, 2012,...(multiple of 4) are leap years (except year 2100).
- 1 day = 86,400 seconds
- 1 hour = 3,600 seconds
- 1 minute = 60 seconds

The following table describes the steps to follow to convert the date from number of seconds since January 1 2000 to current date:

Step	Action
1	Calculate the number of seconds since January 1 2000: $S = (\text{content of register 1} \times 65536) + (\text{content of register 2})$
2	Calculate the number of days since January 1 2000: $D = \text{integer value of the quotient of } S / 86,400$ Calculate the remaining number of seconds: $s = S - (D \times 86,400)$
3	Calculate the number of days elapsed for the current year: $d = D - (NL \times 365) - (L \times 366)$ with $NL$ = number of non-leap years since year 2000 and $L$ = number of leap years since year 2000
4	Calculate the number of hours: $h = \text{integer value of the quotient of } s / 3600$ Calculate the remaining number of seconds: $s' = s - (h \times 3600)$
5	Calculate the number of minutes: $m = \text{integer value of the quotient of } s' / 60$ Calculate the remaining number of seconds: $s'' = s' - (m \times 60)$
6	Calculate the number of milliseconds: $ms = (\text{content of register 3}) \text{ AND } 0x03FF$
7	Result: <ul style="list-style-type: none"> <li>• The current date is <math>\text{date} = d + 1</math>. For example, if <math>d = 303</math>, the current date corresponds to the 304<sup>th</sup> day of the year, which corresponds to October 31 2007.</li> <li>• The current time is <math>h:m:s''</math>:ms</li> </ul>

## ULP Date Conversion Example

Registers 2900 and 2901 return the date in number of seconds since January 1 2000. Register 2902 returns the complement in ms with the quality of the date.



## Notes

- The type column tells how many registers to read to get the variable. For instance INT16U requires reading one register, whereas INT32 requires reading 2 registers.
- Some variables must be read as a block of multiple registers, like the energy measurements. Reading the block partially results in an error.
- Reading from an undocumented register results in a Modbus exception, page 51.
- Numerical values are given in decimal. When it is useful to have the corresponding value in hexadecimal, it is shown as a C language type constant: 0xdddd. For example, the decimal value 123 is represented in hexadecimal as: 0x007B.
- For measures that depend on the presence of neutral as identified by register 3314, page 175, reading the value returns 32768 (0x8000) if not applicable. For each table where it occurs, it is explained in a footnote.
- Out of order and not applicable values depend on the data type.

**NOTE:** As per legacy register implementation, some registers may display different out of order and not applicable values. For example, INT16U registers may return 32768 (0x8000) and INT32U may display 0x80000000.

Data Type	Out of Order and Not Applicable Values
INT16U	65535 (0xFFFF)
INT16	-32768 (0x8000)
INT32U	4294967295 (0xFFFFFFFF)
INT32	0x80000000

Data Type	Out of Order and Not Applicable Values
INT64U	0xFFFFFFFFFFFFFFFF
INT64	0x8000000000000000
FLOAT32	0xFFC00000

# Dataset

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# Standard Dataset

## What's in This Chapter

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# Standard Dataset

## Description

The standard dataset contains the most useful information of each IMU module in one convenient table. The standard dataset is available in the registers 32000 to 32341. It can be read with three read requests.

Each IMU module updates the values in the dataset registers on a regular basis.

The response time of requests to standard dataset registers is shorter than the response time of requests to device registers. Therefore, it is recommended to read the standard dataset registers instead of device registers, to improve the overall performance of the system , [page 45](#).

The standard dataset can be used with:

- the IFE Ethernet interface for one circuit breaker
- the IFE Ethernet switchboard server
- the IFM Modbus-SL interface for one circuit breaker

## Modbus Registers

### Table of Standard Dataset Common Registers

The main information needed for remote supervision of a PowerPact H-, J-, L-, P-, or R-frame, or MasterPact NT/NW circuit breaker is contained in the table of common registers starting at register 32000.

One Modbus read request is limited to 125 registers maximum. Three Modbus read requests are necessary to read the entire table.

It contains the following information:

- Circuit breaker status
- Tripping causes
- Real-time values of main measurements: current, voltage, power, and energy

The content of this table of registers is detailed in [Standard Dataset Common Registers](#), page 81.

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

### Table Format

Register tables have the following columns:

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

- **Address:** a 16-bit register address in hexadecimal. The address is the data used in the Modbus frame.
- **Register:** a 16-bit register number in decimal (register = address + 1).
- **RW:** register read-write status
  - R: the register can be read by using Modbus functions
  - W: the register can be written by using Modbus functions
  - RW: the register can be read and written by using Modbus functions
  - RC: the register can be read by using the command interface
  - WC: the register can be written by using the command interface
- **Unit:** the unit the information is expressed in.
- **Type:** the encoding data type (see data type description below).
- **Range:** the permitted values for this variable, usually a subset of what the format allows.
- **A/E:** types of PowerPact H-, J-, and L-frame MicroLogic trip unit for which the register is available.
  - Type A (Ammeter): current measurements
  - Type E (Energy): current, voltage, power, and energy measurements
- **A/E/P/H:** types of MasterPact NT/NW and PowerPact P- or R-frame MicroLogic trip unit for which the register is available.
  - Type A (Ammeter): current measurements
  - Type E (Energy): current, voltage, power, and energy measurements
  - Type P (Power): current, voltage, power, energy measurements, and advanced protection
  - Type H (Harmonics): current, voltage, power, energy, energy quality measurements, and advanced protection



- **X**: register available in the MicroLogic X control unit for MasterPact MTZ circuit breakers.
- **Description**: provides information about the register and restrictions that apply.

## Data Types

Data Types	Description	Range
INT16U	16-bit unsigned integer	0 to 65535
INT64	64-bit signed integer	- 9 223 372 036 854 775 808 to + 9 223 372 036 854 775 807
INT64U	64-bit unsigned integer	0 to 18 446 744 073 709 600 000
FLOAT32	32-bit signed integer with a floating point	$2^{-126}$ (1.0) to $2^{127}$ ( $2 - 2^{-23}$ )

## Big-Endian Format

INT64 and INT64U variables are stored in big-endian format: the most significant register is transmitted first and the least significant register is transmitted at last place.

INT64 and INT64U variables are made of INT16U variables.

The formulas to calculate the decimal value of these variables are:

- INT64:  $(0\text{-bit}63) \times 2^{63} + \text{bit}62 \times 2^{62} + \text{bit}61 \times 2^{61} + \dots \text{bit}1 \times 2^1 + \text{bit}0 \times 2^0$
- INT64U:  $\text{bit}63 \times 2^{63} + \text{bit}62 \times 2^{62} + \text{bit}61 \times 2^{61} + \dots \text{bit}1 \times 2^1 + \text{bit}0 \times 2^0$

### Example:

The total active energy in the standard dataset is an INT64 variable coded in registers 32096 to 32099.

If the values in the registers are:

- register 32096 = 0
- register 32097 = 0
- register 32098 = 70 (0x0046) 0x0017 or 23
- register 32099 = 2105 (0x0839) 0x9692 or 38546 as INT16U variable and -26990 as INT16 variable (use the INT16U value to calculate the value of the total active energy).

Then the total active energy is equal to  $0 \times 2^{48} + 0 \times 2^{32} + 23 \times 2^{16} + 38546 \times 2^0 = 1545874$  Wh.

## Data Type: FLOAT32

Data type FLOAT32 is represented in the single precision IEEE 754 (IEEE standard for floating-point arithmetic). A value N is calculated as indicated below:

$$N = (-1)^S \times 2^{E-127} \times (1+M)$$

Coefficient	Stands for	Description	Number of Bits
S	Sign	Defines the sign of the value: 0 = positive 1 = negative	1 bit
E	Exponent	Excess 127 binary integer added. When $0 < E < 255$ , the actual exponent is: $e = E - 127$ .	8 bits
M	Mantissa	Magnitude, normalized binary significant	23 bits

**Example:**

$0 = 0$  **00000000** 000000000000000000000000

$-1.5 = 1$  **01111111** 100000000000000000000000

with:

- $S = 1$
- $E = 01111111 = 127$
- $M = 100000000000000000000000 = 1 \times 2^{-1} + 0 \times 2^{-2} + \dots + 0 \times 2^{-23} = 0.5$
- $N = (-1) \times 2^0 \times (1+0.5) = -1.5$

## Quality of Bits in Registers

The quality of each bit of a register coded as INT16U data type as an enumeration of bits can be indicated in the register preceding the register.

**Example:**

The quality of each bit of the register 32001, circuit breaker status, is given in the preceding register, 32000.

The quality of the data corresponding to the bit 0 of register 32001, OF status indication contact, is given in the bit 0 of register 32000:

- bit 0 of register 32000 = quality of OF status indication
- bit 0 of register 32001 = OF status indication contact

If	Then
If bit 0 of register 32000 = 1 AND bit 0 of register 32001 = 0	The OF contact indicates that the device is open
If bit 0 of register 32000 = 1 AND bit 0 of register 32001 = 1	The OF contact indicates that the device is closed
If bit 0 of register 32000 = 0	The OF contact indication is invalid

## Readout Examples

### Readout Example of a Modbus Register

The table below shows how to read the RMS current on phase A ( $I_A$ ) in registers 32028 and 32029 (coded in FLOAT32).

- The address of register 32028 equals  $32028 - 1 = 32027 = 0x7D1B$ .
- The Modbus address of the Modbus slave is  $255 = 0xFF$ .

Request from the Master		Response from the Slave	
Field Name	Example	Field Name	Example
Modbus slave address	0xFF	Modbus slave address	0xFF
Function code	0x03	Function code	0x03
Address of first register to be read (MSB)	0x7D	Data length in bytes	0x04
Address of first register to be read (LSB)	0x1B	Value read at address 0x7D1B (register 32028) (MSB)	0x44
Number of registers (MSB)	0x00	Value read at address 0x7D1B (register 32028) (LSB)	0x0A
Number of registers (LSB)	0x02	Value read at address 0x7D1C (register 32029) (MSB)	0xC0
CRC (MSB)	0XX	Value read at address 0x7D1C (register 32029) (LSB)	0x00
CRC (LSB)	0XX	CRC (MSB)	0XX
-	-	CRC (LSB)	0XX

The converted value of the FLOAT32 registers 32028 and 32029 is 555.

The RMS current on phase A ( $I_A$ ) is thus 555 A.

### Readout Example of the Table of Standard Dataset Common Registers

Since there are more than 125 registers in the standard dataset, at least three Modbus read requests are needed to read the entire table.

Request to read registers 32000 to 32123:

- The address of register 32000 is  $0x7CFF$ .
- The length is 124 registers =  $0x7C$ .
- The number of bytes is  $124 \times 2 = 248$  bytes =  $0xF8$ .
- The Modbus address of the slave is  $255 = 0xFF$ .

Request to read registers 32124 to 32241:

- The address of register 32124 is  $0x7D7B$ .
- The length is 118 registers =  $0x76$ .
- The number of bytes is  $118 \times 2 = 236$  bytes =  $0xEC$ .
- The Modbus address of the slave is  $255 = 0xFF$ .

Request to read registers 32340 to 32435:

- The address of register 32340 is  $0x7E53$ .
- The length is 96 registers =  $0x60$ .
- The number of bytes is  $2 \times 96 = 192$  bytes =  $0xC0$ .
- The Modbus address of the slave is  $255 = 0xFF$ .

Request from the Master		Response from the Slave	
Field Name	Example	Field Name	Example
Modbus slave address	0xFF	Modbus slave address	0xFF
Function code	0x03	Function code	0x03
Address of the first register to be read (MSB)	0x7C	Data length in bytes	0x8F
Address of the first register to be read (LSB)	0xFF	Value of register 32000 (MSB)	0xFF
Number of registers (MSB)	0x00	Value of register 32000 (LSB)	0xFF
Number of registers (LSB)	0x7C	Value of register 32001 (MSB)	0xFF
CRC (MSB)	0xFF	Value of register 32001 (LSB)	0xFF
CRC (LSB)	0xFF	–	0xFF
–	–	–	0xFF
–	–	Value of register 32123 (MSB)	0xFF
–	–	Value of register 32123 (LSB)	0xFF
–	–	CRC (MSB)	0xFF
–	–	CRC (LSB)	0xFF

## Standard Dataset Common Registers

### Circuit Breaker Status Register

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
0x7CFF	32000	R	–	INT16U	–	A/E	A/E/P/H	X	–	Quality of each bit of register 32001, page 78: <ul style="list-style-type: none"> <li>• 0 = Invalid</li> <li>• 1 = Valid</li> </ul>
0x7D00	32001	R	–	INT16U	–	A/E	A/E/P/H	X	–	Circuit breaker status register
						A/E	A/E/P/H	X	0	OF status indication contact <ul style="list-style-type: none"> <li>• 0 = The circuit breaker is open.</li> <li>• 1 = The circuit breaker is closed.</li> </ul>
						A/E	A/E/P/H	X	1	SD trip indication contact <ul style="list-style-type: none"> <li>• 0 = Circuit breaker is not tripped.</li> <li>• 1 = Circuit breaker is tripped due to electrical fault, shunt trip, or push-to-trip.</li> </ul> Bit always equal to 0 for MasterPact and PowerPact P- and R-frame circuit breakers with motor operator.
						A/E	A/E/P/H	X	2	SDE fault trip indication contact <ul style="list-style-type: none"> <li>• 0 = Circuit breaker is not tripped on electrical fault.</li> <li>• 1 = Circuit breaker is tripped due to electrical fault (including ground-fault test and earth-leakage test).</li> </ul>
						–	A/E/P/H	X	3	CH spring charged contact (only with MasterPact) <ul style="list-style-type: none"> <li>• 0 = Spring discharged</li> <li>• 1 = Spring charged</li> </ul> Bit always equal to 0 for MasterPact and PowerPact P- and R-frame circuit breakers with motor operator.
						–	–	–	4	Reserved
						–	A/E/P/H	X	5	PF ready to close contact (only with MasterPact) <ul style="list-style-type: none"> <li>• 0 = Not ready to close</li> <li>• 1 = Ready to close</li> </ul> Bit always equal to 0 for MasterPact and PowerPact P- and R-frame circuit breakers with motor operator.
						–	–	–	6–14	Reserved
						A/E	A/E/P/H	–	15	Data availability <p>If this bit is set at 1, all other bits of the register are not significant.</p>

## IO Status Registers

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
0x7D01	32002	R	–	INT16U	–	A/E	A/E/P/H	X	–	Quality of each bit of register 32003: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x7D02	32003	R	–	INT16U	–	A/E	A/E/P/H	X	–	IO1 module and M2C status
						A/E	A/E/P/H	X	0	Digital input 1 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
						A/E	A/E/P/H	X	1	Digital input 2 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
						A/E	A/E/P/H	X	2	Digital input 3 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
						A/E	A/E/P/H	X	3	Digital input 4 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
						A/E	A/E/P/H	X	4	Digital input 5 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
						A/E	A/E/P/H	X	5	Digital input 6 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
						A/E	A/E/P/H	X	6	Digital output 1 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
						A/E	A/E/P/H	X	7	Digital output 2 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
						A/E	A/E/P/H	X	8	Digital output 3 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
						–	–	X	9	Digital M2C output 1 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
						–	–	X	10	Digital M2C output 2 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
						–	–	–	11–14	Reserved
						A/E	A/E/P/H	–	15	Data availability  If this bit is set at 1, all other bits of the register are not significant.
0x7D03	32004	R	–	INT16U	–	A/E	A/E/P/H	X	–	Quality of each bit of register 32005: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x7D04	32005	R	–	INT16U	–	A/E	A/E/P/H	X	–	IO2 module status
									0	Digital input 1 status:

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
										<ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									1	Digital input 2 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									2	Digital input 3 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									3	Digital input 4 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									4	Digital input 5 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									5	Digital input 6 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									6	Digital output 1 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									7	Digital output 2 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									8	Digital output 3 status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
								–	9–14	Reserved
								–	15	Data availability  If this bit is set at 1, all other bits of the register are not significant.

## Tripping Cause

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

- For MicroLogic A/E trip units for PowerPact H-, J-, and L-Frame circuit breakers, the tripping cause bit is reset by pressing the key OK (keypad of the MicroLogic A/E trip unit) twice (validation and confirmation).
- For MicroLogic A/E/P/H trip units for MasterPact NT/NW and PowerPact P- and R-Frame circuit breakers, the tripping cause bit is reset as soon as the circuit breaker is closed again.
- For MicroLogic X control units for MasterPact MTZ circuit breakers, the tripping cause bit is reset by pressing the test/reset button (located beside the trip cause LEDs on the MicroLogic X control unit). Press and hold the button for 3 to 15 seconds to reset all the trip causes.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
0x7D05	32006	R	–	INT16U	–	A/E	A/E/P/H	–	–	Quality of each bit of register 32007: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x7D06	32007	R	–	INT16U	–	A/E	A/E/P/H	X	–	Tripping cause for the standard protection functions
						A/E	A/E/P/H	X	0	Long-time protection Ir
						A/E	A/E/P/H	X	1	Short-time protection Isd
						A/E	A/E/P/H	X	2	Instantaneous protection Ii
						A/E	A/E/P/H	X	3	Ground-fault protection Ig
						E	A/P/H	X	4	Earth-leakage protection IΔn
						A/E	A/E/P/H	X	5	Integrated instantaneous protection (SELLIM and DIN/ DINF)
						A/E	–	X	6	Internal failure (STOP)
						–	A/E	–	6	Other protections
						–	P/H	–		Internal failure (temperature)
						–	A/E/P/H	–	7	Internal failure (overvoltage)
						–	P/H	X	8	Other protection (see register 32009)
						–	–	–	9	Reserved
						E	–	–	10	Unbalance motor protection
						E	–	–	11	Jam motor protection
						E	–	–	12	Underload motor protection
						E	–	–	13	Long-start motor protection
						A/E	–	–	14	Reflex tripping protection
						A/E	A/E/P/H	–	15	If this bit is at 1, bits 0 to 14 are not valid.
0x7D07	32008	R	–	INT16U	–	–	P/H	–	–	Quality of each bit of register 32009: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x7D08	32009	R	–	INT16U	–	–	P/H	–	–	Tripping causes for the advanced protection functions
						–	P/H	–	0	Current unbalance
						–	P/H	–	1	Overcurrent on phase A
						–	P/H	–	2	Overcurrent on phase B
						–	P/H	–	3	Overcurrent on phase C
						–	P/H	–	4	Overcurrent on Neutral
						–	P/H	X	5	Undervoltage
						–	P/H	X	6	Overvoltage
						–	P/H	–	7	Voltage unbalance
						–	P/H	–	8	Overpower
						–	P/H	X	9	Reverse power
						–	P/H	X	10	Underfrequency
						–	P/H	X	11	Overfrequency
						–	P/H	–	12	Phase rotation



Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
						–	P/H	–	13	Load shedding based on current
						–	P/H	–	14	Load shedding based on power
						–	P/H	–	15	If this bit is at 1, bits 0 to 14 are not valid.
0x7D09– 0x7D0C	32010– 32013	–	–	–	–	–	–	–	–	Reserved

## Overrun of the Protection Setpoints

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

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
0x7D0D	32014	R	–	INT16U	–	A/E	P/H	–	–	Quality of each bit of register 32015: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x7D0E	32015	R	–	INT16U	–	A/E	P/H	–	–	Overrun of the standard protection setpoints
						A/E	P/H	–	0	Long-time protection pick-up
						–	–	–	1–14	Reserved
						A/E	P/H	–	15	If this bit is at 1, bits 0 to 14 are not valid.
0x7D0F	32016	R	–	INT16U	–	A/E	P/H	–	–	Quality of each bit of register 32017: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x7D10	32017	R	–	INT16U	–	A/E	P/H	–	–	Overrun of the advanced protection setpoints
						–	P/H	–	0	Current unbalance
						–	P/H	–	1	Maximum current on phase A
						–	P/H	–	2	Maximum current on phase B
						–	P/H	–	3	Maximum current on phase C
						–	P/H	–	4	Maximum current on the neutral
						–	P/H	–	5	Minimum voltage
						–	P/H	–	6	Maximum voltage
						–	P/H	–	7	Voltage unbalance
						–	P/H	–	8	Maximum power
						–	P/H	–	9	Reverse power
						–	P/H	–	10	Minimum frequency
						–	P/H	–	11	Maximum frequency
						–	P/H	–	12	Phase rotation
						–	P/H	–	13	Load shedding based on the current

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
						–	P/H	–	14	Load shedding based on the power
						–	P/H	–	15	If this bit is at 1, bits 0 to 14 are not valid.
0x7D11	32018	R	–	INT16U	–	–	P/H	–	–	Quality of each bit of register 32019: <ul style="list-style-type: none"> <li>• 0 = Invalid</li> <li>• 1 = Valid</li> </ul>
0x7D12	32019	R	–	INT16U	–	–	P/H	–	–	Advanced protection settings extended
						–	P/H	–	0	Ground-fault alarm
						E	P/H	–	1	Earth-leakage alarm
						–	–	–	2–14	Reserved
						–	P/H	–	15	If this bit is at 1, bits 0 to 14 are not valid.

## Alarms

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

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
0x7D13	32020	R	–	INT16U	–	A/E	–	–	–	Quality of each bit of register 32021: <ul style="list-style-type: none"> <li>• 0 = Invalid</li> <li>• 1 = Valid</li> </ul>
0x7D14	32021	R	–	INT16U	–	A/E	–	–	–	Pre-alarm extended register
						A/E	–	X	0	Long-time protection time pre-alarm (PAL Ir)
						E	–	–	1	Earth-leakage protection pre-alarm (PAL IΔn)
						–	–	X	–	Earth-leakage alarm <sup>(1)</sup>
						A/E	–	–	2	Ground-fault protection pre-alarm (PAL Ig)
						–	–	X	–	Ground-fault alarm <sup>(2)</sup>
						–	–	–	3–14	Reserved
						A/E	–	–	15	If this bit is at 1, bits 0 to 14 are not valid.
0x7D15	32022	R	–	INT16U	–	A/E	–	–	–	Quality of each bit of register 32023: <ul style="list-style-type: none"> <li>• 0 = Invalid</li> <li>• 1 = Valid</li> </ul>
0x7D16	32023	R	–	INT16U	–	A/E	–	–	–	Register of user-defined alarms
						A/E	–	–	0	User-defined alarm 201
						A/E	–	–	1	User-defined alarm 202
						A/E	–	–	2	User-defined alarm 203
						A/E	–	–	3	User-defined alarm 204
						A/E	–	–	4	User-defined alarm 205
						A/E	–	–	5	User-defined alarm 206
						A/E	–	–	6	User-defined alarm 207
						A/E	–	–	7	User-defined alarm 208

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
						A/E	–	–	8	User-defined alarm 209
						A/E	–	–	9	User-defined alarm 210
						–	–	–	10–14	Reserved
						A/E	–	–	15	If this bit is at 1, bits 0 to 14 are not valid.
0x7D17– 0x7D1A	32024– 32027	–	–	–	–	–	–	–	–	Reserved

(1) Value available on MicroLogic 7.0 X control unit only when the Digital Module ANSI 51N/51G Ground-fault alarm is installed.

(2) Value available on MicroLogic 2.0 X, 3.0 X, 5.0 X, and 6.0 X control units only when the Digital Module ANSI 51N/51G Ground-fault alarm is installed.

## Current

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7D1B– 0x7D1C	32028– 32029	R	A	FLOAT32	–	A/E	A/E/P/H	X	RMS current on phase A
0x7D1D– 0x7D1E	32030– 32031	R	A	FLOAT32	–	A/E	A/E/P/H	X	RMS current on phase B
0x7D1F– 0x7D20	32032– 32033	R	A	FLOAT32	–	A/E	A/E/P/H	X	RMS current on phase C
0x7D21– 0x7D22	32034– 32035	R	A	FLOAT32	–	A/E	A/E/P/H	X	RMS current on the neutral <sup>(1)</sup>
0x7D23– 0x7D24	32036– 32037	R	A	FLOAT32	–	A/E	A/E/P/H	X	Maximum of RMS current of phases A, B, C and N (most loaded phase) <sup>(3)</sup>
0x7D25– 0x7D26	32038– 32039	R	–	FLOAT32	–	A/E	A/E/P/H	X	Current ratio on ground (I <sub>g</sub> setting ratio)
0x7D27– 0x7D28	32040– 32041	R	–	FLOAT32	–	E	A/P/H	X	Current ratio on earth-leakage (I <sub>Δn</sub> setting ratio) <sup>(2)</sup>

(1) Value available when system type register returns 30 or 41.

(2) Value available with MicroLogic 7.0 X.

(3) Value reset with the reset minimum/maximum command.

## Maximum Current Values

Maximum current values can be reset with the reset minimum/maximum command.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7D29– 0x7D2A	32042– 32043	R	A	FLOAT32	–	A/E	A/E/P/H	X	Maximum RMS current on phase A
0x7D2B– 0x7D2C	32044– 32045	R	A	FLOAT32	–	A/E	A/E/P/H	X	Maximum RMS current on phase B
0x7D2D– 0x7D2E	32046– 32047	R	A	FLOAT32	–	A/E	A/E/P/H	X	Maximum RMS current on phase C
0x7D2F– 0x7D30	32048– 32049	R	A	FLOAT32	–	A/E	A/E/P/H	X	Maximum RMS current on the neutral <sup>(1)</sup>
0x7D31– 0x7D32	32050– 32051	R	A	FLOAT32	–	A/E	A/E/P/H	X	This is the highest (i.e. maximum) maximum current value since this measurement was last reset. The measurement looks at all 3 currents, MaxI <sub>A</sub> , MaxI <sub>B</sub> , MaxI <sub>C</sub> and MaxI <sub>N</sub> and keeps track of the

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
									highest value of any of them over time.
0x7D33– 0x7D36	32052– 32055	–	–	–	–	–	–	–	Reserved

(1) Value available when system type register returns 30 or 41.

## Voltage

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7D37– 0x7D38	32056– 32057	R	V	FLOAT32	41.6– 2250	E	E/P/H	X	RMS phase-to-phase voltage $V_{AB}$
0x7D39– 0x7D3A	32058– 32059	R	V	FLOAT32	41.6– 2250	E	E/P/H	X	RMS phase-to-phase voltage $V_{BC}$
0x7D3B– 0x7D3C	32060– 32061	R	V	FLOAT32	41.6– 2250	E	E/P/H	X	RMS phase-to-phase voltage $V_{CA}$
0x7D3D– 0x7D3E	32062– 32063	R	V	FLOAT32	24-1500	E	E/P/H	X	RMS phase-to-neutral voltage $V_{AN}^{(1)}$
0x7D3F– 0x7D40	32064– 32065	R	V	FLOAT32	24-1500	E	E/P/H	X	RMS phase-to-neutral voltage $V_{BN}^{(1)}$
0x7D41– 0x7D42	32066– 32067	R	V	FLOAT32	24-1500	E	E/P/H	X	RMS phase-to-neutral voltage $V_{CN}^{(1)}$

(1) Value available when system type register returns 40 or 41.

## Frequency

When the MicroLogic trip unit cannot calculate the frequency, it returns Not applicable = 0xFFC00000.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7D43– 0x7D44	32068– 32069	R	Hz	FLOAT32	40.0–70.0	E	P/H	X	Frequency
0x7D45– 0x7D46	32070– 32071	R	Hz	FLOAT32	40.0–70.0	E	P/H	X	Maximum frequency <sup>(1)</sup>

(1) This value can be reset with the reset minimum/maximum command.

## Power

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7D47– 0x7D48	32072– 32073	R	W	FLOAT32	-16000000– 16000000	E	E/P/H	X	Active power on phase A <sup>(1)</sup>
0x7D49– 0x7D4A	32074– 32075	R	W	FLOAT32	-16000000– 16000000	E	E/P/H	X	Active power on phase B <sup>(1)</sup>
0x7D4B– 0x7D4C	32076– 32077	R	W	FLOAT32	-16000000– 16000000	E	E/P/H	X	Active power on phase C <sup>(1) (2)</sup>
0x7D4D– 0x7D4E	32078– 32079	R	W	FLOAT32	-16000000– 16000000	E	E/P/H	X	Total active power <sup>(2)</sup>
0x7D4F– 0x7D50	32080– 32081	R	VAr	FLOAT32	-16000000– 16000000	E	E/P/H	X	Reactive power on phase A <sup>(1) (2)</sup>
0x7D51– 0x7D52	32082– 32083	R	VAr	FLOAT32	-16000000– 16000000	E	E/P/H	X	Reactive power on phase B <sup>(1) (2)</sup>
0x7D53– 0x7D54	32084– 32085	R	VAr	FLOAT32	-16000000– 16000000	E	E/P/H	X	Reactive power on phase C <sup>(1) (2)</sup>

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7D55– 0x7D56	32086– 32087	R	VA <sub>r</sub>	FLOAT32	-16000000– 16000000	E	E/P/H	X	Total reactive power <sup>(2)</sup>
0x7D57– 0x7D58	32088– 32089	R	VA	FLOAT32	0–16000000	E	E/P/H	X	Apparent power on phase A <sup>(1)</sup>
0x7D59– 0x7D5A	32090– 32091	R	VA	FLOAT32	0–16000000	E	E/P/H	X	Apparent power on phase B <sup>(1)</sup>
0x7D5B– 0x7D5C	32092– 32093	R	VA	FLOAT32	0–16000000	E	E/P/H	X	Apparent power on phase C <sup>(1)</sup>
0x7D5D– 0x7D5E	32094– 32095	R	VA	FLOAT32	0–16000000	E	E/P/H	X	Total apparent power

(1) Value available when system type register returns 40 or 41.

(2) The sign for the active and reactive power depends on the configuration of:

- register 3316 for , PowerPact P- or R-frame and MasterPact NT/NW circuit breakers.
- register 8405 for MasterPact MTZ circuit breakers.

## Energy

Energy is stored in big-endian format: the most significant register is transmitted first.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7D5F– 0x7D62	32096– 32099	R	Wh	INT64	–	E	E/P/H	X	Total active energy <sup>(2)</sup>
0x7D63– 0x7D66	32100– 32103	R	VARh	INT64	–	E	E/P/H <sup>(1)</sup>	X	Total reactive energy <sup>(2)</sup>
0x7D67– 0x7D6A	32104– 32107	R	Wh	INT64U	–	E	P/H	X	Total active energy delivered (into the load, counted positively) <sup>(2)</sup>
0x7D6B– 0x7D6E	32108– 32111	R	Wh	INT64U	–	E	P/H	X	Total active energy received (out of the load, counted negatively) <sup>(2)</sup>
0x7D6F– 0x7D72	32112– 32115	R	VARh	INT64U	–	E	P/H	X	Total reactive energy delivered (into the load, counted positively) <sup>(2)</sup>
0x7D73– 0x7D76	32116– 32119	R	VARh	INT64U	–	E	P/H	X	Total reactive energy received (out of the load, counted negatively) <sup>(2)</sup>
0x7D77– 0x7D7A	32120– 32123	R	VAh	INT64U	–	E	–	X	Total apparent energy <sup>(2)</sup>
0x7D7B– 0x7D7E	32124– 32127	R	Wh	INT64U	–	E	–	X	Total cumulative active energy delivered (into the load, counted positively, not resettable)
0x7D7F– 0x7D82	32128– 32131	R	Wh	INT64U	–	E	–	X	Total cumulative active energy received (out of the load, counted negatively, not resettable)

(1) This value is always positive with MasterPact MicroLogic E trip unit.

(2) Value reset with the reset energies command.

## Average Values

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7D83– 0x7D84	32132– 32133	R	A	FLOAT32	–	–	–	X	Average of 3-phase RMS currents
0x7D85– 0x7D86	32134– 32135	R	V	FLOAT32	–	–	–	X	Average of 3 RMS phase-to-phase voltages: $(V_{AB}+V_{BC}+V_{CA})/3$
0x7D87– 0x7D88	32136– 32137	R	V	FLOAT32	–	–	–	X	Average of 3 RMS phase-to-neutral voltages: $(V_{AN}+V_{BN}+V_{CN})/3^{(1)}$

(1) Value available when system type register returns 40 or 41.

## Maximum Power Values

Maximum power values can be reset with the reset minimum/maximum command.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7D89– 0x7D8A	32138– 32139	R	W	FLOAT32	–	–	–	X	Maximum total active power
0x7D8B– 0x7D8C	32140– 32141	R	VAr	FLOAT32	–	–	–	X	Maximum total reactive power
0x7D8D– 0x7D8E	32142– 32143	R	VA	FLOAT32	–	–	–	X	Maximum total apparent power

## Maximum Average Values

Maximum average values can be reset with the reset minimum/maximum command.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7D8F– 0x7D90	32144– 32145	R	A	FLOAT32	–	–	–	X	Maximum of average of 3-phase RMS currents
0x7D91– 0x7D92	32146– 32147	R	V	FLOAT32	–	–	–	X	Maximum of average of 3 RMS phase-to-phase voltages
0x7D93– 0x7D94	32148– 32149	R	V	FLOAT32	–	–	–	X	Maximum of average of 3 RMS phase-to-neutral voltages

## Ground and Earth-Leakage Current

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7D95– 0x7D96	32150– 32151	R	A	FLOAT32	–	–	–	X	Ground-fault current
0x7D97– 0x7D98	32152– 32153	R	A	FLOAT32	–	–	–	X	Earth-leakage current <sup>(1)</sup>
0x7D99– 0x7D9A	32154– 32155	–	–	–	–	–	–	–	Reserved

(1) Value available with MicroLogic 7

## Current Demand Values

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7D9B– 0x7D9C	32156– 32157	R	A	FLOAT32	–	E	E/P/H	X	Current demand value on phase A: $I_A$ Dmd
0x7D9D– 0x7D9E	32158– 32159	R	A	FLOAT32	–	E	E/P/H	X	Current demand value on phase B: $I_B$ Dmd
0x7D9F– 0x7DA0	32160– 32161	R	A	FLOAT32	–	E	E/P/H	X	Current demand value on phase C: $I_C$ Dmd
0x7DA1– 0x7DA2	32162– 32163	R	A	FLOAT32	–	E	E/P/H	X	Current demand value on the neutral: $I_N$ Dmd <sup>(1)</sup>

(1) Value available when system type register returns 30 or 41.

## Power Demand Values

- For the block window, the demand value is updated at the end of the window.
- For the sliding window,
  - If window duration is configured for less or equal to 15 minutes, the demand value is updated every 15 seconds
  - If window duration is configured for more than 15 minutes, the demand value is updated every 1 minute.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7DA3– 0x7DA4	32164– 32165	R	W	FLOAT32	–	E	E/P/H	X	Total active power demand: P Dmd
0x7DA5– 0x7DA6	32166– 32167	R	VAR	FLOAT32	–	E	P/H	X	Total reactive power demand: Q Dmd
0x7DA7– 0x7DA8	32168– 32169	R	VA	FLOAT32	–	E	P/H	X	Total apparent power demand: S Dmd

## Current Peak Demand Values

Current peak demand values can be reset with the reset minimum/maximum command.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7DA9– 0x7DAA	32170– 32171	R	A	FLOAT32	–	–	–	X	Current peak demand value on phase A: $I_A$ dmd max
0x7DAB– 0x7DAC	32172– 32173	R	A	FLOAT32	–	–	–	X	Current peak demand value on phase B: $I_B$ dmd max
0x7DAD– 0x7DAE	32174– 32175	R	A	FLOAT32	–	–	–	X	Current peak demand value on phase C: $I_C$ dmd max
0x7DAF– 0x7DB0	32176– 32177	R	A	FLOAT32	–	–	–	X	Current peak demand value on the neutral: $I_N$ dmd max <sup>(1)</sup>

(1) Value available when system type register returns 30 or 41.

## Power Peak Demand Values

Power peak demand values are updated every 15 seconds. Power peak demand values can be reset with the reset minimum/maximum command.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7DB1– 0x7DB2	32178– 32179	R	W	FLOAT32	–	–	–	X	Total active power peak demand: P dmd max
0x7DB3– 0x7DB4	32180– 32181	R	VAR	FLOAT32	–	–	–	X	Total reactive power peak demand: Q dmd max
0x7DB5– 0x7DB6	32182– 32183	R	VA	FLOAT32	–	–	–	X	Total apparent power peak demand: S dmd max

## Maximum Ground and Earth-Leakage Current Values

Maximum ground and earth-leakage current values can be reset with the reset minimum/maximum command.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7DB7– 0x7DB8	32184– 32185	R	A	FLOAT32	–	–	–	X	Maximum ground-fault current
0x7DB9– 0x7DBA	32186– 32187	R	V	FLOAT32	–	E	–	X	Maximum earth-leakage current <sup>(1)</sup>
0x7DBB– 0x7DC0	32188– 32193	–	–	–	–	–	–	–	Reserved

(1) Value available with MicroLogic 7.

## Maximum Voltage Values

Maximum voltage values can be reset with the reset minimum/maximum command.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7DC1– 0x7DC2	32194– 32195	R	V	FLOAT32	41.6– 2250	E	E/P/H	X	Maximum RMS phase-to-phase voltage $V_{AB}$
0x7DC3– 0x7DC4	32196– 32197	R	V	FLOAT32	41.6– 2250	E	E/P/H	X	Maximum RMS phase-to-phase voltage $V_{BC}$
0x7DC5– 0x7DC6	32198– 32199	R	V	FLOAT32	41.6– 2250	E	E/P/H	X	Maximum RMS phase-to-phase voltage $V_{CA}$
0x7DC7– 0x7DC8	32200– 32201	R	V	FLOAT32	24–1500	E	E/P/H	X	Maximum RMS phase-to-neutral voltage $V_{AN}^{(1)}$
0x7DC9– 0x7DCA	32202– 32203	R	V	FLOAT32	24–1500	E	E/P/H	X	Maximum RMS phase-to-neutral voltage $V_{BN}^{(1)}$
0x7DCB– 0x7DCC	32204– 32205	R	V	FLOAT32	24–1500	E	E/P/H	X	Maximum RMS phase-to-neutral voltage $V_{CN}^{(1)}$

(1) Value available when system type register returns 40 or 41.

## Power Factor

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7DCD– 0x7DCE	32206– 32207	R	–	FLOAT32	–	E	E/P/H	X	Power factor on phase A <sup>(1)</sup>
0x7DCF– 0x7DD0	32208– 32209	R	–	FLOAT32	–	E	E/P/H	X	Power factor on phase B <sup>(1)</sup>
0x7DD1– 0x7DD2	32210– 32211	R	–	FLOAT32	–	E	E/P/H	X	Power factor on phase C <sup>(1)</sup>
0x7DD3– 0x7DD4	32212– 32213	R	–	FLOAT32	–	E	E/P/H	X	Total power factor



Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7DD5– 0x7DD6	32214– 32215	R	–	FLOAT32	–	E	H	X	Fundamental power factor on phase A ( $\cos\phi 1$ ) <sup>(1)(2)</sup>
0x7DD7– 0x7DD8	32216– 32217	R	–	FLOAT32	–	E	H	X	Fundamental power factor on phase B ( $\cos\phi 2$ ) <sup>(1)(2)</sup>
0x7DD9– 0x7DDA	32218– 32219	R	–	FLOAT32	–	E	H	X	Fundamental power factor on phase C ( $\cos\phi 3$ ) <sup>(1)(2)</sup>
0x7DDB– 0x7DDC	32220– 32221	R	–	FLOAT32	–	E	H	X	Total fundamental power factor <sup>(2)</sup>

(1) Value available when system type register returns 40 or 41.

(2) The sign for the fundamental power factor ( $\cos\phi$ ) depends on the configuration:

- register 3318 for PowerPact H-, J-, and L-Frame, ComPact NS and MasterPact NT/NW circuit breakers.
- register 8404 for MasterPact MTZ circuit breakers.

## Total Harmonic Distortion (THD)

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7DDD– 0x7DDE	32222– 32223	R	–	FLOAT32	0–2	E	H	X	Total harmonic distortion (THD) of phase-to phase voltage $V_{AB}$ compared to the fundamental
0x7DDF– 0x7DE0	32224– 32225	R	–	FLOAT32	0–2	E	H	X	Total harmonic distortion (THD) of phase-to phase voltage $V_{BC}$ compared to the fundamental
0x7DE1– 0x7DE2	32226– 32227	R	–	FLOAT32	0–2	E	H	X	Total harmonic distortion (THD) of phase-to phase voltage $V_{CA}$ compared to the fundamental
0x7DE3– 0x7DE4	32228– 32229	R	–	FLOAT32	0–2	E	H	X	Total harmonic distortion (THD) of phase-to-neutral voltage $V_{AN}$ compared to the fundamental <sup>(1)</sup>
0x7DE5– 0x7DE6	32230– 32231	R	–	FLOAT32	0–2	E	H	X	Total harmonic distortion (THD) of phase-to-neutral voltage $V_{BN}$ compared to the fundamental <sup>(1)</sup>
0x7DE7– 0x7DE8	32232– 32233	R	–	FLOAT32	0–2	E	H	X	Total harmonic distortion (THD) of phase-to-neutral voltage $V_{CN}$ compared to the fundamental <sup>(1)</sup>
0x7DE9– 0x7DEA	32234– 32235	R	–	FLOAT32	0–2	E	H	X	Total harmonic distortion (THD) of current on phase A compared to the fundamental
0x7DEB– 0x7DEC	32236– 32237	R	–	FLOAT32	0–2	E	H	X	Total harmonic distortion (THD) of current on phase B compared to the fundamental
0x7DED– 0x7DEE	32238– 32239	R	–	FLOAT32	0–2	E	H	X	Total harmonic distortion (THD) of current on phase C compared to the fundamental
0x7DEF– 0x7DF0	32240– 32241	R	–	FLOAT32	0–2	E	H	X	Average of 3-phase current Total harmonic distortions (THD) compared to the fundamental

(1) Value available when system type register returns 40 or 41.

## Maximum Power Factor

Maximum power factor can be reset with the reset minimum/maximum command.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x7DF1– 0x7DF2	32242– 32243	R	–	FLOAT32	–	–	–	X	Maximum total power factor
0x7DF3– 0x7E52	32244– 32339	–	–	–	–	–	–	–	Reserved

## Inhibit Close Order

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
0x7E53	32340	R	–	INT16U	–	A/E	A/E/P/H	X	–	Quality of each bit of register 32341: <ul style="list-style-type: none"> <li>• 0 = Invalid</li> <li>• 1 = Valid</li> </ul>
0x7E54	32341	R	–	INT16U	–	A/E	A/E/P/H	X	–	Inhibit close order status
									0	Close breaker inhibited by IO module <ul style="list-style-type: none"> <li>• 0 = Disable</li> <li>• 1 = Enable</li> </ul>
									1	Close breaker inhibited by communication <ul style="list-style-type: none"> <li>• 0 = Disable</li> <li>• 1 = Enable</li> </ul>
						–	–	–	2–15	Reserved

# Legacy Dataset

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# Legacy Dataset

## Description

The legacy dataset contains the most useful information of each IMU module in one convenient table. The legacy dataset is available in the registers 12000 to 12165. It can be read with two read requests.

Each IMU module updates the values in the dataset registers on a regular basis.

The response time of requests to legacy dataset registers is shorter than the response time of requests to device registers. Therefore, it is recommended to read the legacy dataset registers instead of device registers, to improve the overall performance of the system, [page 45](#).

**NOTE:**

- The legacy dataset is compatible with legacy versions of the MicroLogic trip unit for ComPact NSX, PowerPact H-, J-, and L-frame, ComPact NS, PowerPact P-, and R-frame or MasterPact NT/NW circuit breaker. For this reason, data read directly in the Modbus registers is organized in a different way than in the standard dataset.
- For new applications, it is recommended to use the standard dataset instead of the legacy dataset.

# Modbus Registers

## Table of Legacy Dataset Common Registers

The main information needed for remote supervision of a PowerPact H-, J-, L-, P-, or R-frame, MasterPact NT/NW, or MasterPact MTZ circuit breaker is contained in the table of common registers starting at register 12000.

This compact table of 114 registers can be read with a single Modbus request.

It contains the following information:

- Circuit breaker status
- Tripping causes
- Real-time values of main measurements: current, voltage, power, energy, total harmonic distortion

The content of this table of registers is detailed in [Legacy Dataset Common Registers](#), page 101.

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

## Table Format

Register tables have the following columns:

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

- **Address:** a 16-bit register address in hexadecimal. The address is the data used in the Modbus frame.
- **Register:** a 16-bit register number in decimal (register = address + 1).
- **RW:** register read-write status
  - R: the register can be read by using Modbus functions
  - W: the register can be written by using Modbus functions
  - RW: the register can be read and written by using Modbus functions
  - RC: the register can be read by using the command interface
  - WC: the register can be written by using the command interface
- **Unit:** the unit the information is expressed in.
- **Type:** the encoding data type (see data type description below).
- **Range:** the permitted values for this variable, usually a subset of what the format allows.
- **A/E:** types of PowerPact H-, J-, and L-frame MicroLogic trip unit for which the register is available.
  - Type A (Ammeter): current measurements
  - Type E (Energy): current, voltage, power, and energy measurements
- **A/E/P/H:** types of MasterPact NT/NW and PowerPact P- and R-frame MicroLogic trip unit for which the register is available.
  - Type A (Ammeter): current measurements
  - Type E (Energy): current, voltage, power, and energy measurements
  - Type P (Power): current, voltage, power, energy measurements, and advanced protection
  - Type H (Harmonics): current, voltage, power, energy, energy quality measurements, and advanced protection

- **X**: register available in the MicroLogic X control unit for MasterPact MTZ circuit breakers when the Modbus legacy dataset Digital Module is purchased and installed on the MicroLogic X control unit.
- **Description**: provides information about the register and restrictions that apply.

## Data Types

Data Types	Description	Range
INT16U	16-bit unsigned integer	0 to 65535
INT16	16-bit signed integer	-32768 to +32767
INT32U	32-bit unsigned integer	0 to 4 294 967 295
INT32	32-bit signed integer	-2 147 483 648 to +2 147 483 647

## Big-Endian Format

INT32 and INT32U variables are stored in big-endian format: the most significant register is transmitted first and the least significant register is transmitted at last place.

INT32 and INT32U variables are made of INT16U variables.

The formulas to calculate the decimal value of these variables are:

- INT32:  $(0\text{-bit}31) \times 2^{31} + \text{bit}30 \times 2^{30} + \text{bit}29 \times 2^{29} + \dots \text{bit}1 \times 2^1 + \text{bit}0 \times 2^0$
- INT32U:  $\text{bit}31 \times 2^{31} + \text{bit}30 \times 2^{30} + \text{bit}29 \times 2^{29} + \dots \text{bit}1 \times 2^1 + \text{bit}0 \times 2^0$

### Example:

The reactive energy in the legacy dataset is an INT32 variable coded in registers 12052 to 12053.

If the values in the registers are:

- register 12052 = 0xFFFF2 = 0x8000 + 0x7FF2 or 32754
- register 12053 = 0xA96E or 43374 as INT16U variable and -10606 as INT16 variable (use the INT16U value to calculate the value of the reactive energy).

Then the reactive energy is equal to  $(0-1) \times 2^{31} + 32754 \times 2^{16} + 43374 \times 2^0 = -874130$  kVARh.

## Readout Examples

### Readout Example of a Modbus Register

The table below shows how to read the rms current on phase A (I<sub>A</sub>) in register 12016.

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

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

The content of register 12016 (address 0x2EEF) is  $0x022B = 555$ .

The rms current on phase A (I<sub>A</sub>) is thus 555 A.

### Readout Example of the Table of Legacy Dataset Common Registers

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

- The address of register 12000 =  $0x2EDF$ .
- The table length is 113 registers =  $0x71$ .
- The number of bytes is  $113 \times 2 = 226$  bytes =  $0xE2$ .
- The Modbus address of the slave is  $47 = 0x2F$ .

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

Request from the Master		Response from the Slave	
Field Name	Example	Field Name	Example
–	–	CRC (MSB)	0xXX
–	–	CRC (LSB)	0xXX



## Legacy Dataset Common Registers

### Circuit Breaker Status Register

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
0x2EDF	12000	R	–	INT16U	–	A/E	A/E/P/H	X	–	Validity of each bit in the circuit breaker status register.
0x2EE0	12001	R	–	INT16U	–	A/E	A/E/P/H	X	–	Circuit breaker status register
						A/E	A/E/P/H	X	0	OF status indication contact  0 = The circuit breaker is open.  1 = The circuit breaker is closed.
						A/E	A/E/P/H	X	1	SD trip indication contact  0 = Circuit breaker is not tripped.  1 = Circuit breaker is tripped due to electrical default or shunt trip or push-to-trip.  Bit always equal to 0 for MasterPact NT/NW and PowerPact P- and R-frame circuit breakers with motor operator.
						A/E	A/E/P/H	X	2	SDE fault trip indication contact  0 = Circuit breaker is not tripped on electrical default.  1 = Circuit breaker is tripped due to electrical default (including ground-fault test and earth-leakage test).
						–	A/E/P/H	X	3	CH spring charged contact (only with MasterPact)  0 = Spring discharged  1 = Spring charged  Bit always equal to 0 for PowerPact P- and R-frame circuit breaker.
						–	–	–	4	Reserved
						–	A/E/P/H	X	5	PF ready to close contact (only with MasterPact)  0 = Not ready to close  1 = Ready to close  Bit always equal to 0 for PowerPact P- and R-frame circuit breakers.
						–	A/E/P/H	X	6	Distinction between PowerPact P- and R-frame and MasterPact NT/NW  0 = PowerPact P- and R-frame  1 = MasterPact NT/NW

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
						–	–	–	7–14	Reserved
						A/E	–	X	15	Data availability If this bit is set at 1, all other bits of the register are not significant.

## IO Status Registers

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
0x2EE1	12002	R	–	INT16U	–	A/E	A/E/P/H	X	–	Status IO 1
									0	Input 1 status • 0 = Off • 1 = On
									1	Input 2 status • 0 = Off • 1 = On
									2	Input 3 status • 0 = Off • 1 = On
									3	Input 4 status • 0 = Off • 1 = On
									4	Input 5 status • 0 = Off • 1 = On
									5	Input 6 status • 0 = Off • 1 = On
									6	Output 1 status • 0 = Off • 1 = On
									7	Output 2 status • 0 = Off • 1 = On
									8	Output 3 status • 0 = Off • 1 = On
									9–14	Reserved
0x2EE2	12003	R	–	INT16U	–	A/E	A/E/P/H	X	15	Data availability If this bit is set at 1, all other bits of the register are not significant.
									–	Status IO 2
									0	Input 1 status • 0 = Off • 1 = On
									1	Input 2 status • 0 = Off • 1 = On
									2	Input 3 status • 0 = Off

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
										<ul style="list-style-type: none"> <li>1 = On</li> </ul>
									3	Input 4 status <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									4	Input 5 status <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									5	Input 6 status <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									6	Output 1 status <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									7	Output 2 status <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									8	Output 3 status <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
									9–14	Reserved
									15	Data availability  If this bit is set at 1, all other bits of the register are not significant.

## Tripping Cause

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

- For MicroLogic A/E trip units for PowerPact H-, J-, and L-frame circuit breakers, the tripping cause bit is reset by pressing the OK key (keypad of the MicroLogic A/E trip unit) twice (validation and confirmation).
- For MicroLogic A/E/P/H trip units for MasterPact NT/NW and PowerPact P- and R-frame circuit breakers, the tripping cause bit is reset as soon as the circuit breaker is closed again.
- For MicroLogic X control units for MasterPact MTZ circuit breakers, the tripping cause bit is reset by pressing the test/reset button (located beside the trip cause LEDs on the MicroLogic X control unit). Press and hold the button for 3 to 15 seconds to reset all the trip causes.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
0x2EE3	12004	R	–	INT16U	–	A/E	A/E/P/H	X	–	Tripping cause for the standard protection functions
						A/E	A/E/P/H	X	0	Long-time protection I <sub>r</sub>
						A/E	P/H	X	1	Short-time protection I <sub>sd</sub>
						–	A/E	X	1	Short-time protection I <sub>sd</sub> or Instantaneous protection I <sub>i</sub>
						A/E	P/H	X	2	Instantaneous protection I <sub>i</sub>
						A/E	A/E/P/H	X	3	Ground-fault protection I <sub>g</sub>
						E	A/P/H	X	4	Earth-leakage protection I $\Delta$ n
						A/E	A/E/P/H	X	5	Integrated instantaneous protection for:

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
										<ul style="list-style-type: none"> <li>MasterPact NT06L1, NT08L1, NT10L1, and equivalent PowerPact M-, P-, and R-Frame</li> <li>PowerPact H-, J-, and L-Frame</li> </ul>
						A/E	–	X	6	Internal failure (STOP)
						–	A/E	–		Other protections or integrated instantaneous protection
						–	P/H	–		Internal failure (temperature)
						–	A/E/P/H	–	7	Internal failure (overvoltage)
						–	P/H	X	8	Other protection (see register 12005)
						E	–	–	9	Instantaneous with earth-leakage protection on the trip unit.
						E	–	–	10	Unbalance motor protection
						E	–	–	11	Jam motor protection
						E	–	–	12	Underload motor protection
						E	–	–	13	Long-start motor protection
						A/E	–	–	14	Reflex tripping protection
						A/E	A/E/P/H	X	15	If this bit is at 1, bits 0 to 14 are not valid.
0x2EE4	12005	R	–	INT16U	–	–	P/H	X	–	Tripping causes for the advanced protection functions
						–	P/H	–	0	Current unbalance
						–	P/H	–	1	Overcurrent on phase A
						–	P/H	–	2	Overcurrent on phase B
						–	P/H	–	3	Overcurrent on phase C
						–	P/H	–	4	Overcurrent on Neutral
						–	P/H	X	5	Undervoltage
						–	P/H	X	6	Overvoltage
						–	P/H	–	7	Voltage unbalance
						–	P/H	–	8	Overpower
						–	P/H	X	9	Reverse power
						–	P/H	X	10	Underfrequency
						–	P/H	X	11	Overfrequency
						–	P/H	–	12	Phase rotation
						–	P/H	–	13	Load shedding based on current
						–	P/H	–	14	Load shedding based on power
						–	P/H	X	15	If this bit is at 1, bits 0 to 14 are not valid.
0x2EE5– 0x2EE6	12006– 12007	–	–	–	–	–	–	–	–	Reserved

## Overrun of the Protection Setpoints

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

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
0x2EE7	12008	R	–	INT16U	–	A/E	P/H	–	–	Overrun of the standard protection setpoints
						A/E	P/H	–	0	Long-time protection pick-up
						–	–	–	1–14	Reserved
						A/E	P/H	–	15	If this bit is at 1, bits 0 to 14 are not valid.
0x2EE8	12009	R	–	INT16U	–	–	P/H	–	–	Overrun of the advanced protection setpoints
						–	P/H	–	0	Current unbalance
						–	P/H	–	1	Maximum current on phase A
						–	P/H	–	2	Maximum current on phase B
						–	P/H	–	3	Maximum current on phase C
						–	P/H	–	4	Maximum current on the neutral
						–	P/H	–	5	Minimum voltage
						–	P/H	–	6	Maximum voltage
						–	P/H	–	7	Voltage unbalance
						–	P/H	–	8	Maximum power
						–	P/H	–	9	Reverse power
						–	P/H	–	10	Minimum frequency
						–	P/H	–	11	Maximum frequency
						–	P/H	–	12	Phase rotation
						–	P/H	–	13	Load shedding based on the current
						–	P/H	–	14	Load shedding based on the power
						–	P/H	–	15	If this bit is at 1, bits 0 to 14 are not valid.
0x2EE9	12010	R	–	INT16U	–	–	P/H	–	–	Continuation of the previous register
						–	P/H	–	0	Ground-fault alarm
						E	P/H	–	1	Earth-leakage alarm
						–	–	–	2–14	Reserved
						–	P/H	–	15	If this bit is at 1, bits 0 to 14 are not valid.

## Alarms

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

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
0x2EEA	12011	R	–	INT16U	–	A/E	–	X	–	Pre-alarm register
						A/E	–	X	0	Long-time protection time pre-alarm (PAL Ir)
						E	–	–	1	Earth-leakage protection pre-alarm (PAL IΔn)

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
						–	–	X		Earth-leakage alarm <sup>(1)</sup>
						A/E	–	–	2	Ground-fault protection pre-alarm (PAL Ig)
						–	–	X		Ground-fault alarm <sup>(2)</sup>
						–	–	–	3–14	Reserved
						A/E	–	X	15	If this bit is at 1, bits 0 to 14 are not valid.
0x2EEB	12012	R	–	INT16U	–	A/E	–	–	–	Register of user-defined alarms
						A/E	–	–	0	User-defined alarm 201
						A/E	–	–	1	User-defined alarm 202
						A/E	–	–	2	User-defined alarm 203
						A/E	–	–	3	User-defined alarm 204
						A/E	–	–	4	User-defined alarm 205
						A/E	–	–	5	User-defined alarm 206
						A/E	–	–	6	User-defined alarm 207
						A/E	–	–	7	User-defined alarm 208
						A/E	–	–	8	User-defined alarm 209
						A/E	–	–	9	User-defined alarm 210
						–	–	–	10–14	Reserved
						A/E	–	–	15	If this bit is at 1, bits 0 to 14 are not valid.
0x2EEC– 0x2EEE	12013– 12015	–	–	–	–	–	–	–	–	Reserved
(1) Value available on MicroLogic 7.0 X control unit only when the Digital Module ANSI 51N/51G Ground-fault alarm is installed.										
(2) Value available on MicroLogic 2.0 X, 3.0 X, 5.0 X, and 6.0 X control units only when the Digital Module ANSI 51N/51G Ground-fault alarm is installed.										

## Current

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2EEF	12016	R	A	INT16U	0–32767	A/E	A/E/P/H	X	RMS current on phase A: I <sub>A</sub>
0x2EF0	12017	R	A	INT16U	0–32767	A/E	A/E/P/H	X	RMS current on phase B: I <sub>B</sub>
0x2EF1	12018	R	A	INT16U	0–32767	A/E	A/E/P/H	X	RMS current on phase C: I <sub>C</sub>
0x2EF2	12019	R	A	INT16U	0–32767	A/E	A/E/P/H	X	RMS current on the neutral: I <sub>N</sub> (1)
0x2EF3	12020	R	A	INT16U	0–32767	A/E	A/E/P/H	X	Maximum of I <sub>A</sub> , I <sub>B</sub> , I <sub>C</sub> , and I <sub>N</sub>
0x2EF4	12021	R	%I <sub>g</sub>	INT16U	0–32767	A/E	A/E/P/H	X	Ground-fault current I <sub>g</sub> (2)
0x2EF5	12022	R	%IΔ <sub>n</sub>	INT16U	0–32767	E	A/P/H	X	Earth-leakage current IΔ <sub>n</sub> (3)

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

(2) This value is only available:

- For MasterPact MTZ MicroLogic 6.0 X control units, expressed as %I<sub>g</sub> pick-up
- For MasterPact NT/NW and PowerPact P- and R-frame MicroLogic 6.0 trip units, expressed as %I<sub>g</sub> pick-up
- For PowerPact H-, J-, and L-frame MicroLogic 6.2 and 6.3 trip units, expressed as %I<sub>g</sub> pick-up

(3) This value is only available:

- For MasterPact MTZ MicroLogic 7.0 X control units, expressed as %IΔ<sub>n</sub> pick-up
- For MasterPact NT/NW and PowerPact P- and R-frame MicroLogic 7.0 trip units, expressed as %IΔ<sub>n</sub> pick-up
- For PowerPact H-, J-, and L-frame MicroLogic 7.2 and 7.3 trip units, expressed as %IΔ<sub>n</sub> pick-up

## Maximum Current Values

Maximum current values can be reset with the reset minimum/maximum command.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2EF6	12023	R	A	INT16U	0–32767	A/E	A/E/P/H	X	Maximum RMS current on phase A: $I_A$
0x2EF7	12024	R	A	INT16U	0–32767	A/E	A/E/P/H	X	Maximum RMS current on phase B: $I_B$
0x2EF8	12025	R	A	INT16U	0–32767	A/E	A/E/P/H	X	Maximum RMS current on phase C: $I_C$
0x2EF9	12026	R	A	INT16U	0–32767	A/E	A/E/P/H	X	Maximum RMS current on the neutral: $I_N$ <sup>(1)</sup>
0x2EFA	12027	R	A	INT16U	0–32767	A/E	A/E/P/H	X	Maximum RMS current out of the 4 previous registers
0x2EFB	12028	R	%Ig	INT16U	0–32767	A/E	A/E/P/H	X	Maximum ground-fault current $I_g$ <sup>(2)</sup>
0x2EFC	12029	R	%IΔn	INT16U	0–32767	E	A/P/H	X	Maximum earth-leakage current <sup>(3)</sup>

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

(2) This value is only available:

- For MasterPact MTZ MicroLogic 6.0 X control units, expressed as %Ig pick-up
- For MasterPact NT/NW and PowerPact P- and R-frame MicroLogic 6.0 trip units, expressed as %Ig pick-up
- For PowerPact H-, J-, and L-frame MicroLogic 6.2 and 6.3 trip units, expressed as %Ig pick-up

(3) This value is only available:

- For MasterPact MTZ MicroLogic 7.0 X control units, expressed as %IΔn pick-up
- For MasterPact NT/NW and PowerPact P- and R-frame MicroLogic 7.0 trip units, expressed as %IΔn pick-up
- For PowerPact H-, J-, and L-frame MicroLogic 7.2 and 7.3 trip units, expressed as %IΔn pick-up

## Voltage

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2EFD	12030	R	V	INT16U	0–1200	E	E/P/H	X	RMS phase-to-phase voltage $V_{AB}$
0x2EFE	12031	R	V	INT16U	0–1200	E	E/P/H	X	RMS phase-to-phase voltage $V_{BC}$
0x2EFF	12032	R	V	INT16U	0–1200	E	E/P/H	X	RMS phase-to-phase voltage $V_{CA}$
0x2F00	12033	R	V	INT16U	0–1200	E	E/P/H	X	RMS phase-to-neutral voltage $V_{AN}$ <sup>(1)</sup>
0x2F01	12034	R	V	INT16U	0–1200	E	E/P/H	X	RMS phase-to-neutral voltage $V_{BN}$ <sup>(1)</sup>
0x2F02	12035	R	V	INT16U	0–1200	E	E/P/H	X	RMS phase-to-neutral voltage $V_{CN}$ <sup>(1)</sup>

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

## Frequency

When the MicroLogic trip unit cannot calculate the frequency, it returns Not applicable = 32768 (0x8000).

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2F03	12036	R	0.1 Hz	INT16U	400–600	E	P/H	X	Frequency
0x2F04	12037	R	0.1 Hz	INT16U	400–600	E	P/H	X	Maximum frequency <sup>(1)</sup>

(1) This value can be reset with the reset minimum/maximum command.

## Power

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2F05	12038	R	0.1 kW	INT16	-32767– +32767	E	E/P/H	X	Active power on phase A: $P_A$ <sup>(1) (2)</sup>
0x2F06	12039	R	0.1 kW	INT16	-32767– +32767	E	E/P/H	X	Active power on phase B: $P_B$ <sup>(1) (2)</sup>
0x2F07	12040	R	0.1 kW	INT16	-32767– +32767	E	E/P/H	X	Active power on phase C: $P_C$ <sup>(1) (2)</sup>
0x2F08	12041	R	0.1 kW	INT16	-32767– +32767	E	E/P/H	X	Total active power: $P_{tot}$ <sup>(2)</sup>
0x2F09	12042	R	0.1 kVAR	INT16	-32767– +32767	E	E/P/H	X	Reactive power on phase A: $Q_A$ <sup>(1) (2)</sup>
0x2F0A	12043	R	0.1 kVAR	INT16	-32767– +32767	E	E/P/H	X	Reactive power on phase B: $Q_B$ <sup>(1) (2)</sup>
0x2F0B	12044	R	0.1 kVAR	INT16	-32767– +32767	E	E/P/H	X	Reactive power on phase C: $Q_C$ <sup>(1) (2)</sup>
0x2F0C	12045	R	0.1 kVAR	INT16	-32767– +32767	E	E/P/H	X	Total reactive power: $Q_{tot}$ <sup>(2)</sup>
0x2F0D	12046	R	0.1 kVA	INT16U	0–32767	E	E/P/H	X	Apparent power on phase A: $S_A$ <sup>(1)</sup>
0x2F0E	12047	R	0.1 kVA	INT16U	0–32767	E	E/P/H	X	Apparent power on phase B: $S_B$ <sup>(1)</sup>
0x2F0F	12048	R	0.1 kVA	INT16U	0–32767	E	E/P/H	X	Apparent power on phase C: $S_C$ <sup>(1)</sup>
0x2F10	12049	R	0.1 kVA	INT16U	0–32767	E	E/P/H	X	Total apparent power: $S_{tot}$

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

(2) The sign for the active and reactive power depends on the configuration of:

- register 3316 for PowerPact H-, J-, and L-frame, PowerPact P- and R-frame and MasterPact NT/NW circuit breakers.
- register 8405 for MasterPact MTZ circuit breakers.

## Energy

Energy is stored in big-endian format: the most significant register is transmitted first, the least significant second.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2F11– 0x2F12	12050– 12051	R	kWh	INT32	-1 999 999 999– +1 999 999 999	E	E/P/H	X	Active energy: $E_p$ <sup>(1)</sup>
0x2F13– 0x2F14	12052– 12053	R	kVARh	INT32	-1 999 999 999– +1 999 999 999	E	E/P/H	X	Reactive energy: $E_q$ <sup>(1)</sup>
0x2F15– 0x2F16	12054– 12055	R	kWh	INT32U	0–1 999 999 999	E	P/H	X	Active energy counted positively: $E_{pin}$



Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2F17– 0x2F18	12056– 12057	R	kWh	INT32U	0–1 999 999 999	E	P/H	X	Active energy counted negatively: EpOut
0x2F19– 0x2F1A	12058– 12059	R	kVARh	INT32U	0–1 999 999 999	E	P/H	X	Reactive energy counted positively: EqIn
0x2F1B– 0x2F1C	12060– 12061	R	kVARh	INT32U	0–1 999 999 999	E	P/H	X	Reactive energy counted negatively: EqOut
0x2F1D– 0x2F1E	12062– 12063	R	kVAh	INT32U	0–1 999 999 999	E	E/P/H	X	Total apparent energy: Es
0x2F1F– 0x2F20	12064– 12065	R	kWh	INT32U	0–1 999 999 999	E	–	X	Active energy counted positively (non-resettable): EpIn
0x2F21– 0x2F22	12066– 12067	R	kWh	INT32U	0–1 999 999 999	E	–	X	Active energy counted negatively (non-resettable): EpOut
0x2F23– 0x2F2E	12068– 12079	–	–	–	–	–	–	–	Reserved

(1) This value is always positive with MicroLogic E trip units for MasterPact NT/NW and PowerPact P-, and R-frame circuit breakers.

## Current Demand Values

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2F2F	12080	R	A	INT16U	0–32767	E	E/P/H	X	Current demand value on phase A: I <sub>A</sub> Dmd
0x2F30	12081	R	A	INT16U	0–32767	E	E/P/H	X	Current demand value on phase B: I <sub>B</sub> Dmd
0x2F31	12082	R	A	INT16U	0–32767	E	E/P/H	X	Current demand value on phase C: I <sub>C</sub> Dmd
0x2F32	12083	R	A	INT16U	0–32767	E	E/P/H	X	Current demand value on the neutral: I <sub>N</sub> Dmd <sup>(1)</sup>

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

## Power Demand Values

- For the block window, the demand value is updated at the end of the window.
- For the sliding window,
  - If window duration is configured for less or equal to 15 minutes, the demand value is updated every 15 seconds
  - If window duration is configured for more than 15 minutes, the demand value is updated every 1 minute.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2F33	12084	R	0.1 kW	INT16U	0–32767	E	E/P/H	X	Total active power demand: P Dmd
0x2F34	12085	R	0.1 kVAR	INT16U	0–32767	E	P/H	X	Total reactive power demand: Q Dmd

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2F35	12086	R	0.1 kVA	INT16U	0–32767	E	P/H	X	Total apparent power demand: S Dmd
0x2F36– 0x2F38	12087– 12089	–	–	–	–	–	–	–	Reserved

## Maximum Voltage Values

Maximum voltage values can be reset with the reset minimum/maximum command.

Register = 0 if the voltage < 25 V.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2F39	12090	R	V	INT16U	0–1200	E	E/P/H	X	Maximum RMS phase-to-phase voltage $V_{AB}$
0x2F3A	12091	R	V	INT16U	0–1200	E	E/P/H	X	Maximum RMS phase-to-phase voltage $V_{BC}$
0x2F3B	12092	R	V	INT16U	0–1200	E	E/P/H	X	Maximum RMS phase-to-phase voltage $V_{CA}$
0x2F3C	12093	R	V	INT16U	0–1200	E	E/P/H	X	Maximum RMS phase-to-neutral voltage $V_{AN}^{(1)}$
0x2F3D	12094	R	V	INT16U	0–1200	E	E/P/H	X	Maximum RMS phase-to-neutral voltage $V_{BN}^{(1)}$
0x2F3E	12095	R	V	INT16U	0–1200	E	E/P/H	X	Maximum RMS phase-to-neutral voltage $V_{CN}^{(1)}$
(1) This value cannot be accessed for motor applications and in cases of three-pole circuit breakers without external neutral voltage transformer (ENVVT).									

## Power Factor

The sign for the fundamental power factor ( $\cos\phi$ ) depends on the MicroLogic configuration.

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2F3F	12096	R	0.01	INT16	-100– +100	E	E/P/H	X	Power factor on phase A: $PF_A^{(1)}$
0x2F40	12097	R	0.01	INT16	-100– +100	E	E/P/H	X	Power factor on phase B: $PF_B^{(1)}$
0x2F41	12098	R	0.01	INT16	-100– +100	E	E/P/H	X	Power factor on phase C: $PF_C^{(1)}$
0x2F42	12099	R	0.01	INT16	-100– +100	E	E/P/H	X	Total power factor: PF
0x2F43	12100	R	0.01	INT16	-100– +100	E	H	X	Fundamental power factor on phase A: $\cos\phi 1^{(1)}$
0x2F44	12101	R	0.01	INT16	-100– +100	E	H	X	Fundamental power factor on phase B: $\cos\phi 2^{(1)}$
0x2F45	12102	R	0.01	INT16	-100– +100	E	H	X	Fundamental power factor on phase C: $\cos\phi 3^{(1)}$

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2F46	12103	R	0.01	INT16	-100– +100	E	H	X	Total fundamental power factor: $\cos\phi$
(1) This value cannot be accessed for motor applications and in cases of three-pole circuit breakers without external neutral voltage transformer (ENVT).									

## Total Harmonic Distortion (THD)

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2F47	12104	R	0.1 %	INT16U	0–5000	E	H	X	Total harmonic distortion of $V_{AB}$ compared to the fundamental
0x2F48	12105	R	0.1 %	INT16U	0–5000	E	H	X	Total harmonic distortion of $V_{BC}$ compared to the fundamental
0x2F49	12106	R	0.1 %	INT16U	0–5000	E	H	X	Total harmonic distortion of $V_{CA}$ compared to the fundamental
0x2F4A	12107	R	0.1 %	INT16U	0–5000	E	H	X	Total harmonic distortion of $V_{AN}$ compared to the fundamental <sup>(1)</sup>
0x2F4B	12108	R	0.1 %	INT16U	0–5000	E	H	X	Total harmonic distortion of $V_{BN}$ compared to the fundamental <sup>(1)</sup>
0x2F4C	12109	R	0.1 %	INT16U	0–5000	E	H	X	Total harmonic distortion of $V_{CN}$ compared to the fundamental <sup>(1)</sup>
0x2F4D	12110	R	0.1 %	INT16U	0–5000	E	H	X	Total harmonic distortion of $I_A$ compared to the fundamental
0x2F4E	12111	R	0.1 %	INT16U	0–5000	E	H	X	Total harmonic distortion of $I_B$ compared to the fundamental
0x2F4F	12112	R	0.1 %	INT16U	0–5000	E	H	X	Total harmonic distortion of $I_C$ compared to the fundamental
0x2F50	12113	R	0.1 %	INT16U	0–5000	E	H	X	Total harmonic distortion of total current compared to the fundamental
(1) This value cannot be accessed for motor applications and in cases of three-pole circuit breakers without external neutral voltage transformer (ENVT).									

## Counters

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Description
0x2F7F	12160	R	–	INT16U	0–32766	A/E	A/E/P/H	X	Trip counter
0x2F80	12161	R	–	INT16U	0–32766	A/E	A/E/P/H	X	Counter of alarms with priority level = 3 (high)
0x2F81	12162	R	–	INT16U	0–32766	A/E	A/E/P/H	X	Counter of alarms with priority level = 2 (medium)
0x2F82	12163	R	–	INT16U	0–32766	A/E	A/E/P/H	X	Counter of alarms with priority level = 1 (low)

## Miscellaneous

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
0x2F83	12164	R	–	INT16U	–	A/E	A/E/P/H	X	–	Validity of the breaker close inhibit
									0	Validity of the breaker close inhibit by IO module

Address	Register	RW	Unit	Type	Range	A/E	A/E/P/H	X	Bit	Description
									1	Validity of the breaker close inhibit by remote controller
									2–15	Reserved
0x2F84	12165	R	–	INT16U	–	A/E	A/E/P/H	X	–	Status of the breaker close inhibit
									0	Status of the breaker close inhibit by IO module
									1	Status of the breaker close inhibit by remote controller
									2–15	Reserved

# MicroLogic Trip Unit Data for MasterPact NT/NW and PowerPact P- and R-Frame Circuit Breakers

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# MicroLogic Trip Unit Registers

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# Real-Time Measurements

## General Description

The metering manager refreshes the real-time measurements every second. Real-time measurements include:

- voltage and voltage unbalance
- current and current unbalance
- active, reactive, apparent, and distortion power
- power factor and fundamental power factor
- frequency
- fundamental voltage and current
- fundamental active, reactive, and apparent power
- THD (total harmonic distortion in relation to the fundamental)
- thd (total harmonic distortion in relation to the RMS value)
- voltage to current phase shift
- K-factor
- peak factor
- voltage to voltage phase shift

## Voltage

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x03E7	1000	R	1	V	INT16U	0–1200	E/P/H	RMS phase-to-phase voltage $V_{AB}$
0x03E8	1001	R	1	V	INT16U	0–1200	E/P/H	RMS phase-to-phase voltage $V_{BC}$
0x03E9	1002	R	1	V	INT16U	0–1200	E/P/H	RMS phase-to-phase voltage $V_{CA}$
0x03EA	1003	R	1	V	INT16U	0–1200	E/P/H	RMS phase-to-neutral voltage $V_{AN}$ <sup>(1)</sup>
0x03EB	1004	R	1	V	INT16U	0–1200	E/P/H	RMS phase-to-neutral voltage $V_{BN}$ <sup>(1)</sup>
0x03EC	1005	R	1	V	INT16U	0–1200	E/P/H	RMS phase-to-neutral voltage $V_{CN}$ <sup>(1)</sup>
0x03ED	1006	R	1	V	INT16U	0–1200	E/P/H	Arithmetic mean of $V_{AB}$ , $V_{BC}$ , and $V_{CA}$ : $(V_{AB} + V_{BC} + V_{CA}) / 3 = V_{avg} \text{ L-L}$
0x03EE	1007	R	1	V	INT16U	0–1200	E/P/H	Arithmetic mean of $V_{AN}$ , $V_{BN}$ , and $V_{CN}$ : $(V_{AN} + V_{BN} + V_{CN}) / 3 = V_{avg} \text{ L-N}$ <sup>(1)</sup>

(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.

## Voltage Unbalance

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x03EF	1008	R	10	%	INT16	-1000–+1000	E/P/H	$V_{AB}$ phase-to-phase voltage unbalance in relation to the arithmetic mean of phase-to-phase voltages
0x03F0	1009	R	10	%	INT16	-1000–+1000	E/P/H	$V_{BC}$ phase-to-phase voltage unbalance in relation to the arithmetic mean of phase-to-phase voltages
0x03F1	1010	R	10	%	INT16	-1000–+1000	E/P/H	$V_{CA}$ phase-to-phase voltage unbalance in relation to the arithmetic mean of phase-to-phase voltages

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x03F2	1011	R	10	%	INT16	-1000–+1000	E/P/H	V <sub>AN</sub> phase-to-neutral voltage unbalance in relation to the arithmetic mean of phase-to-neutral voltages <sup>(1)</sup>
0x03F3	1012	R	10	%	INT16	-1000–+1000	E/P/H	V <sub>BN</sub> phase-to-neutral voltage unbalance in relation to the arithmetic mean of phase-to-neutral voltages <sup>(1)</sup>
0x03F4	1013	R	10	%	INT16	-1000–+1000	E/P/H	V <sub>CN</sub> phase-to-neutral voltage unbalance in relation to the arithmetic mean of phase-to-neutral voltages <sup>(1)</sup>
0x03F5	1014	R	10	%	INT16	-1000–+1000	E/P/H	Maximum phase-to-phase voltage unbalance value of registers 1008, 1009, and 1010
0x03F6	1015	R	10	%	INT16	-1000–+1000	E/P/H	Maximum phase-to-neutral voltage unbalance value of registers 1011, 1012, and 1013 <sup>(1)</sup>
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								

## Current

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x03F7	1016	R	1	A	INT16U	0–32767	A/E/P/H	RMS current on phase A: I <sub>A</sub>
0x03F8	1017	R	1	A	INT16U	0–32767	A/E/P/H	RMS current on phase B: I <sub>B</sub>
0x03F9	1018	R	1	A	INT16U	0–32767	A/E/P/H	RMS current on phase C: I <sub>C</sub>
0x03FA	1019	R	1	A	INT16U	0–32767	A/E/P/H	RMS current on the neutral: I <sub>N</sub> <sup>(1)</sup>
0x03FB	1020	R	1	A	INT16U	0–32767	A/E/P/H	Maximum of I <sub>A</sub> , I <sub>B</sub> , I <sub>C</sub> , and I <sub>N</sub>
0x03FC	1021	R	1	%Ig	INT16U	0–32767	A/E/P/H	Ground-fault current <sup>(2)</sup>
0x03FD	1022	R	1	mA	INT16U	0–32767	A/P/H	Ground-leakage current <sup>(3)(4)</sup>
0x03FE	1023	R	1	A	INT16U	0–32767	H	Apparent current phase A (peak/√2)
0x03FF	1024	R	1	A	INT16U	0–32767	H	Apparent current phase B (peak/√2)
0x0400	1025	R	1	A	INT16U	0–32767	H	Apparent current phase C (peak/√2)
0x0401	1026	R	1	A	INT16U	0–32767	H	Apparent current neutral (peak/√2)
0x0402	1027	R	1	A	INT16U	0–32767	E/P/H	Arithmetic mean of I <sub>A</sub> , I <sub>B</sub> , and I <sub>C</sub> : (I <sub>A</sub> + I <sub>B</sub> + I <sub>C</sub> ) / 3 = I <sub>avg</sub>
(1) Value is not available when the system type in register 3314 is 31 or 40. Refer to System Type, page 175.								
(2) Accessible only with MicroLogic 5.0 P/H and 6.0 A/E/P/H trip units.								
(3) Accessible only with MicroLogic 7.0 A/P/H trip units.								
(4) If this current exceeds 32767 A, the register blocks at 32767.								

## Current Unbalance

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0403	1028	R	10	%	INT16	-1000–+1000	E/P/H	I <sub>A</sub> current unbalance in relation to the arithmetic mean of the phase currents
0x0404	1029	R	10	%	INT16	-1000–+1000	E/P/H	I <sub>B</sub> current unbalance in relation to the arithmetic mean of the phase currents
0x0405	1030	R	10	%	INT16	-1000–+1000	E/P/H	I <sub>C</sub> current unbalance in relation to the arithmetic mean of the phase currents
0x0406	1031	R	10	%	INT16	-1000–+1000	E/P/H	I <sub>N</sub> current unbalance in relation to the arithmetic mean of the phase currents <sup>(1)</sup>



Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0407	1032	R	10	%	INT16	-1000– +1000	E/P/H	Maximum current unbalance of registers 1028, 1029, and 1030
(1) Value is not available when the system type in register 3314 is 31 or 40. Refer to System Type, page 175.								

## Active Power

The flow sign of the active power depends on the configuration of register 3316, page 175.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0409	1034	R	1	kW	INT16	-32767– +32767	E/P/H	Active power on phase A: $P_A$ <sup>(1)</sup>
0x040A	1035	R	1	kW	INT16	-32767– +32767	E/P/H	Active power on phase B: $P_B$ <sup>(1)</sup>
0x040B	1036	R	1	kW	INT16	-32767– +32767	E/P/H	Active power on phase C: $P_C$ <sup>(1)</sup>
0x040C	1037	R	1	kW	INT16	-32767– +32767	E/P/H	Total active power: $P_{tot}$
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								

## Reactive Power

The flow sign of the reactive power depends on the configuration of register 3316, page 175.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x040D	1038	R	1	kVAR	INT16	-32767– +32767	E/P/H	Reactive power on phase A: $Q_A$
0x040E	1039	R	1	kVAR	INT16	-32767– +32767	E/P/H	Reactive power on phase B: $Q_B$
0x040F	1040	R	1	kVAR	INT16	-32767– +32767	E/P/H	Reactive power on phase C: $Q_C$
0x0410	1041	R	1	kVAR	INT16	-32767– +32767	E/P/H	Total reactive power: $Q_{tot}$
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								

## Apparent Power

Address	Register	RW	X	Unit	Type	Range	A/E	Description
0x0411	1042	R	1	kVA	INT16U	0–32767	E/P/H	Apparent power on phase A: $S_A$ <sup>(1)</sup>
0x0412	1043	R	1	kVA	INT16U	0–32767	E/P/H	Apparent power on phase B: $S_B$ <sup>(1)</sup>
0x0413	1044	R	1	kVA	INT16U	0–32767	E/P/H	Apparent power on phase C: $S_C$ <sup>(1)</sup>
0x0414	1045	R	1	kVA	INT16U	0–32767	E/P/H	Total apparent power: $S_{tot}$
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								

## Power Factor

The sign of the power factor depends on the configuration of register 3318, page 176.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0415	1046	R	1000	–	INT16	-1000– +1000	E/P/H	Power factor on phase A: $PF_A$ (absolute value equal to $ P_A /S_A$ ) <sup>(1)</sup>
0x0416	1047	R	1000	–	INT16	-1000– +1000	E/P/H	Power factor on phase B: $PF_B$ (absolute value equal to $ P_B /S_B$ ) <sup>(1)</sup>
0x0417	1048	R	1000	–	INT16	-1000– +1000	E/P/H	Power factor on phase C: $PF_C$ (absolute value equal to $ P_C /S_C$ ) <sup>(1)</sup>
0x0418	1049	R	1000	–	INT16	-1000– +1000	E/P/H	Total power factor: PF (absolute value equal to $ P_{total}  / S_{total}$ ) <sup>(1)</sup>
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								

## Fundamental Power Factor ( $\cos\phi$ )

The sign of the fundamental power factor ( $\cos\phi$ ) depends on the configuration of register 3318, page 176.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0419	1050	R	1000	–	INT16	-1000– +1000	H	Fundamental power factor on phase A: $\cos\phi_1$ (absolute value equal to $ P_A \text{ Fund} /S_A \text{ Fund}$ ) <sup>(1)</sup>
0x041A	1051	R	1000	–	INT16	-1000– +1000	H	Fundamental power factor on phase B: $\cos\phi_2$ (absolute value equal to $ P_B \text{ Fund} /S_B \text{ Fund}$ ) <sup>(1)</sup>
0x041B	1052	R	1000	–	INT16	-1000– +1000	H	Fundamental power factor on phase C: $\cos\phi_3$ (absolute value equal to $ P_C \text{ Fund} /S_C \text{ Fund}$ ) <sup>(1)</sup>
0x041C	1053	R	1000	–	INT16	-1000– +1000	H	Total fundamental power factor: $\cos\phi$ (absolute value equal to $ P_{tot \text{ Fund}} /S_{tot \text{ Fund}}$ )
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								

## Frequency

When the MicroLogic trip unit cannot calculate the frequency, it returns Not applicable = 32768 (0x8000).

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x041D	1054	R	10	Hz	INT16U	400–600	P/H	System frequency: F

## Fundamental Voltage

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x041F	1056	R	1	V	INT16U	0–1200	H	Fundamental rms phase-to-phase voltage $V_{AB \text{ Fund}}$
0x0420	1057	R	1	V	INT16U	0–1200	H	Fundamental rms phase-to-phase voltage $V_{BC \text{ Fund}}$
0x0421	1058	R	1	V	INT16U	0–1200	H	Fundamental rms phase-to-phase voltage $V_{CA \text{ Fund}}$

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0422	1059	R	1	V	INT16U	0–1200	H	Fundamental rms phase-to-neutral voltage $V_{AN}$ Fund <sup>(1)</sup>
0x0423	1060	R	1	V	INT16U	0–1200	H	Fundamental rms phase-to-neutral voltage $V_{BN}$ Fund <sup>(1)</sup>
0x0424	1061	R	1	V	INT16U	0–1200	H	Fundamental rms phase-to-neutral voltage $V_{CN}$ Fund <sup>(1)</sup>

(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.

## Fundamental Current

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x042B	1068	R	1	A	INT16U	0–32767	H	Fundamental rms current on phase A: $I_A$ Fund
0x042C	1069	R	1	A	INT16U	0–32767	H	Fundamental rms current on phase B: $I_B$ Fund
0x042D	1070	R	1	A	INT16U	0–32767	H	Fundamental rms current on phase C: $I_C$ Fund
0x042E	1071	R	1	A	INT16U	0–32767	H	Fundamental rms current on neutral: $I_N$ Fund <sup>(1) (2)</sup>

(1) Value is not available when the system type in register 3314 is 31 or 40. Refer to System Type, page 175.

(2) Measured with system type 41.

## Fundamental Active Power

The flow sign of the active power depends on the configuration of register 3316, page 175.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0433	1076	R	1	kW	INT16U	-32767–32767	H	Fundamental active power on phase A: $P_A$ Fund <sup>(1)</sup>
0x0434	1077	R	1	kW	INT16U	-32767–32767	H	Fundamental active power on phase B: $P_B$ Fund <sup>(1)</sup>
0x0435	1078	R	1	kW	INT16U	-32767–32767	H	Fundamental active power on phase C: $P_C$ Fund <sup>(1)</sup>
0x0436	1079	R	1	kW	INT16U	-32767–32767	H	Total fundamental active power: $P_{tot}$ Fund

(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.

## Fundamental Reactive Power

The flow sign of the reactive power depends on the configuration of register 3316, page 175.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0437	1080	R	1	kVAR	INT16U	-32767–32767	H	Fundamental reactive power on phase A: $Q_A$ Fund <sup>(1)</sup>
0x0438	1081	R	1	kVAR	INT16U	-32767–32767	H	Fundamental reactive power on phase B: $Q_B$ Fund <sup>(1)</sup>
0x0439	1082	R	1	kVAR	INT16U	-32767–32767	H	Fundamental reactive power on phase C: $Q_C$ Fund <sup>(1)</sup>

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x043A	1083	R	1	kVAR	INT16U	-32767–32767	H	Total fundamental reactive power: $Q_{\text{tot Fund}}$
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								

## Fundamental Apparent Power

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x043B	1084	R	1	kVA	INT16U	0–32767	H	Fundamental apparent power on phase A: $S_A \text{ Fund}^{(1)}$
0x043C	1085	R	1	kVA	INT16U	0–32767	H	Fundamental apparent power on phase B: $S_B \text{ Fund}^{(1)}$
0x043D	1086	R	1	kVA	INT16U	0–32767	H	Fundamental apparent power on phase C: $S_C \text{ Fund}^{(1)}$
0x043E	1087	R	1	kVA	INT16U	0–32767	H	Total fundamental apparent power: $S_{\text{tot Fund}}$
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								

## Distortion Power

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x043F	1088	R	1	kVAR	INT16U	0–32767	H	Distortion power on phase A: $D_A^{(1)}$
0x0440	1089	R	1	kVAR	INT16U	0–32767	H	Distortion power on phase B: $D_B^{(1)}$
0x0441	1090	R	1	kVAR	INT16U	0–32767	H	Distortion power on phase C: $D_C^{(1)}$
0x0442	1091	R	1	kVAR	INT16U	0–32767	H	Total distortion power: $D_{\text{tot}}$
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								

## Total Harmonic Distortion in Relation to the Fundamental (THD)

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0443	1092	R	10	%	INT16U	0–5000	H	Total harmonic distortion of $V_{AB}$ in relation to the fundamental
0x0444	1093	R	10	%	INT16U	0–5000	H	Total harmonic distortion of $V_{BC}$ in relation to the fundamental
0x0445	1094	R	10	%	INT16U	0–5000	H	Total harmonic distortion of $V_{CA}$ in relation to the fundamental
0x0446	1095	R	10	%	INT16U	0–5000	H	Total harmonic distortion of $V_{AN}$ in relation to the fundamental <sup>(1)</sup>
0x0447	1096	R	10	%	INT16U	0–5000	H	Total harmonic distortion of $V_{BN}$ in relation to the fundamental <sup>(1)</sup>
0x0448	1097	R	10	%	INT16U	0–5000	H	Total harmonic distortion of $V_{CN}$ in relation to the fundamental <sup>(1)</sup>
0x0449	1098	R	10	%	INT16U	0–5000	H	Total harmonic distortion of $I_A$ in relation to the fundamental
0x044A	1099	R	10	%	INT16U	0–5000	H	Total harmonic distortion of $I_B$ in relation to the fundamental
0x044B	1100	R	10	%	INT16U	0–5000	H	Total harmonic distortion of $I_C$ in relation to the fundamental

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x044C	1101	R	10	%	INT16U	0–5000	H	Total harmonic distortion of $I_N$ in relation to the fundamental <sup>(1)</sup> <sup>(2)</sup>
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								
(2) Measured with system type 41, calculated with system type 40.								

## Total Harmonic Distortion in Relation to the RMS Value (thd)

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x044D	1102	R	10	%	INT16U	0–1000	H	Total harmonic distortion of $V_{AB}$ in relation to the rms value
0x044E	1103	R	10	%	INT16U	0–1000	H	Total harmonic distortion of $V_{BC}$ in relation to the rms value
0x044F	1104	R	10	%	INT16U	0–1000	H	Total harmonic distortion of $V_{CA}$ in relation to the rms value
0x0450	1105	R	10	%	INT16U	0–1000	H	Total harmonic distortion of $V_{AN}$ in relation to the rms value <sup>(1)</sup>
0x0451	1106	R	10	%	INT16U	0–1000	H	Total harmonic distortion of $V_{BN}$ in relation to the rms value <sup>(1)</sup>
0x0452	1107	R	10	%	INT16U	0–1000	H	Total harmonic distortion of $V_{CN}$ in relation to the rms value <sup>(1)</sup>
0x0453	1108	R	10	%	INT16U	0–1000	H	Total harmonic distortion of $I_A$ in relation to the rms value
0x0454	1109	R	10	%	INT16U	0–1000	H	Total harmonic distortion of $I_B$ in relation to the rms value
0x0455	1110	R	10	%	INT16U	0–1000	H	Total harmonic distortion of $I_C$ in relation to the rms value
0x0456	1111	R	10	%	INT16U	0–1000	H	Total harmonic distortion of $I_N$ in relation to the rms value <sup>(1)</sup> <sup>(2)</sup>
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								
(2) Measured with system type 41, calculated with system type 40.								

## Voltage-to-Current Phase Shift

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0457	1112	R	10	Deg	INT16U	0–3600	H	<ul style="list-style-type: none"> <li>Phase shift <math>V_{AB}/I_A</math> with system type 31</li> <li>Phase shift <math>V_{AN}/I_A</math> with system type 40 and 41</li> </ul>
0x0458	1113	R	10	Deg	INT16U	0–3600	H	<ul style="list-style-type: none"> <li>Phase shift <math>V_{BC}/I_B</math> with system type 31</li> <li>Phase shift <math>V_{BN}/I_B</math> with system type 40 and 41</li> </ul>
0x0459	1114	R	10	Deg	INT16U	0–3600	H	<ul style="list-style-type: none"> <li>Phase shift <math>V_{CA}/I_C</math> with system type 31</li> <li>Phase shift <math>V_{CN}/I_C</math> with system type 40 and 41</li> </ul>

## K-Factor

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x045A	1115	R	10	–	INT16U	0–1000	H	Phase A K-factor <sup>(2)</sup>
0x045B	1116	R	10	–	INT16U	0–1000	H	Phase B K-factor <sup>(2)</sup>
0x045C	1117	R	10	–	INT16U	0–1000	H	Phase C K-factor <sup>(2)</sup>
0x045D	1118	R	10	–	INT16U	0–1000	H	Neutral K-factor <sup>(1)</sup> <sup>(2)</sup>
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								
(2) Not applicable in 400 Hz nominal frequency system.								

## Peak Factor

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x045E	1119	R	100	–	INT16U	0–10000	H	V <sub>AB</sub> voltage peak factor <sup>(3)(4)</sup>
0x045F	1120	R	100	–	INT16U	0–10000	H	V <sub>BC</sub> voltage peak factor <sup>(3)(4)</sup>
0x0460	1121	R	100	–	INT16U	0–10000	H	V <sub>CA</sub> voltage peak factor <sup>(3)(4)</sup>
0x0461	1122	R	100	–	INT16U	0–10000	H	V <sub>AN</sub> voltage peak factor <sup>(1)</sup> <sup>(4)</sup>
0x0462	1123	R	100	–	INT16U	0–10000	H	V <sub>BN</sub> voltage peak factor <sup>(1)</sup> <sup>(4)</sup>
0x0463	1124	R	100	–	INT16U	0–10000	H	V <sub>CN</sub> voltage peak factor <sup>(1)</sup> <sup>(4)</sup>
0x0464	1125	R	100	–	INT16U	0–10000	H	Phase A current peak factor <sup>(4)</sup>
0x0465	1126	R	100	–	INT16U	0–10000	H	Phase B current peak factor <sup>(4)</sup>
0x0466	1127	R	100	–	INT16U	0–10000	H	Phase C current peak factor <sup>(4)</sup>
0x0467	1128	R	100	–	INT16U	0–10000	H	Neutral current peak factor <sup>(2)(4)</sup>
(1) Value is not available when the system type in register 3314 is 30 or 31. Refer to System Type, page 175.								
(2) Value is not available when the system type in register 3314 is 31 or 40. Refer to System Type, page 175.								
(3) Value is not available when the system type in register 3314 is 40 or 41. Refer to System Type, page 175.								
(4) Not applicable in 400 Hz nominal frequency system.								

## Voltage-to-Voltage Phase Shift

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x046C	1133	R	10	Deg	INT16U	0–3600	H	<ul style="list-style-type: none"> <li>Phase shift V<sub>AB</sub>/V<sub>AB</sub> with system type 31</li> <li>Phase shift V<sub>AN</sub>/V<sub>AN</sub> with system type 40 and 41</li> </ul> Always equal to 0.
0x046D	1134	R	10	Deg	INT16U	0–3600	H	<ul style="list-style-type: none"> <li>Phase shift V<sub>BC</sub>/V<sub>AB</sub> with system type 31</li> <li>Phase shift V<sub>BN</sub>/V<sub>AN</sub> with system type 40 and 41</li> </ul> Under phase balanced conditions, equals 240 degrees.
0x046E	1135	R	10	Deg	INT16U	0–3600	H	<ul style="list-style-type: none"> <li>Phase shift V<sub>CA</sub>/V<sub>AB</sub> with system type 31</li> <li>Phase shift V<sub>CN</sub>/V<sub>AN</sub> with system type 40 and 41</li> </ul> Under phase balanced conditions, equals 120 degrees.

# Minimum/Maximum Values of Real-Time Measurements

## Minimum/Maximum Measurements Rule

Minimum and maximum measurements take into account the relative value of real-time measurements. Therefore the following rule applies:

$-3800 < -400 < 0 < 200 < 600$ .

In this case:

- the minimum value = -3800
- the maximum value = 600

**NOTE:** This rule does not apply for the power factor (PF) and for the fundamental power factor ( $\cos\phi$ ):

- PFmax (or  $\cos\phi$  max.) is obtained for the smallest positive value of PF (or  $\cos\phi$ ).
- PFmin (or  $\cos\phi$  min.) is obtained for the highest negative value of PF (or  $\cos\phi$ ).

The reset minimum/maximum command (command code = 46728) can reset the content of the minimum/maximum real-time measurement registers.

## Minimum of Real-Time Measurements

Registers 1300 to 1599 hold the minimum values of real-time metering parameters:

- Available only with MicroLogic E,P, and H trip units.
- The register of the minimum value of a real-time metering parameter is equal to the register of the real-time metering parameter plus 300.

**Examples:**

- Register 1300 holds the minimum value of the phase-to-phase voltage  $V_{AB}$  (register 1000).
- Register 1316 holds the minimum value of the current on phase A (register 1016).
- The order of the registers is the same as that of the real-time metering variables.
- The scale factors of the minimum values are the same as those of the real-time metering parameters.
- The minimum values of arithmetic means and unbalance voltage (registers 1306–1315) and for unbalance current (registers 1327 to 1332) are not available with MicroLogic E trip units.

## Maximum of Real-Time Measurements

Registers 1600 to 1899 hold the maximum values of real-time metering parameters:

- Available only with MicroLogic E,P, and H trip units.
- The register of the maximum value of a real-time metering parameter is equal to the register of the real-time metering parameter plus 600.

**Examples:**

- Register 1600 holds the maximum value of the phase-to-phase voltage  $V_{AB}$  (register 1000).
- Register 1616 holds the maximum value of the current on phase A (register 1016).

- The order of the registers is the same as that of the real-time metering variables.
- The scale factors of the maximum values are the same as those of the real-time metering parameters.
- The maximum values of arithmetic means and unbalance voltage (registers 1606–1615) and for unbalance current (registers 1627 to 1632) are not available with MicroLogic E trip units.

## Energy Measurements

### General Description

Energy measurements include:

- active energy  $E_p$
- reactive energy  $E_q$
- apparent energy  $E_s$
- active energy counted positively ( $E_{pIn}$ ) or negatively ( $E_{pOut}$ ), according to the configuration of register 3316 , page 175
- reactive energy counted positively ( $E_{qIn}$ ) or negatively ( $E_{qOut}$ ), according to the configuration of register 3316 , page 175
- active energy and reactive energy are accumulated according to the configuration of register 3324 (absolute mode by factory setting) , page 176

The reset minimum/maximum command (command code = 46728) can reset the content of the energy measurement registers.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x07CF– 0x07D2	2000– 2003	R	1	kWh	MOD 10000	$-10^{16}$ to $+10^{16}$	E/P/H	Total active energy: $E_p$ <sup>(1)</sup>
0x07D3– 0x07D6	2004– 2007	R	1	kVARh	MOD 10000	$-10^{16}$ to $+10^{16}$	E/P/H	Total reactive energy: $E_q$ <sup>(1)</sup>
0x07D7– 0x07DA	2008– 2011	R	1	kWh	MOD 10000	$-10^{16}$ to $+10^{16}$	P/H	Active energy counted positively: $E_{pIn}$
0x07DB– 0x07DE	2012– 2015	R	1	kWh	MOD 10000	$-10^{16}$ to $+10^{16}$	P/H	Active energy counted negatively: $E_{pOut}$
0x07DF– 0x07E2	2016– 2019	R	1	kVARh	MOD 10000	$-10^{16}$ to $+10^{16}$	P/H	Reactive energy counted positively: $E_{qIn}$
0x07E3– 0x07E6	2020– 2023	R	1	kVARh	MOD 10000	$-10^{16}$ to $+10^{16}$	P/H	Reactive energy counted negatively: $E_{qOut}$
0x07E7– 0x07EA	2024– 2027	R	1	kVAh	MOD 10000	$-10^{16}$ to $+10^{16}$	E/P/H	Total apparent energy: $E_s$
(1) Total active energy and total reactive energy are always counted positively with MicroLogic E trip unit.								



**NOTE:**

- The MicroLogic E trip unit screen displays positive values (only) up to 999 999 kWh. Over this value, MicroLogic E trip unit screen displays 999 999 kWh.
- The MicroLogic P or H trip unit screen displays positive values up to 99 999 kWh. Over this value, MicroLogic P or H trip unit screen displays 0 and then 1 kWh.
- The MicroLogic P or H trip unit screen displays negative values up to -99 999 kWh. Over this value, MicroLogic P or H trip unit screen displays 0 and then -1 kWh.
- MOD10000 format is explained in the data type description, page 67.

The behavior is the same for reactive energy and apparent energy.

## Demand Measurements

### General Description

Demand registers include:

- current demand
- active, reactive, and apparent power demand

The window duration of current demand depends on the configuration of register 3352. Refer to [Demand Time](#), page 177.

The window duration and the window type of power demand depend on the configuration of registers 3354 and 3355. Refer to [Demand Time](#), page 177.

- For the block window, the demand value is updated at the end of the window.
- For the sliding window,
  - If window duration is configured for less or equal to 15 minutes, the demand value is updated every 15 seconds.
  - If window duration is configured for more than 15 minutes, the demand value is updated every 1 minute.

The reset minimum/maximum command (command code = 46728) can reset the content of the peak demand measurement registers.

### Current Demand

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0897	2200	R	1	A	INT16U	0–32767	E/P/H	Current demand on phase A: I <sub>A</sub> Dmd <sup>(2)</sup>
0x0898	2201	R	1	A	INT16U	0–32767	E/P/H	Current demand on phase B: I <sub>B</sub> Dmd <sup>(2)</sup>
0x0899	2202	R	1	A	INT16U	0–32767	E/P/H	Current demand on phase C: I <sub>C</sub> Dmd <sup>(2)</sup>
0x089A	2203	R	1	A	INT16U	0–32767	E/P/H	Current demand on the neutral: I <sub>N</sub> Dmd <sup>(1)</sup> <sup>(2)</sup>
0x089B	2204	R	1	A	INT16U	0–32767	E/P/H	Maximum current demand on phase A since the last reset: I <sub>A</sub> Peak Dmd
0x089C	2205	R	1	A	INT16U	0–32767	E/P/H	Maximum current demand on phase B since the last reset: I <sub>B</sub> Peak Dmd
0x089D	2206	R	1	A	INT16U	0–32767	E/P/H	Maximum current demand on phase C since the last reset: I <sub>C</sub> Peak Dmd
0x089E	2207	R	1	A	INT16U	0–32767	E/P/H	Maximum current demand on the neutral since the last reset: I <sub>N</sub> Peak Dmd <sup>(1)</sup>

(1) Value is not available when the system type in register 3314 is 31 or 40. Refer to [System Type](#), page 175.

(2) Only the thermal algorithm is available with MicroLogic E trip units while MicroLogic P/H trip units have both the thermal and arithmetical mean algorithms.

### K-Factor Demand

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x08A3	2212	R	10	–	INT16U	0–1000	H	K-factor demand on phase A
0x08A4	2213	R	10	–	INT16U	0–1000	H	K-factor demand on phase B
0x08A5	2214	R	10	–	INT16U	0–1000	H	K-factor demand on phase C
0x08A6	2215	R	10	–	INT16U	0–1000	H	K-factor demand on the neutral <sup>(1)</sup>
0x08A7	2216	R	10	–	INT16U	0–1000	H	Maximum K-factor demand on phase A since last reset

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x08A8	2217	R	10	–	INT16U	0–1000	H	Maximum K-factor demand on phase B since last reset
0x08A9	2218	R	10	–	INT16U	0–1000	H	Maximum K-factor demand on phase C since last reset
0x08AA	2219	R	10	–	INT16U	0–1000	H	Maximum K-factor demand on the neutral since last reset <sup>(1)</sup>

(1) Value is not available when the system type in register 3314 is 31 or 40. Refer to System Type, page 175.

## Active Power Demand

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x08AF	2224	R	1	kW	INT16U	0–32767	E/P/H	Total active power demand: P Dmd <sup>(1)</sup> <sub>(3)</sub>
0x08B0	2225	R	1	kW	INT16U	0–32767	E/P/H	Maximum total active power demand since the last reset: P Peak Dmd
0x08B1	2226	R	1	kW	INT16U	0–32767	P/H	Predicted active power demand at the end of the window <sup>(2)</sup>
0x08B2	2227	R	1000	–	INT16	-1000–+1000	P/H	Total power factor at last active power demand maximum
0x08B3	2228	R	1	kVAR	INT16U	0–32767	P/H	Reactive power demand at last active power demand maximum
0x08B4	2229	R	1	kVA	INT16U	0–32767	P/H	Apparent power demand at last active power demand maximum

(1) For the block window type, this value is updated at the end of the window interval. For the sliding window type, the value is updated every 15 seconds.

(2) Value is updated every 15 seconds for both block window and sliding window types.

(3) Only the thermal algorithm is available with MicroLogic E trip units while MicroLogic P/H trip units have both the thermal and arithmetical mean algorithms.

## Reactive Power Demand

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x08B5	2230	R	1	kVAR	INT16U	0–32767	P/H	Total reactive power demand: Q Dmd <sup>(1)</sup>
0x08B6	2231	R	1	kVAR	INT16U	0–32767	P/H	Reactive power demand maximum since the last reset: Q Peak Dmd
0x08B7	2232	R	1	kVAR	INT16U	0–32767	P/H	Predicted reactive power demand at the end of the window <sup>(2)</sup>
0x08B8	2233	R	1000	–	INT16	-1000–+1000	P/H	Total power factor at last reactive power demand maximum
0x08B9	2234	R	1	kW	INT16U	0–32767	P/H	Active power demand at last reactive power demand maximum
0x08BA	2235	R	1	kVA	INT16U	0–32767	P/H	Apparent power demand at last reactive power demand maximum

(1) For the block window type, this value is updated at the end of the window interval. For the sliding window type, the value is updated every 15 seconds.

(2) Value is updated every 15 seconds for both block window and sliding window types.

## Apparent Power Demand

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x08BB	2236	R	1	kVA	INT16U	0–32767	E/P/H	Total apparent power demand: S Dmd <sup>(1)</sup>
0x08BC	2237	R	1	kVA	INT16U	0–32767	E/P/H	Maximum total apparent power demand since last reset: S Peak Dmd
0x08BD	2238	R	1	kVA	INT16U	0–32767	P/H	Predicted apparent power demand at the end of the window <sup>(2)</sup>
0x08BE	2239	R	1000	–	INT16	-1000– +1000	P/H	Total power factor at last apparent power demand maximum
0x08BF	2240	R	1	kW	INT16U	0–32767	P/H	Active power demand at last apparent power demand maximum
0x08C0	2241	R	1	kVAR	INT16U	0–32767	P/H	Reactive power demand at last apparent power demand maximum
<p>(1) For the block window type, this value is updated at the end of the window interval. For the sliding window type, the value is updated every 15 seconds.</p> <p>(2) Value is updated every 15 seconds for both block window and sliding window types.</p>								

# Spectral Components

## Overview

Parity	Spectral Component	Addresses	Registers
Odd rank	Amplitude of voltage harmonic	0x1003–0x105C	4100–4189
	Amplitude of current harmonic	0x105D–0x1098	4190–4249
	Phase of voltage harmonic	0x1099–0x10AA	4250–4267
	Phase of current harmonic	0x10F3–0x1102	4340–4355
Even rank	Amplitude of voltage harmonic	0x112F–0x1188	4400–4489
	Amplitude of current harmonic	0x1189–0x11C4	4490–4549
	Phase of voltage harmonic	0x11C5–0x11D6	4550–4567
	Phase of current harmonic	0x121F–0x122E	4640–4655

Only the registers of the odd rank harmonics are detailed:

- The registers of the even rank harmonics (n) are equal to the registers of the odd rank harmonics (n+1) plus 300.
- The order of the even rank registers is the same as that of the odd rank registers.
- The scale factor of the even rank registers is the same as that of the odd rank registers.

## Amplitude of Odd Rank Voltage Harmonic

The amplitude of odd rank voltage harmonic is expressed as a ratio in % to the amplitude of the fundamental (not applicable in 400 Hz nominal frequency system):

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1003	4100	R	10	%	INT16U	0–1200	H	Harmonic 3 of $V_{AB}$
0x1004	4101	R	10	%	INT16U	0–1200	H	Harmonic 3 of $V_{BC}$
0x1005	4102	R	10	%	INT16U	0–1200	H	Harmonic 3 of $V_{CA}$
0x1006	4103	R	10	%	INT16U	0–1200	H	Harmonic 3 of $V_{AN}$ <sup>(1)</sup>
0x1007	4104	R	10	%	INT16U	0–1200	H	Harmonic 3 of $V_{BN}$ <sup>(1)</sup>
0x1008	4105	R	10	%	INT16U	0–1200	H	Harmonic 3 of $V_{CN}$ <sup>(1)</sup>
0x1009	4106	R	10	%	INT16U	0–1200	H	Harmonic 5 of $V_{AB}$
0x100A	4107	R	10	%	INT16U	0–1200	H	Harmonic 5 of $V_{BC}$
0x100B	4108	R	10	%	INT16U	0–1200	H	Harmonic 5 of $V_{CA}$
0x100C	4109	R	10	%	INT16U	0–1200	H	Harmonic 5 of $V_{AN}$ <sup>(1)</sup>
0x100D	4110	R	10	%	INT16U	0–1200	H	Harmonic 5 of $V_{BN}$ <sup>(1)</sup>
0x100E	4111	R	10	%	INT16U	0–1200	H	Harmonic 5 of $V_{CN}$
0x100F	4112	R	10	%	INT16U	0–1200	H	Harmonic 7 of $V_{AB}$
0x1010	4113	R	10	%	INT16U	0–1200	H	Harmonic 7 of $V_{BC}$
0x1011	4114	R	10	%	INT16U	0–1200	H	Harmonic 7 of $V_{CA}$
0x1012	4115	R	10	%	INT16U	0–1200	H	Harmonic 7 of $V_{AN}$ <sup>(1)</sup>
0x1013	4116	R	10	%	INT16U	0–1200	H	Harmonic 7 of $V_{BN}$ <sup>(1)</sup>
0x1014	4117	R	10	%	INT16U	0–1200	H	Harmonic 7 of $V_{CN}$ <sup>(1)</sup>
0x1015	4118	R	10	%	INT16U	0–1200	H	Harmonic 9 of $V_{AB}$

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1016	4119	R	10	%	INT16U	0–1200	H	Harmonic 9 of V <sub>BC</sub>
0x1017	4120	R	10	%	INT16U	0–1200	H	Harmonic 9 of V <sub>CA</sub>
0x1018	4121	R	10	%	INT16U	0–1200	H	Harmonic 9 of V <sub>AN</sub> <sup>(1)</sup>
0x1019	4122	R	10	%	INT16U	0–1200	H	Harmonic 9 of V <sub>BN</sub> <sup>(1)</sup>
0x101A	4123	R	10	%	INT16U	0–1200	H	Harmonic 9 of V <sub>CN</sub> <sup>(1)</sup>
0x101B	4124	R	10	%	INT16U	0–1200	H	Harmonic 11 of V <sub>AB</sub>
0x101C	4125	R	10	%	INT16U	0–1200	H	Harmonic 11 of V <sub>BC</sub>
0x101D	4126	R	10	%	INT16U	0–1200	H	Harmonic 11 of V <sub>CA</sub>
0x101E	4127	R	10	%	INT16U	0–1200	H	Harmonic 11 of V <sub>AN</sub> <sup>(1)</sup>
0x101F	4128	R	10	%	INT16U	0–1200	H	Harmonic 11 of V <sub>BN</sub> <sup>(1)</sup>
0x1020	4129	R	10	%	INT16U	0–1200	H	Harmonic 11 of V <sub>CN</sub> <sup>(1)</sup>
0x1021	4130	R	10	%	INT16U	0–1200	H	Harmonic 13 of V <sub>AB</sub>
0x1022	4131	R	10	%	INT16U	0–1200	H	Harmonic 13 of V <sub>BC</sub>
0x1023	4132	R	10	%	INT16U	0–1200	H	Harmonic 13 of V <sub>CA</sub>
0x1024	4133	R	10	%	INT16U	0–1200	H	Harmonic 13 of V <sub>AN</sub> <sup>(1)</sup>
0x1025	4134	R	10	%	INT16U	0–1200	H	Harmonic 13 of V <sub>BN</sub> <sup>(1)</sup>
0x1026	4135	R	10	%	INT16U	0–1200	H	Harmonic 13 of V <sub>CN</sub> <sup>(1)</sup>
0x1027	4136	R	10	%	INT16U	0–1200	H	Harmonic 15 of V <sub>AB</sub>
0x1028	4137	R	10	%	INT16U	0–1200	H	Harmonic 15 of V <sub>BC</sub>
0x1029	4138	R	10	%	INT16U	0–1200	H	Harmonic 15 of V <sub>CA</sub>
0x102A	4139	R	10	%	INT16U	0–1200	H	Harmonic 15 of V <sub>AN</sub> <sup>(1)</sup>
0x102B	4140	R	10	%	INT16U	0–1200	H	Harmonic 15 of V <sub>BN</sub> <sup>(1)</sup>
0x102C	4141	R	10	%	INT16U	0–1200	H	Harmonic 15 of V <sub>CN</sub> <sup>(1)</sup>
0x102D	4142	R	10	%	INT16U	0–1200	H	Harmonic 17 of V <sub>AB</sub>
0x102E	4143	R	10	%	INT16U	0–1200	H	Harmonic 17 of V <sub>BC</sub>
0x102F	4144	R	10	%	INT16U	0–1200	H	Harmonic 17 of V <sub>CA</sub>
0x1030	4145	R	10	%	INT16U	0–1200	H	Harmonic 17 of V <sub>AN</sub> <sup>(1)</sup>
0x1031	4146	R	10	%	INT16U	0–1200	H	Harmonic 17 of V <sub>BN</sub> <sup>(1)</sup>
0x1032	4147	R	10	%	INT16U	0–1200	H	Harmonic 17 of V <sub>CN</sub> <sup>(1)</sup>
0x1033	4148	R	10	%	INT16U	0–1200	H	Harmonic 19 of V <sub>AB</sub>
0x1034	4149	R	10	%	INT16U	0–1200	H	Harmonic 19 of V <sub>BC</sub>
0x1035	4150	R	10	%	INT16U	0–1200	H	Harmonic 19 of V <sub>CA</sub>
0x1036	4151	R	10	%	INT16U	0–1200	H	Harmonic 19 of V <sub>AN</sub> <sup>(1)</sup>
0x1037	4152	R	10	%	INT16U	0–1200	H	Harmonic 19 of V <sub>BN</sub> <sup>(1)</sup>
0x1038	4153	R	10	%	INT16U	0–1200	H	Harmonic 19 of V <sub>CN</sub> <sup>(1)</sup>
0x1039	4154	R	10	%	INT16U	0–1200	H	Harmonic 21 of V <sub>AB</sub>
0x103A	4155	R	10	%	INT16U	0–1200	H	Harmonic 21 of V <sub>BC</sub>
0x103B	4156	R	10	%	INT16U	0–1200	H	Harmonic 21 of V <sub>CA</sub>
0x103C	4157	R	10	%	INT16U	0–1200	H	Harmonic 21 of V <sub>AN</sub> <sup>(1)</sup>
0x103D	4158	R	10	%	INT16U	0–1200	H	Harmonic 21 of V <sub>BN</sub> <sup>(1)</sup>
0x103E	4159	R	10	%	INT16U	0–1200	H	Harmonic 21 of V <sub>CN</sub> <sup>(1)</sup>
0x103F	4160	R	10	%	INT16U	0–1200	H	Harmonic 23 of V <sub>AB</sub>
0x1040	4161	R	10	%	INT16U	0–1200	H	Harmonic 23 of V <sub>BC</sub>
0x1041	4162	R	10	%	INT16U	0–1200	H	Harmonic 23 of V <sub>CA</sub>

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1042	4163	R	10	%	INT16U	0–1200	H	Harmonic 23 of $V_{AN}$ <sup>(1)</sup>
0x1043	4164	R	10	%	INT16U	0–1200	H	Harmonic 23 of $V_{BN}$ <sup>(1)</sup>
0x1044	4165	R	10	%	INT16U	0–1200	H	Harmonic 23 of $V_{CN}$ <sup>(1)</sup>
0x1045	4166	R	10	%	INT16U	0–1200	H	Harmonic 25 of $V_{AB}$
0x1046	4167	R	10	%	INT16U	0–1200	H	Harmonic 25 of $V_{BC}$
0x1047	4168	R	10	%	INT16U	0–1200	H	Harmonic 25 of $V_{CA}$
0x1048	4169	R	10	%	INT16U	0–1200	H	Harmonic 25 of $V_{AN}$ <sup>(1)</sup>
0x1049	4170	R	10	%	INT16U	0–1200	H	Harmonic 25 of $V_{BN}$ <sup>(1)</sup>
0x104A	4171	R	10	%	INT16U	0–1200	H	Harmonic 25 of $V_{CN}$ <sup>(1)</sup>
0x104B	4172	R	10	%	INT16U	0–1200	H	Harmonic 27 of $V_{AB}$
0x104C	4173	R	10	%	INT16U	0–1200	H	Harmonic 27 of $V_{BC}$
0x104D	4174	R	10	%	INT16U	0–1200	H	Harmonic 27 of $V_{CA}$
0x104E	4175	R	10	%	INT16U	0–1200	H	Harmonic 27 of $V_{AN}$ <sup>(1)</sup>
0x104F	4176	R	10	%	INT16U	0–1200	H	Harmonic 27 of $V_{BN}$ <sup>(1)</sup>
0x1050	4177	R	10	%	INT16U	0–1200	H	Harmonic 27 of $V_{CN}$ <sup>(1)</sup>
0x1051	4178	R	10	%	INT16U	0–1200	H	Harmonic 29 of $V_{AB}$
0x1052	4179	R	10	%	INT16U	0–1200	H	Harmonic 29 of $V_{BC}$
0x1053	4180	R	10	%	INT16U	0–1200	H	Harmonic 29 of $V_{CA}$
0x1054	4181	R	10	%	INT16U	0–1200	H	Harmonic 29 of $V_{AN}$ <sup>(1)</sup>
0x1055	4182	R	10	%	INT16U	0–1200	H	Harmonic 29 of $V_{BN}$ <sup>(1)</sup>
0x1056	4183	R	10	%	INT16U	0–1200	H	Harmonic 29 of $V_{CN}$ <sup>(1)</sup>
0x1057	4184	R	10	%	INT16U	0–1200	H	Harmonic 31 of $V_{AB}$
0x1058	4185	R	10	%	INT16U	0–1200	H	Harmonic 31 of $V_{BC}$
0x1059	4186	R	10	%	INT16U	0–1200	H	Harmonic 31 of $V_{CA}$
0x105A	4187	R	10	%	INT16U	0–1200	H	Harmonic 31 of $V_{AN}$ <sup>(1)</sup>
0x105B	4188	R	10	%	INT16U	0–1200	H	Harmonic 31 of $V_{BN}$ <sup>(1)</sup>
0x105C	4189	R	10	%	INT16U	0–1200	H	Harmonic 31 of $V_{CN}$ <sup>(1)</sup>
(1) Value is not available when the system type in register 3314 is 31. Refer to System Type, page 175.								

## Amplitude of Odd Rank Current Harmonic

The amplitude of odd rank current harmonic is expressed as a ratio in % to the amplitude of the fundamental (not applicable in 400 Hz nominal frequency system):

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x105D	4190	R	10	%	INT16U	0–32767	H	Harmonic 3 of $I_A$
0x105E	4191	R	10	%	INT16U	0–32767	H	Harmonic 3 of $I_B$
0x105F	4192	R	10	%	INT16U	0–32767	H	Harmonic 3 of $I_C$
0x1060	4193	R	10	%	INT16U	0–32767	H	Harmonic 3 of $I_N$ <sup>(1)</sup>
0x1061	4194	R	10	%	INT16U	0–32767	H	Harmonic 5 of $I_A$
0x1062	4195	R	10	%	INT16U	0–32767	H	Harmonic 5 of $I_B$
0x1063	4196	R	10	%	INT16U	0–32767	H	Harmonic 5 of $I_C$
0x1064	4197	R	10	%	INT16U	0–32767	H	Harmonic 5 of $I_N$ <sup>(1)</sup>
0x1065	4198	R	10	%	INT16U	0–32767	H	Harmonic 7 of $I_A$

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1066	4199	R	10	%	INT16U	0–32767	H	Harmonic 7 of I <sub>B</sub>
0x1067	4200	R	10	%	INT16U	0–32767	H	Harmonic 7 of I <sub>C</sub>
0x1068	4201	R	10	%	INT16U	0–32767	H	Harmonic 7 of I <sub>N</sub> <sup>(1)</sup>
0x1069	4202	R	10	%	INT16U	0–32767	H	Harmonic 9 of I <sub>A</sub>
0x106A	4203	R	10	%	INT16U	0–32767	H	Harmonic 9 of I <sub>B</sub>
0x106B	4204	R	10	%	INT16U	0–32767	H	Harmonic 9 of I <sub>C</sub>
0x106C	4205	R	10	%	INT16U	0–32767	H	Harmonic 9 of I <sub>N</sub> <sup>(1)</sup>
0x106D	4206	R	10	%	INT16U	0–32767	H	Harmonic 11 of I <sub>A</sub>
0x106E	4207	R	10	%	INT16U	0–32767	H	Harmonic 11 of I <sub>B</sub>
0x106F	4208	R	10	%	INT16U	0–32767	H	Harmonic 11 of I <sub>C</sub>
0x1070	4209	R	10	%	INT16U	0–32767	H	Harmonic 11 of I <sub>N</sub> <sup>(1)</sup>
0x1071	4210	R	10	%	INT16U	0–32767	H	Harmonic 13 of I <sub>A</sub>
0x1072	4211	R	10	%	INT16U	0–32767	H	Harmonic 13 of I <sub>B</sub>
0x1073	4212	R	10	%	INT16U	0–32767	H	Harmonic 13 of I <sub>C</sub>
0x1074	4213	R	10	%	INT16U	0–32767	H	Harmonic 13 of I <sub>N</sub> <sup>(1)</sup>
0x1075	4214	R	10	%	INT16U	0–32767	H	Harmonic 15 of I <sub>A</sub>
0x1076	4215	R	10	%	INT16U	0–32767	H	Harmonic 15 of I <sub>B</sub>
0x1077	4216	R	10	%	INT16U	0–32767	H	Harmonic 15 of I <sub>C</sub>
0x1078	4217	R	10	%	INT16U	0–32767	H	Harmonic 15 of I <sub>N</sub> <sup>(1)</sup>
0x1079	4218	R	10	%	INT16U	0–32767	H	Harmonic 17 of I <sub>A</sub>
0x107A	4219	R	10	%	INT16U	0–32767	H	Harmonic 17 of I <sub>B</sub>
0x107B	4220	R	10	%	INT16U	0–32767	H	Harmonic 17 of I <sub>C</sub>
0x107C	4221	R	10	%	INT16U	0–32767	H	Harmonic 17 of I <sub>N</sub> <sup>(1)</sup>
0x107D	4222	R	10	%	INT16U	0–32767	H	Harmonic 19 of I <sub>A</sub>
0x107E	4223	R	10	%	INT16U	0–32767	H	Harmonic 19 of I <sub>B</sub>
0x107F	4224	R	10	%	INT16U	0–32767	H	Harmonic 19 of I <sub>C</sub>
0x1080	4225	R	10	%	INT16U	0–32767	H	Harmonic 19 of I <sub>N</sub> <sup>(1)</sup>
0x1081	4226	R	10	%	INT16U	0–32767	H	Harmonic 21 of I <sub>A</sub>
0x1082	4227	R	10	%	INT16U	0–32767	H	Harmonic 21 of I <sub>B</sub>
0x1083	4228	R	10	%	INT16U	0–32767	H	Harmonic 21 of I <sub>C</sub>
0x1084	4229	R	10	%	INT16U	0–32767	H	Harmonic 21 of I <sub>N</sub> <sup>(1)</sup>
0x1085	4230	R	10	%	INT16U	0–32767	H	Harmonic 23 of I <sub>A</sub>
0x1086	4231	R	10	%	INT16U	0–32767	H	Harmonic 23 of I <sub>B</sub>
0x1087	4232	R	10	%	INT16U	0–32767	H	Harmonic 23 of I <sub>C</sub>
0x1088	4233	R	10	%	INT16U	0–32767	H	Harmonic 23 of I <sub>N</sub> <sup>(1)</sup>
0x1089	4234	R	10	%	INT16U	0–32767	H	Harmonic 25 of I <sub>A</sub>
0x108A	4235	R	10	%	INT16U	0–32767	H	Harmonic 25 of I <sub>B</sub>
0x108B	4236	R	10	%	INT16U	0–32767	H	Harmonic 25 of I <sub>C</sub>
0x108C	4237	R	10	%	INT16U	0–32767	H	Harmonic 25 of I <sub>N</sub> <sup>(1)</sup>
0x108D	4238	R	10	%	INT16U	0–32767	H	Harmonic 27 of I <sub>A</sub>
0x108E	4239	R	10	%	INT16U	0–32767	H	Harmonic 27 of I <sub>B</sub>
0x108F	4240	R	10	%	INT16U	0–32767	H	Harmonic 27 of I <sub>C</sub>
0x1090	4241	R	10	%	INT16U	0–32767	H	Harmonic 27 of I <sub>N</sub> <sup>(1)</sup>
0x1091	4242	R	10	%	INT16U	0–32767	H	Harmonic 29 of I <sub>A</sub>
0x1092	4243	R	10	%	INT16U	0–32767	H	Harmonic 29 of I <sub>B</sub>



Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1093	4244	R	10	%	INT16U	0–32767	H	Harmonic 29 of I <sub>C</sub>
0x1094	4245	R	10	%	INT16U	0–32767	H	Harmonic 29 of I <sub>N</sub> <sup>(1)</sup>
0x1095	4246	R	10	%	INT16U	0–32767	H	Harmonic 31 of I <sub>A</sub>
0x1096	4247	R	10	%	INT16U	0–32767	H	Harmonic 31 of I <sub>B</sub>
0x1097	4248	R	10	%	INT16U	0–32767	H	Harmonic 31 of I <sub>C</sub>
0x1098	4249	R	10	%	INT16U	0–32767	H	Harmonic 31 of I <sub>N</sub> <sup>(1)</sup>

(1) Value is not available when the system type in register 3314 is 31. Refer to System Type, page 175.

## Phase of Odd Rank Voltage Harmonic

These registers contain the odd rank voltage harmonic phase value (not applicable in 400 Hz nominal frequency system):

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1099	4250	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 3 of V <sub>AB</sub>
0x109A	4251	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 3 of V <sub>BC</sub>
0x109B	4252	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 3 of V <sub>CA</sub>
0x109C	4253	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 3 of V <sub>AN</sub> <sup>(1)</sup>
0x109D	4254	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 3 of V <sub>BN</sub> <sup>(1)</sup>
0x109E	4255	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 3 of V <sub>CN</sub> <sup>(1)</sup>
0x109F	4256	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 5 of V <sub>AB</sub>
0x10A0	4257	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 5 of V <sub>BC</sub>
0x10A1	4258	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 5 of V <sub>CA</sub>
0x10A2	4259	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 5 of V <sub>AN</sub> <sup>(1)</sup>
0x10A3	4260	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 5 of V <sub>BN</sub> <sup>(1)</sup>
0x10A4	4261	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 5 of V <sub>CN</sub> <sup>(1)</sup>
0x10A5	4262	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 7 of V <sub>AB</sub>
0x10A6	4263	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 7 of V <sub>BC</sub>
0x10A7	4264	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 7 of V <sub>CA</sub>
0x10A8	4265	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 7 of V <sub>AN</sub> <sup>(1)</sup>
0x10A9	4266	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 7 of V <sub>BN</sub> <sup>(1)</sup>
0x10AA	4267	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 7 of V <sub>CN</sub> <sup>(1)</sup>

(1) Value is not available when the system type in register 3314 is 31. Refer to System Type, page 175.

## Phase of Odd Rank Current Harmonic

These registers contain the odd rank current harmonic phase value (not applicable in 400 Hz nominal frequency system):

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x10F3	4340	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 3 of I <sub>A</sub>
0x10F4	4341	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 3 of I <sub>B</sub>
0x10F5	4342	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 3 of I <sub>C</sub>
0x10F6	4343	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 3 of I <sub>N</sub> <sup>(1)</sup>

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x10F7	4344	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 5 of I <sub>A</sub>
0x10F8	4345	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 5 of I <sub>B</sub>
0x10F9	4346	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 5 of I <sub>C</sub>
0x10FA	4347	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 5 of I <sub>N</sub> <sup>(1)</sup>
0x10FB	4348	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 7 of I <sub>A</sub>
0x10FC	4349	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 7 of I <sub>B</sub>
0x10FD	4350	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 7 of I <sub>C</sub>
0x10FE	4351	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 7 of I <sub>N</sub> <sup>(1)</sup>
0x10FF	4352	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 9 of I <sub>A</sub>
0x1100	4353	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 9 of I <sub>B</sub>
0x1101	4354	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 9 of I <sub>C</sub>
0x1102	4355	R	10	Deg	INT16U	0–3600	H	Phase of harmonic 9 of I <sub>N</sub> <sup>(1)</sup>

(1) Value is not available when the system type in register 3314 is 31. Refer to System Type, page 175.

# MicroLogic Trip Unit Identification

## Identification of the Metering Manager

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0CE6– 0x0CE7	3303– 3304	RW	–	–	OCTET STRING	0x00–0x7F	P/H	Short identifier of the metering manager, coded over 4 ASCII characters.  Factory setting: ' <b>set!</b> '
0x0CE8– 0x0CEF	3305– 3312	RW	–	–	OCTET STRING	0x00–0x7F	P/H	Long identifier of the metering manager, coded over 16 ASCII characters.  Factory setting: ' <b>please set me up</b> '

## Serial Number

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x21FB– 0x21FE	8700–8703	R	1	–	OCTET STRING	–	A/E/P/H	Serial number encoded in ASCII

## Hardware Version

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2204	8709	R	–	–	INT16U	0x0000– 0xFFFF	P/H	Hardware version of the MicroLogic trip unit.

## Firmware Version

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2205	8710	R	1	–	INT16	–	A/E/P/H	MicroLogic trip unit firmware version.  For example, the value 8244 corresponds to version 8.244.

## Product Identification

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x220B	8716	R	1	–	INT16U	15133–15137	A/E/P/H	Product identification with the protection manager:  15131 = MicroLogic A  15137 = MicroLogic E  15133 = MicroLogic P  15135 = MicroLogic H
0x0EE7	3816	R	1	–	INT16U	15134–15138	E/P/H	Product identification with the metering manager:  15138 = MicroLogic E  15134 = MicroLogic P  15136 = MicroLogic H

## Protection Type

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2223	8740	R	1	–	OCTET STRING	20–70	A/E/P/H	Type of protection:  '20' = MicroLogic 2.0  '30' = MicroLogic 3.0  '40' = MicroLogic 4.0  '50' = MicroLogic 5.0  '60' = MicroLogic 6.0  '70' = MicroLogic 7.0

## Metering Type

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2224	8741	R	1	–	OCTET STRING	0x2041–0x204D	A/E/P/H	Type of measurement:  0x2041 = 'space' and 'A'  0x2045 = 'space' and 'E'  0x2050 = 'space' and 'P'  0x2048 = 'space' and 'H'  Or type of application:  0x204D = 'space' and 'M'

## Long-Time Rating Plug

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2225	8742	R	1	–	INT16U	0–15	A/E/P/H	Type of long-time rating plug:  0 = missing 1 = IEC standard 2 = IEC low 3 = IEC High 7 = UL-A 8 = UL-B 9 = UL-C 10 = OFF 11 = UL-D 12 = UL-E 13 = UL-F 14 = UL-G 15 = UL-H

## Identification of the Protection Manager

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2583– 0x2584	9604– 9605	RW	–	–	OCTET STRING	–	P/H	Short identifier of the protection manager, coded over 4 ASCII characters.  Factory setting: <b>'set!'</b>
0x2585– 0x258C	9606– 9613	RW	–	–	OCTET STRING	–	P/H	Long identifier of the protection manager, coded over 16 ASCII characters.  Factory setting: <b>'please set me up'</b>

## Circuit Breaker Type

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2591	9618	RW	–	–	INT16U	0–2	P/H	0 = 3-pole circuit breaker without external neutral current transformer (factory setting)  1 = 4-pole circuit breaker  2 = 3-pole circuit breaker with external neutral current transformer

## Circuit Breaker Characteristics

The characteristics can be:

- set by using the MicroLogic HMI in **MicroLogic setup > Breaker selection**
- downloaded by using the test kit

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2675	9846	R	–	–	INT16U	0–3	P/H	Standard:  0 = UL 1 = IEC 2 = ANSI 3 = IEC/GB
0x2676	9847	R	–	–	INT16U	0–2	P/H	Type:  0 = MasterPact 1 = PowerPact P- or R-frame 2 = PowerPact
0x2677– 0x267C	9848– 9853	R	–	–	OCTET STRING	–	P/H	ASCII character strings (for example, 'NT08N')

## Status

### Predefined Alarms Status

The predefined alarms status register indicates the current status of the alarms:

- alarm bit = 0: alarm is not active.
- alarm bit = 1: alarm is active.

The following table details the values for each bit of the alarm status registers:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x1643	5700	R	–	–	INT16U	–	H	–	Predefined alarms status
								0	Predefined alarm 48
								1	Predefined alarm 49
								2	Predefined alarm 50
								3	Predefined alarm 51
								4	Predefined alarm 52
								5	Predefined alarm 53
								6	Predefined alarm 54
								7	Predefined alarm 55
								8	Predefined alarm 56
								9	Predefined alarm 57
								10	Predefined alarm 58
								11	Predefined alarm 59
								12	Predefined alarm 60
								13	Predefined alarm 61
								14	Predefined alarm 62
								15	Predefined alarm 63
0x1644	5701	R	–	–	INT16U	–	H	–	Predefined alarms status
								0	Predefined alarm 32
								1	Predefined alarm 33
								2	Predefined alarm 34
								3	Predefined alarm 35
								4	Predefined alarm 36
								5	Predefined alarm 37
								6	Predefined alarm 38
								7	Predefined alarm 39
								8	Predefined alarm 40
								9	Predefined alarm 41
								10	Predefined alarm 42
								11	Predefined alarm 43
								12	Predefined alarm 44
								13	Predefined alarm 45
								14	Predefined alarm 46
								15	Predefined alarm 47
0x1645	5702	R	–	–	INT16U	–	H	–	Predefined alarms status
								0	Predefined alarm 16
								1	Predefined alarm 17
								2	Predefined alarm 18

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
								3	Predefined alarm 19
								4	Predefined alarm 20
								5	Predefined alarm 21
								6	Predefined alarm 22
								7	Predefined alarm 23
								8	Predefined alarm 24
								9	Predefined alarm 25
								10	Predefined alarm 26
								11	Predefined alarm 27
								12	Predefined alarm 28
								13	Predefined alarm 29
								14	Predefined alarm 30
								15	Predefined alarm 31
0x1646	5703	R	–	–	INT16U	–	H	–	Predefined alarms status
								0	Predefined alarm 0
								1	Predefined alarm 1
								2	Predefined alarm 2
								3	Predefined alarm 3
								4	Predefined alarm 4
								5	Predefined alarm 5
								6	Predefined alarm 6
								7	Predefined alarm 7
								8	Predefined alarm 8
								9	Predefined alarm 9
								10	Predefined alarm 10
								11	Predefined alarm 11
								12	Predefined alarm 12
								13	Predefined alarm 13
								14	Predefined alarm 14
								15	Predefined alarm 15

## M2C/M6C Programmable Contacts Status

The M2C/M6C status register indicates the status of the programmable contacts:

- status bit = 0: the contact is open.
- status bit = 1: the contact is closed.

The contact statuses are automatically updated, a reset is not possible.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x2298	8857	R	–	–	INT16U	–	E/P/H	0	Contact 1 status
							E/P/H	1	Contact 2 status
							P/H	2	Contact 3 status
							P/H	3	Contact 4 status
							P/H	4	Contact 5 status
							P/H	5	Contact 6 status
							–	6–15	Reserved



## Protection Status

The following table details the values for each bit of protection pick-up value registers:

- protection status bit = 0: protection pick-up value is not overrun.
- protection status bit = 1: protection pick-up value is overrun, even if the time delay has not expired.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x229D	8862	R	–	–	INT16U	–	E/P/H	0	Long-time protection status
								1–15	Reserved
0x229E	8863	R	–	–	INT16U	–	P/H	0	Current-unbalance status
								1	Maximum current status on phase A
								2	Maximum current status on phase B
								3	Maximum current status on phase C
								4	Maximum current status on the neutral
								5	Minimum voltage status
								6	Maximum voltage status
								7	Voltage unbalance status
								8	Maximum power status
								9	Reverse power status
								10	Minimum frequency status
								11	Maximum frequency status
								12	Phase rotation status
								13	Load shedding based on current status
								14	Load shedding based on power status
								15	Reserved
0x229F	8864	R	–	–	INT16U	–	E/P/H	0	Ground-fault alarm status
							P/H	1	Earth-leakage alarm status
							–	2–15	Reserved

# Alarm History

## General Description

The alarm history registers describe the last ten encountered alarms. The alarm history format corresponds to a series of ten records saved in a FIFO (first in first out) stack. The last record erases the oldest. Each record is composed of 15 registers describing one alarm.

Register 9300 returns the number of alarms recorded in the alarm history (FIFO). Register 9301 returns the value of the pointer for the last alarm recorded in the alarm history.

### Example:

If the register 9300 = 10 and the register 9301 = 3, then the last alarm recorded is the alarm record 3.

In this case, the last but one is the alarm record 2.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2453	9300	R	–	–	INT16U	0–10	P/H	Number of alarms recorded in the alarm history (FIFO)
0x2454	9301	R	–	–	INT16U	0–9	P/H	Value of the pointer for last alarm recorded in the alarm history

## Record Number

A read request of 15x(n) registers is necessary to read n alarm records, where 15 is the number of registers for each trip record.

For example, a read request of 15x3 = 45 registers is necessary to read 3 alarm records of the alarm history:

- The first 15 registers describe the first alarm record.
- The next 15 registers describe the second alarm record.
- The last 15 registers describe the third alarm record.

Address	Register	Description
0x2455–0x2463	9302–9316	Alarm record 0
0x2464–0x2472	9317–9331	Alarm record 1
0x2473–0x2481	9332–9346	Alarm record 2
0x2482–0x2490	9347–9361	Alarm record 3
0x2491–0x249F	9362–9376	Alarm record 4
0x24A0–0x24AE	9377–9391	Alarm record 5
0x24AF–0x24BD	9392–9406	Alarm record 6
0x24BE–0x24CC	9407–9421	Alarm record 7
0x24CD–0x24DB	9422–9436	Alarm record 8
0x24DC–0x24EA	9437–9451	Alarm record 9

## Alarm Record

A read request of 15 registers is necessary to read an alarm record.

The order and the description of the alarms record registers are the same as that of the alarm record 0:

Alarm Record 0								
Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2455–0x2458	9302–9305	R	–	–	XDATE	–	P/H	Alarm date
0x2459	9306	R	–	–	INT16U	–	P/H	Alarm code
0x245A–0x245B	9307–9308	R	–	–	MOD 10000	–	P/H	Value of protection setting that caused alarm activation
0x245C	9309	R	–	–	INT16U	–	P/H	Value of time delay that caused alarm activation
0x245D	9310	R	–	–	INT16U	0–16000	P/H	Alarm current phase A <sup>(1)</sup>
0x245E	9311	R	–	–	INT16U	0–16000	P/H	Alarm current phase B <sup>(1)</sup>
0x245F	9312	R	–	–	INT16U	0–16000	P/H	Alarm current phase C <sup>(1)</sup>
0x2460	9313	R	–	–	INT16U	0–16000	P/H	Alarm current neutral <sup>(1)</sup>
0x2461–0x2462	9314–9315	R	–	–	–	–	P/H	Additional information depending on type of the alarm
0x2463	9316	–	–	–	–	–	–	Reserved
(1) Expressed as x 0.1 of I <sub>n</sub> (rated current).								

## Alarm Codes

Alarm Code	Description
1013 (0x03F5)	Long-time protection alarm
1014 (0x03F6)	Ground-fault protection alarm
1015 (0x03F7)	Earth-leakage protection alarm
1016 (0x03F8)	Current unbalance
1017 (0x03F9)	I <sub>A</sub> maximum demand
1018 (0x03FA)	I <sub>B</sub> maximum demand
1019 (0x03FB)	I <sub>C</sub> maximum demand
1020 (0x03FC)	I <sub>N</sub> maximum demand
1021 (0x03FD)	Undervoltage
1022 (0x03FE)	Overvoltage
1023 (0x03FF)	Voltage unbalance
1024 (0x0400)	Reserved
1025 (0x0401)	Reverse power
1026 (0x0402)	Underfrequency
1027 (0x0403)	Overfrequency
1028 (0x0404)	Phase rotation
1029 (0x0405)	Current load shedding
1030 (0x0406)	Power load shedding
1031–1099 (0x0407–0x044B)	Reserved
1100 (0x044C)	System energized / reset
1101–1105 (0x044D–0x0451)	Reserved
1106 (0x0452)	Loss of date and time
1107–1114 (0x0453–0x045A)	Reserved
1115 (0x045B)	Battery low

# Trip History

## General Description

The trip history registers describe the last 10 encountered trips. The trip history format corresponds to a series of 10 records saved in a FIFO (first in first out) stack. The last record erases the oldest. Each record is composed of 20 registers describing one trip.

Register 9098 returns the number of faults recorded in the trip history (FIFO).

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

### Example:

If the register 9098 = 10 and the register 9099 = 5, then the last fault recorded is the trip record 5.

In this case, the last but one is the alarm record 4.

### NOTE:

- 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 characteristics of the circuit breaker have not been defined. In this case, see **Breaker selection** in the **MicroLogic setup** menu on the MicroLogic HMI, in registers 9846–9853, page 137.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2385	9094	R	1	%	INT16U	0–32767	P/H	Phase A contact wear indicator <sup>(1)</sup>
0x2386	9095	R	1	%	INT16U	0–32767	P/H	Phase B contact wear indicator <sup>(1)</sup>
0x2387	9096	R	1	%	INT16U	0–32767	P/H	Phase C contact wear indicator <sup>(1)</sup>
0x2388	9097	R	1	%	INT16U	0–32767	P/H	Neutral contact wear indicator <sup>(1)</sup>
0x2389	9098	R	–	–	INT16U	0–10	P/H	Number of alarms recorded in the trip history (FIFO)
0x238A	9099	R	–	–	INT16U	0–9	P/H	Value of the pointer for last alarm recorded in the trip history

(1) Factory setting = 0x8000.

## Trip Record Number

A read request of 20x(n) registers is necessary to read the last n trip records, where 20 is the number of registers for each trip record.

For example, a read request of 20x3 = 60 registers is necessary to read the last 3 trip records of the trip history:

- The first 20 registers describe the first trip record.
- The next 20 registers describe the second trip record.
- The last 20 registers describe the third trip record.

Address	Register	Description
0x238B–0x239E	9100–9119	Trip record 0
0x239F–0x23B2	9120–9139	Trip record 1
0x23B3–0x23C6	9140–9159	Trip record 2
0x23C7–0x23DA	9160–9179	Trip record 3
0x23DB–0x23EE	9180–9199	Trip record 4

Address	Register	Description
0x23EF–0x2402	9200–9219	Trip record 5
0x2403–0x2416	9220–9239	Trip record 6
0x2417–0x242A	9240–9259	Trip record 7
0x242B–0x243E	9260–9279	Trip record 8
0x243F–0x2452	9280–9299	Trip record 9

## Trip Record

A read request of 20 registers is necessary to read a trip record.

The order and the description of the trip record registers are the same as that of the trip record 0:

Trip Record 0								
Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x238B– 0x238E	9100– 9103	R	–	–	XDATE	–	E/P/H	Trip date
0x238F	9104	R	–	–	INT16U	1000–1030	E/P/H	Trip code
0x2390– 0x2391	9105– 9106	R	–	–	MOD 10000	–	P/H	Value of protection setting that caused alarm activation
0x2392	9107	R	–	–	INT16U	–	P/H	Value of time delay that caused trip
0x2393	9108	R	–	–	INT16U	0–16000	P/H	Trip current phase A <sup>(1)</sup>
0x2394	9109	R	–	–	INT16U	0–16000	P/H	Trip current phase B <sup>(1)</sup>
0x2395	9110	R	–	–	INT16U	0–16000	P/H	Trip current phase C <sup>(1)</sup>
0x2396	9111	R	–	–	INT16U	0–16000	P/H	Trip current neutral (1)
0x2397	9112	R	–	–	–	–	P/H	New value of contact-wear indicator following a trip <sup>(2)</sup>
0x2398– 0x2399	9113– 9114	–	–	–	–	–	–	Reserved
0x239A– 0x239E	9115– 9119	–	–	–	–	–	–	Reserved

(1) Expressed as x 0.1 of I<sub>n</sub> (rated current).

(2) The trip unit records one indicator per contact. Here, only the value for the most worn contact is given. See registers 9094 to 9097.

## Trip Codes

Trip Code	Description
1000 (0x03E8)	Trip due to long-time protection I <sub>r</sub>
1001 (0x03E9)	Trip due to short-time protection I <sub>sd</sub>
1002 (0x03EA)	Trip due to instantaneous protection I <sub>i</sub>
1003 (0x03EB)	Trip due to ground-fault protection I <sub>g</sub>
1004 (0x03EC)	Trip due to earth-leakage protection IΔn
1005 (0x03ED)	Trip due to integrated instantaneous protection I >>
1006–1007 (0x03EE–0x03EF)	Reserved

<b>Trip Code</b>	<b>Description</b>
1008 (0x03F0)	Trip due to advanced protection
1009 (0x03F1)	Trip due to extended advanced protection
1010–1015 (0x03F2–0x03F7)	Reserved
1016 (0x3F8)	Current unbalance
1017 (0x3F9)	I <sub>A</sub> maximum demand
1018 (0x3FA)	I <sub>B</sub> maximum demand
1019 (0x3FB)	I <sub>C</sub> maximum demand
1020 (0x3FC)	I <sub>N</sub> maximum demand
1021 (0x3FD)	Undervoltage
1022 (0x3FE)	Overvoltage
1023 (0x3FF)	Voltage unbalance
1024 (0x400)	Reserved
1025 (0x401)	Reverse power
1026 (0x402)	Underfrequency
1027 (0x403)	Overfrequency
1028 (0x404)	Phase rotation
1029 (0x405)	Current load shedding
1030 (0x406)	Power load shedding

# Analog Predefined Alarms

## General Description

The EcoStruxure Power Commission software, page 18 enables the configuration of analog predefined alarms.

Analog predefined alarms:

- may be modified via the command interface in configuration mode
- are only available with a MicroLogic H trip unit
- can be used to trigger waveform capture

## Analog Predefined Alarms Number

The following table describes the list of predefined alarms and corresponding numbers, registers, and addresses.

Alarm Number	Alarm Addresses	Alarm Registers	Alarm Description
1	0x176F–0x177A	6000–6011	Overcurrent phase A
2	0x177B–0x1786	6012–6023	Overcurrent phase B
3	0x1787–0x1792	6024–6035	Overcurrent phase C
4	0x1793–0x179E	6036–6047	Over neutral current
5	0x179F–0x17AA	6048–6059	Over ground current
6	0x17AB–0x17B6	6060–6071	Undercurrent phase A
7	0x17B7–0x17C2	6072–6083	Undercurrent phase B
8	0x17C3–0x17CE	6084–6095	Undercurrent phase C
9	0x17CF–0x17DA	6096–6107	Overcurrent unbalance phase A
10	0x17DB–0x17E6	6108–6119	Overcurrent unbalance phase B
11	0x17E7–0x17F2	6120–6131	Overcurrent unbalance phase C
12	0x17F3–0x17FE	6132–6143	Overvoltage phase A
13	0x17FF–0x180A	6144–6155	Overvoltage phase B
14	0x180B–0x1816	6156–6167	Overvoltage phase C
15	0x1817–0x1822	6168–6179	Undervoltage phase A
16	0x1823–0x182E	6180–6191	Undervoltage phase B
17	0x182F–0x183A	6192–6203	Undervoltage phase C
18	0x183B–0x1846	6204–6215	Overvoltage unbalance phase A
19	0x1847–0x1852	6216–6227	Overvoltage unbalance phase B
20	0x1853–0x185E	6228–6239	Overvoltage unbalance phase C
21	0x185F–0x186A	6240–6251	Over total apparent power
22	0x186B–0x1876	6252–6263	Over total active power
23	0x1877–0x1882	6264–6275	Over total active reverse power
24	0x1883–0x188E	6276–6287	Over total reactive power
25	0x188F–0x189A	6288–6299	Over total reactive reverse power
26	0x189B–0x18A6	6300–6311	Under total apparent power
27	0x18A7–0x18B2	6312–6323	Under total active power
28	0x18B3–0x18BE	6324–6335	Under total active reverse power

Alarm Number	Alarm Addresses	Alarm Registers	Alarm Description
29	0x18BF–0x18CA	6336–6347	Under total reactive power
30	0x18CB–0x18D6	6348–6359	Under total reactive reverse power
31	0x18D7–0x18E2	6360–6371	Lagging true power factor
32	0x18E3–0x18EE	6372–6383	Leading true power factor
33	0x18EF–0x18FA	6384–6395	Lagging displacement power factor
34	0x18FB–0x1906	6396–6407	Leading displacement power factor
35	0x1907–0x1912	6408–6419	Over total harmonic distortion current phase A
36	0x1913–0x191E	6420–6431	Over total harmonic distortion current phase B
37	0x191F–0x192A	6432–6443	Over total harmonic distortion current phase C
38	0x192B–0x1936	6444–6455	Over total harmonic distortion voltage (phase A to neutral)
39	0x1937–0x1942	6456–6467	Over total harmonic distortion voltage (phase B to neutral)
40	0x1943–0x194E	6468–6479	Over total harmonic distortion voltage (phase C to neutral)
41	0x194F–0x195A	6480–6491	Over total harmonic distortion voltage (phase A to B)
42	0x195B–0x1966	6492–6503	Over total harmonic distortion voltage (phase B to C)
43	0x1967–0x1972	6504–6515	Over total harmonic distortion voltage (phase C to A)
44	0x1973–0x197E	6516–6527	Over predicted apparent power demand
45	0x197F–0x198A	6528–6539	Over predicted total active power demand
46	0x198B–0x1996	6540–6551	Over predicted total active reverse power demand
47	0x1997–0x19A2	6552–6563	Over predicted total reactive power demand
48	0x19A3–0x19AE	6564–6575	Over predicted total reactive reverse power demand
49	0x19AF–0x19BA	6576–6587	Under predicted apparent power demand
50	0x19BB–0x19C6	6588–6599	Under predicted total active power demand
51	0x19C7–0x19D2	6600–6611	Under predicted total active reverse power demand
52	0x19D3–0x19DE	6612–6623	Under predicted total reactive power demand
53	0x19DF–0x19EA	6624–6635	Under predicted total reactive reverse power demand

## Analog Predefined Alarm Record

Analog predefined alarms are coded on 12 registers.

The order and the description of the analog predefined alarms are the same as that of analog predefined alarm 1:



Analog Predefined Alarm 1								
Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x176F	6000	RW	–	–	INT16U	–	H	<p>The MSB gives the activity of the alarm:</p> <p>0 = On</p> <p>1 = Off</p> <p>The LSB gives the priority of the alarm:</p> <p>0, 1, 2, or 3.</p> <p>The factory setting value is 0x0101.</p> <p>Register set to 0 will not log event into the event log (file number 10) and Waveform Capture file (file number 5).</p>
0x1770	6001	R	–	–	INT16U	1016	H	<p>Register number which content gets in relation to the pick-up value and to the drop-out value.</p> <p>The factory setting is 1016.</p>
0x1771	6002	R	–	–	INT16U	–	H	<p>Comparison mode:</p> <p>The MSB indicates Pickup mode.</p> <p>The LSB indicates the Dropout mode.</p> <p>MSB and LSB can be set to 1, 2 or 4:</p> <ul style="list-style-type: none"> <li>1 = immediate mode (register 6003 contains the numerical value to which the monitored register is compared) (factory setting for pickup mode and dropout mode) <sup>(2)</sup></li> <li>2 = direct mode (register 6003 contains the register number of the register that is in relation to the monitored register) (percentage is applied)</li> <li>4 = selects bit test mode (register 6003 must contain the bitmask that gets compared (AND operation) to the monitored register)</li> </ul>
0x1772	6003	RW	1	–	INT16U	–	H	<p>Alarm actuation pick-up value <sup>(1)</sup></p> <p>The factory setting is 0x8000.</p>
0x1773	6004	R	100	%	INT16U	–	H	<p>This register contains a numerical value that is multiplied by the content of the pickup register when Direct Mode is selected. Otherwise, register is not used.</p> <p>The factory setting is 0x8000.</p>
0x1774	6005	RW	1	s	INT16U	–	H	<p>Actuation time delay</p> <p>The factory setting is 0x8000.</p>
0x1775	6006	RW	–	–	INT16U	–	H	Release pick-up value <sup>(1)</sup>

Analog Predefined Alarm 1								
Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
								The factory setting is 0x8000.
0x1776	6007	R	–	%	INT16U	–	H	This register contains a numerical value that is multiplied by the content of the pickup register when Direct Mode is selected. Otherwise, register is not used.  The factory setting is 0x8000.
0x1777	6008	RW	1	s	INT16U	0–3000	H	Release time delay.  The factory setting is 0x8000.
0x1778	6009	R	–	–	INT16U	0–3	A/E	Alarm type:  0 = Over 1 = Under (factory setting) 2 = Equal 3 = Different from 5 is used for all other alarms.
0x1779	6010	RW	–	–	INT16U	–	H	Action associated with overrunning of the pick-up value after the time delay has run out.  Log into the Waveform Capture file (file no. 5).  Bit 9 set to 1 = action activated  The factory setting is 0.
0x177A	6011	–	–	–	–	–	–	Reserved
(1) When Immediate mode is selected, care must be taken to set this register with the same units and scale factors as the register 6001.								
(2) No percentage is applied.								

## Basic Protection Parameters

### Neutral Protection Parameters

The neutral protection is only available when system type in register 3314 is 30 or 41, page 175.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2230	8753	RW	1	–	INT16U	0–3	A/E/P/H	Type of neutral protection: <sup>(1)</sup> 0 = OFF 1 = N/2 (I <sub>r</sub> /2) 2 = N (I <sub>r</sub> ) 3 = N <sub>x</sub> 1.6 (1.6 I <sub>r</sub> ) <sup>(2)</sup>
(1) Write Access only with MicroLogic P and H trip unit.								
(2) Value accessible only for MicroLogic P and H trip unit.								

### Long-Time Protection Parameters

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x2231	8754	R	–	–	INT16U	0–1	A/E/P/H	–	Status: 0x0001 = On
0x2232	8755	RW	–	–	INT16U	–	–	–	Type of IDMTL curve <sup>(1)</sup>
							A/E/P/H	0	Standard long-time curve I <sup>2</sup> t (factory setting)
							P/H	1	SIT curve
							P/H	2	VIT curve
							P/H	3	EIT (I <sup>2</sup> t on) curve
							P/H	4	HVF curve
							P/H	5	Constant time (I <sup>2</sup> t off)
							–	6–15	Reserved
0x2233– 0x2234	8756– 8757	RW	1	A	MOD 10000	40–8000	A/E/P/H	–	I <sub>r</sub> pick-up value <sup>(1)</sup>
0x2235	8758	RW	1	ms	INT16U	500– 24000	A/E/P/H	–	t <sub>r</sub> time delay <sup>(1)</sup>
0x2236– 0x2238	8759– 8761	–	–	–	–	–	–	–	Reserved
0x2239	8762	RW	–	–	INT16U	–	H	–	Waveform capture setting: 0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file no. 22 at the end of the time delay t <sub>r</sub> .
0x223A	8763	RW	–	–	INT16U	–	–	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay t <sub>r</sub> (factory setting)  Bit set to 0 = contact open at the end of the time delay t <sub>r</sub>

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
							–	0	Always set to 1
							–	1–7	Reserved
							E/P/H	8	Contact 1
							E/P/H	9	Contact 2
							P/H	10	Contact 3
							P/H	11	Contact 4
							P/H	12	Contact 5
							P/H	13	Contact 6
							–	14–15	Reserved
(1) Write Access only with MicroLogic P and H trip unit.									

## Short-Time Protection Parameters

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x223B	8764	R	–	–	INT16U	0–1	A/E/P/H	–	Status: 0x0001 = On
0x223C	8765	RW	–	–	INT16U	0–1	A/E/P/H	–	Type of protection: <sup>(1)</sup> 0 = I <sub>2</sub> t On 1 = I <sub>2</sub> t Off
0x223D– 0x223E	8766– 8767	RW	1	A	MOD 10000	60– 80 000	A/E/P/H	–	I <sub>sd</sub> pick-up value <sup>(1)</sup>
0x223F	8768	RW	1	ms	INT16U	0–400	A/E/P/H	–	t <sub>sd</sub> time delay <sup>(1)</sup>  0 s: valid only for the I <sub>2</sub> t off position  100–400 ms: valid for the I <sub>2</sub> t on and I <sub>2</sub> t off positions
0x2243	8772	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay t <sub>sd</sub> .
0x2244	8773	RW	–	–	INT16U	–	–	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay t <sub>sd</sub> (factory setting)  Bit set to 0 = contact open at the end of the time delay t <sub>sd</sub>
							–	0	Always set to 1
							–	1–7	Reserved
							E/P/H	8	Contact 1
							E/P/H	9	Contact 2
							P/H	10	Contact 3
							P/H	11	Contact 4
							P/H	12	Contact 5
							P/H	13	Contact 6
							–	14–15	Reserved
(1) Write Access only with MicroLogic P and H trip unit.									

## Instantaneous Protection Parameters

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x2245	8774	R	–	–	INT16U	0x0001– 0x0101	A/E/P/H	–	0x0001 = protection active (factory setting)  0x0101 = protection OFF
0x2246	8775	–	–	–	–	–	–	–	Reserved
0x2247– 0x2248	8776– 8777	RW	1	A	MOD 10000	200– 120000	A/E/P/H	–	I pick-up value for the instantaneous protection <sup>(1)</sup>
0x2249	8778	–	–	–	–	–	–	–	Reserved
0x224D	8782	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x224E	8783	RW	–	–	INT16U	–	–	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay (factory setting)  Bit set to 0 = contact open at the end of the time delay
							–	0	Always set to 1
							–	1–7	Reserved
							E/P/H	8	Contact 1
							E/P/H	9	Contact 2
							P/H	10	Contact 3
							P/H	11	Contact 4
							P/H	12	Contact 5
							P/H	13	Contact 6
							–	14–15	Reserved

(1) Write Access only with MicroLogic P and H trip unit.

## Ground-Fault Protection Parameters

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x224F	8784	RW	–	–	INT16U	0x0001– 0x0101	A/E/P/H	–	Protection status: <sup>(1)</sup> <sup>(2)</sup>  0x0001 = protection active (factory setting)  0x0101 = protection OFF
0x2250	8785	RW	–	–	INT16U	0–1	A/E/P/H	–	Type of protection: <sup>(1)</sup>  0 = I <sub>2</sub> t On  1 = I <sub>2</sub> t Off
0x2251– 0x2252	8786– 8787	RW	1	A	MOD 10000	30– 1200	A/E/P/H	–	I <sub>g</sub> pickup for the ground- fault protection <sup>(1)</sup>
0x2253	8788	RW	1	ms	INT16U	0–400	A/E/P/H	–	t <sub>g</sub> tripping time delay for the ground-fault protection: <sup>(1)</sup>  0 s = valid only for the I <sub>2</sub> t off position

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
									100–400 ms = valid for the I²t on and I²t off positions
0x2257	8792	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay tg.
0x2258	8793	RW	–	–	INT16U	–	–	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay tg (factory setting)  Bit set to 0 = contact open at the end of the time delay tg
							–	0	Always set to 1
							–	1–7	Reserved
							E/P/H	8	Contact 1
							E/P/H	9	Contact 2
							P/H	10	Contact 3
							P/H	11	Contact 4
							P/H	12	Contact 5
							P/H	13	Contact 6
							–	14–15	Reserved
(1) Write Access only with MicroLogic P and H trip unit.  (2) In order to be able to write this register, the following conditions must be met: <ul style="list-style-type: none"><li>• MicroLogic 6 P or 6 H firmware version 8.244 or above (see register 8710)</li><li>• Activation of the option Ground-Fault Inhibit through the utility enable_GFI (available on request)</li></ul>									

## Earth-Leakage (Vigi) Protection Parameters

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x2259	8794	R	–	–	INT16U	0x0001	A/P/H	–	0x0001 = protection active
0x225A	8795	–	–	–	–	–	–	–	Reserved
0x225B– 0x225C	8796– 8797	RW	1	mA	MOD 10000	5–300	A/P/H	–	I <sub>Δn</sub> pickup for the earth-leakage protection <sup>(1)</sup>
0x225D	8798	RW	1	ms	INT16U	0–1000	A/P/H	–	Δt tripping time delay for the earth-leakage protection <sup>(1)</sup>
0x2261	8802	RW	–	–	INT16U	–	H	–	Waveform capture setting: 0 = no waveform capture 0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay Δt.
0x2262	8803	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay Δt (factory setting)

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
									Bit set to 0 = contact open at the end of the time delay $\Delta t$
							–	0	Always set to 1
							–	1–7	Reserved
							P/H	8	Contact 1
							P/H	9	Contact 2
							P/H	10	Contact 3
							P/H	11	Contact 4
							P/H	12	Contact 5
							P/H	13	Contact 6
–	14–15	Reserved							
(1) Write Access only with MicroLogic P and H trip unit.									

## Advanced Protection Parameters

### Ground-Fault Alarm

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x259C	9629	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = alarm active  0x0101 = OFF (factory setting)
0x259D	9630	–	–	–	–	–	–	–	Reserved
0x259E– 0x259F	9631– 9632	RW	1	A	MOD 10000	20–1200	P/H	–	Alarm pick-up value <sup>(1)</sup>  Minimum value = 0.05 x I <sub>n</sub>  Factory setting = 1200 A
0x25A0	9633	RW	10	s	INT16U	10–100	P/H	–	Alarm pick-up time delay  Factory setting = 100 (10 s)
0x25A1– 0x25A2	9634– 9635	RW	1	A	MOD 10000	20–1200	P/H	–	Alarm drop-out value <sup>(1)</sup>  Maximum value = alarm pick-up value  Minimum value = 0.05 x I <sub>n</sub>  Factory setting = 1200 A
0x25A3	9636	RW	10	s	INT16U	10–100	P/H	–	Alarm drop-out time delay <sup>(1)</sup>  Factory setting = 10 (1 s)
0x25A4	9637	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.



Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x25A5	9638	RW	–	–	INT16U	–	–	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)
							–	0	Always set to 0 (trip disabled for this type of alarm)
							–	1–7	Reserved
							P/H	8	Contact 1
							P/H	9	Contact 2
							P/H	10	Contact 3
							P/H	11	Contact 4
							P/H	12	Contact 5
							P/H	13	Contact 6
							–	14–15	Reserved
(1) Accessible only with MicroLogic 5.0 P, 6.0 P, 5.0 H and 6.0 H trip unit.									

## Earth-Leakage Alarm

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x25A6	9639	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	Alarm status: <sup>(1)</sup>  0x0001 = alarm active  0x0101 = OFF (factory setting)
0x25A7	9640	–	–	–	–	–	–	–	Reserved
0x25A8– 0x25A9	9641– 9642	RW	10	A	MOD 10000	5–300	P/H	–	Alarm pick-up value <sup>(1)</sup>  Factory setting = 300 (30 A)
0x25AA	9643	RW	10	s	INT16U	10–100	P/H	–	Alarm pick-up time delay  Factory setting = 100 (10 s)
0x25AB– 0x25AC	9644– 9645	RW	10	A	MOD 10000	5–300	P/H	–	Alarm drop-out value <sup>(1)</sup>  Maximum value = alarm pick-up value  Factory setting = 300 (30 A)
0x25AD	9646	RW	10	s	INT16U	10–100	P/H	–	Alarm drop-out time delay <sup>(1)</sup>  Factory setting = 10 (1 s)
0x25AE	9647	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x25AF	9648	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
									Bit set to 0 = contact open at the end of the time delay (factory setting)
								0	Always set to 0 (trip disabled for this type of alarm)
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved
(1) Accessible only with MicroLogic 7.0 P and 7.0 H trip unit.									

## Current Unbalance Protection

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x25B0	9649	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = Alarm or protection active  0x0101 = OFF (factory setting)
0x25B1	9650	–	–	–	–	–	–	–	Reserved
0x25B2– 0x25B3	9651– 9652	RW	1	%	MOD 10000	5–60	P/H	–	I unbal pick-up value  Factory setting = 60 %
0x25B4	9653	RW	10	s	INT16U	10–400	P/H	–	Protection pick-up time delay  Factory setting = 400 (40 s)
0x25B5– 0x25B6	9654– 9655	RW	1	%	MOD 10000	5–60	P/H	–	Protection drop-out value  Factory setting = 60 %
0x25B7	9656	RW	10	s	INT16U	100– 3600	P/H	–	Protection drop-out time delay  Factory setting = 100 (10 s)
0x25B8	9657	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x25B9	9658	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)
								0	Bit set to 1 = the circuit breaker trips
								1–7	Reserved

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved

## Maximum Current Protection on Phase A

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x25BA	9659	RW	–	–	INT16U	0x0001–0x0101	P/H	–	0x0001 = alarm or protection active  0x0101 = OFF (factory setting)
0x25BB	9660	–	–	–	–	–	–	–	Reserved
0x25BC– 0x25BD	9661– 9662	RW	1	A	MOD 10000	20–80000	P/H	–	I <sub>A</sub> max. pick-up value  maximum limitation = 1 x nominal current register value (factory setting), page 182  minimum limitation = 0.2 x nominal current register value, page 182
0x25BE	9663	RW	1	s	INT16U	15–1500	P/H	–	Protection pick-up time delay  Factory setting = 1500 s
0x25BF– 0x25C0	9664– 9665	RW	1	A	MOD 10000	20–80000	P/H	–	Protection drop-out value  maximum limitation = 1 x nominal current register value (factory setting), page 182  minimum limitation = 0.2 x nominal current register value, page 182
0x25C1	9666	RW	1	s	INT16U	15–3000	P/H	–	Protection drop-out time delay  Factory setting = 15 s
0x25C2	9667	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x25C3	9668	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)
								0	Bit set to 1 = the circuit breaker trips

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved

## Maximum Current Protection on Phase B

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x25C4	9669	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = alarm or protection active  0x0101 = OFF (factory setting)
0x25C5	9670	–	–	–	–	–	–	–	Reserved
0x25C6– 0x25C7	9671– 9672	RW	1	A	MOD 10000	20–80000	P/H	–	I <sub>B</sub> max. pick-up value  maximum limitation = 1 x nominal current register value (factory setting), page 182  minimum limitation = 0.2 x nominal current register value, page 182
0x25C8	9673	RW	1	s	INT16U	15–1500	P/H	–	Protection pick-up time delay  Factory setting = 1500 s
0x25C9– 0x25CA	9674– 9675	RW	1	A	MOD 10000	20–80000	P/H	–	Protection drop-out value  maximum limitation = 1 x nominal current register value (factory setting), page 182  minimum limitation = 0.2 x nominal current register value, page 182
0x25CB	9676	RW	1	s	INT16U	15–3000	P/H	–	Protection drop-out time delay  Factory setting = 15 s
0x25CC	9677	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x25CD	9678	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)
								0	Bit set to 1 = the circuit breaker trips

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved

## Maximum Current Protection on Phase C

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x25CE	9679	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = alarm or protection active  0x0101 = OFF (factory setting)
0x25CF	9680	–	–	–	–	–	–	–	Reserved
0x25D0– 0x25D1	9681– 9682	RW	1	A	MOD 10000	20–80000	P/H	–	I <sub>c</sub> max. pick-up value  maximum limitation = 1 x nominal current register value (factory setting), page 182  minimum limitation = 0.2 x nominal current register value, page 182
0x25D2	9683	RW	1	s	INT16U	15–1500	P/H	–	Protection pick-up time delay  Factory setting = 1500 s
0x25D3– 0x25D4	9684– 9685	RW	1	A	MOD 10000	20–80000	P/H	–	Protection drop-out value  maximum limitation = 1 x nominal current register value (factory setting), page 182  minimum limitation = 0.2 x nominal current register value, page 182
0x25D5	9686	RW	1	s	INT16U	15–3000	P/H	–	Protection drop-out time delay  Factory setting = 15 s
0x25D6	9687	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x25D7	9688	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
								0	Bit set to 1 = the circuit breaker trips
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved

## Maximum Current Protection on the Neutral

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x25D8	9689	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = alarm or protection active  0x0101 = OFF (factory setting)
0x25D9	9690	–	–	–	–	–	–	–	Reserved
0x25DA– 0x25DB	9691– 9692	RW	1	A	MOD 10000	20–80000	P/H	–	I <sub>N</sub> max. pick-up value  maximum limitation = 1 x nominal current register value (factory setting), page 182  minimum limitation = 0.2 x nominal current register value, page 182
0x25DC	9693	RW	1	s	INT16U	15–1500	P/H	–	Protection pick-up time delay  Factory setting = 1500 s
0x25DD– 0x25DE	9694– 9695	RW	1	A	MOD 10000	20–80000	P/H	–	Protection drop-out value  maximum limitation = 1 x nominal current register value (factory setting), page 182  minimum limitation = 0.2 x nominal current register value, page 182
0x25DF	9696	RW	1	s	INT16U	15–3000	P/H	–	Protection drop-out time delay  Factory setting = 15 s
0x25E0	9697	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x25E1	9698	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
								0	Bit set to 1 = the circuit breaker trips
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved

## Minimum Voltage Protection

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x25E2	9699	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = alarm or protection active  0x0101 = OFF (factory setting)
0x25E3	9700	–	–	–	–	–	–	–	Reserved
0x25E4– 0x25E5	9701– 9702	RW	1	V	MOD 10000	100–1200	P/H	–	U min. pick-up value  Maximum value = protection pick-up value of maximum voltage.  Factory setting = 100 V
0x25E6	9703	RW	100	s	INT16U	20–500	P/H	–	Protection pick-up time delay  Factory setting = 500 (5 s)
0x25E7– 0x25E8	9704– 9705	RW	1	V	MOD 10000	100–1200	P/H	–	Protection drop-out value  Minimum value = protection pick-up value  Factory setting = 100 V
0x25E9	9706	RW	100	s	INT16U	120–3600	P/H	–	Protection drop-out time delay  Factory setting = 120 (1.2 s)
0x25EA	9707	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = wave form capture into the Fault Waveform Capture file at the end of the time delay.
0x25EB	9708	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
									Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)
								0	Bit set to 1 = the circuit breaker trips
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved

## Maximum Voltage Protection

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x25EC	9709	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = alarm or protection active  0x0101 = OFF (factory setting)
0x25ED	9710	–	–	–	–	–	–	–	Reserved
0x25EE– 0x25EF	9711– 9712	RW	1	V	MOD 10000	100–1200	P/H	–	U max. pick-up value  Minimum value = protection pick-up value of minimum voltage.  Factory setting = +5 % above primary voltage on the voltage transformer, page 177
0x25F0	9713	RW	100	s	INT16U	20–500	P/H	–	Protection pick-up time delay  Factory setting = 500 (5 s)
0x25F1– 0x25F2	9714– 9715	RW	1	V	MOD 10000	100–1200	P/H	–	Protection drop-out value  Maximum value = protection pick-up value  Factory setting = +5 % primary voltage on the voltage transformer, page 177
0x25F3	9716	RW	100	s	INT16U	120–3600	P/H	–	Protection drop-out time delay  Factory setting = 120 (1.2 s)
0x25F4	9717	RW	–	–	INT16U	–	H	–	Waveform capture setting:



Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
									0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x25F5	9718	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)
								0	Bit set to 1 = the circuit breaker trips
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved

## Voltage Unbalance Protection

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x25F6	9719	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = alarm or protection active  0x0101 = OFF (factory setting)
0x25F7	9720	–	–	–	–	–	–	–	Reserved
0x25F8– 0x25F9	9721– 9722	RW	1	%	MOD 10000	2–30	P/H	–	U unbal pick-up value  Factory setting = 30 %
0x25FA	9723	RW	10	s	INT16U	10–400	P/H	–	Protection pick-up time delay  Factory setting = 400 (40 s)
0x25FB– 0x25FC	9724– 9725	RW	1	%	MOD 10000	2–30	P/H	–	Protection drop-out value  Maximum value = protection pick-up value  Factory setting = 30 %
0x25FD	9726	RW	10	s	INT16U	100–3600	P/H	–	Protection drop-out time delay  Factory setting = 100 (10 s)
0x25FE	9727	RW	–	–	INT16U	–	H	–	Waveform capture setting:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
									0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x25FF	9728	RW	–	–	INT16U	–	–	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)
								0	Bit set to 1 = the circuit breaker trips
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved

## Reverse Power Protection

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x260A	9739	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = alarm or protection active  0x0101 = OFF (factory setting)
0x260B	9740	RW	–	–	INT16U	–	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 0 set to 1 = reverse - power connections made to the upper terminals of the circuit breaker  The direction may be modified by the trip unit or by directly writing to the register after obtaining the right (using a command).  Factory setting = 0x0000
0x260C– 0x260D	9741– 9742	RW	1	kW	MOD 10000	5–500	P/H	–	rP max. pick-up value  Factory setting = 500 kW
0x260E	9743	RW	10	s	INT16U	2–200	P/H	–	Protection pick-up time delay

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
									Factory setting = 200 (20 s)
0x260F– 0x2610	9744– 9745	RW	1	kW	MOD 10000	5–500	P/H	–	Protection drop-out value  Maximum value = protection pick-up value  Factory setting = 500 kW
0x2611	9746	RW	10	s	INT16U	10–3600	P/H	–	Protection drop-out time delay  Factory setting = 10 (1 s)
0x2612	9747	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x2613	9748	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)
								0	Bit set to 1 = the circuit breaker trips
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved

## Minimum Frequency Protection

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x2614	9749	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = alarm or protection active  0x0101 = OFF (factory setting)
0x2615	9750	–	–	–	–	–	–	–	Reserved
0x2616– 0x2617	9751– 9752	RW	10	Hz	MOD 10000	450–5400	P/H	–	F min. pick-up value  Maximum value = protection pick-up value of maximum frequency  Factory setting = 450 (45 Hz)

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x2618	9753	RW	100	s	INT16U	20–500	P/H	–	Protection pick-up time delay  Factory setting = 500 (5 s)
0x2619– 0x261A	9754– 9755	RW	10	Hz	MOD 10000	450–4400	P/H	–	Protection drop-out value  Minimum value = protection pick-up value  Factory setting = 450 (45 Hz)
0x261B	9756	RW	100	s	INT16U	100–3600	P/H	–	Protection drop-out time delay  Factory setting = 100 (1 s)
0x261C	9757	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x261D	9758	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)
								0	Bit set to 1 = the circuit breaker trips
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved

## Maximum Frequency Protection

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x261E	9759	RW	–	–	INT16U	0x0001–0x0101	P/H	–	0x0001 = alarm or protection active  0x0101 = OFF (factory setting)
0x261F	9760	–	–	–	–	–	–	–	Reserved
0x2620– 0x2621	9761– 9762	RW	10	Hz	MOD 10000	450–5400	P/H	–	F max. pick-up value

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
									Minimum value = protection pick-up value of minimum frequency Factory setting = 650 (65 Hz)
0x2622	9763	RW	100	s	INT16U	20–500	P/H	–	Protection pick-up time delay Factory setting = 500 (5 s)
0x2623– 0x2624	9764– 9765	RW	10	Hz	MOD 10000	450–4400	P/H	–	Protection drop-out value Maximum value = protection pick-up value Factory setting = 650 (65 Hz)
0x2625	9766	RW	100	s	INT16U	100–3600	P/H	–	Protection drop-out time delay Factory setting = 100 (1 s)
0x2626	9767	RW	–	–	INT16U	–	H	–	Waveform capture setting: 0 = no waveform capture 0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x2627	9768	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting: Bit set to 1 = contact closed at the end of the time delay Bit set to 0 = contact open at the end of the time delay (factory setting)
								0	Bit set to 1 = the circuit breaker trips
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved

## Phase Rotation Alarm

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x2628	9769	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = alarm active 0x0101 = OFF (factory setting)
0x2629	9770	–	–	–	–	–	–	–	Reserved
0x262A– 0x262B	9771– 9772	RW	–	–	MOD 10000	0–1	P/H	–	0 = phase rotation is Ph1, Ph2, Ph3 (factory setting)

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
									1 = phase rotation is Ph1, Ph3, and Ph2
0x262C– 0x262F	9773– 9776	–	–	–	–	–	–	–	Reserved
0x2630	9777	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x2631	9778	RW	–	–	INT16U	–	P/H	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)
								0	Always set to 0 (trip disabled for this type of alarm)
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved

## Load Shedding and Reconnection Based on Current

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x2632	9779	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = alarm active  0x0101 = OFF (factory setting)
0x2633	9780	–	–	–	–	–	–	–	Reserved
0x2634– 0x2635	9781– 9782	RW	1	%	MOD 10000	50–100	P/H	–	Pick-up for load shedding and reconnection based on current, expressed as a % of the long-time I <sub>r</sub> pick-up value  Factory setting = 100 %
0x2636	9783	RW	1	%Tr	INT16U	20–80	P/H	–	Pick-up time delay for load shedding and reconnection based on current, expressed as a % of the longtime delay tr pick-up value (20–80 %)

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
									Factory setting = 80 %
0x2637– 0x2638	9784– 9785	RW	1	%	MOD 10000	30–100	P/H	–	Drop-out for load shedding and reconnection based on current, expressed as a % of the longtime I <sub>r</sub> pick-up value  Factory setting = 100 %
0x2639	9786	RW	1	s	INT16U	10–600	P/H		Drop-out time delay for load shedding and reconnection based on current  Factory setting = 10 s
0x263A	9787	RW	–	–	INT16U	–	H	–	Waveform capture setting:  0 = no waveform capture  0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.
0x263B	9788	RW	–	–	INT16U	–	–	–	M2C/M6C programmable contact setting:  Bit set to 1 = contact closed at the end of the time delay  Bit set to 0 = contact open at the end of the time delay (factory setting)
							P/H	0	Always set to 0 (trip disabled for this type of alarm)
							–	1–7	Reserved
							P/H	8	Contact 1
							P/H	9	Contact 2
							P/H	10	Contact 3
							P/H	11	Contact 4
							P/H	12	Contact 5
							P/H	13	Contact 6
							–	14–15	Reserved

## Load Shedding and Reconnection Based on Power

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x263C	9789	RW	–	–	INT16U	0x0001– 0x0101	P/H	–	0x0001 = alarm active  0x0101 = OFF (factory setting)
0x263D	9790	RW	–	–	INT16U	–	–	–	Direction of active power flow  Bit set to 0 = standard, power connections made to the lower terminals of the circuit breaker

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
									<p>Bit set to 1 = reverse, power connections made to the upper terminals of the circuit breaker</p> <p>The direction may be modified by the command interface or by directly writing to the register after obtaining the right (using a command).</p> <p>Factory setting = 0x0000</p>
0x263E– 0x263F	9791– 9792	RW	1	kW	MOD 10000	200–10000	P/H	–	<p>Pick-up for load shedding and reconnection based on power</p> <p>Factory setting = 10000 kW</p>
0x2640	9793	RW	1	s	INT16U	10–3600	P/H	–	<p>Pick-up time delay for load shedding and reconnection based on power</p> <p>Factory setting = 3600 s</p>
0x2641– 0x2642	9794– 9795	RW	1	kW	MOD 10000	100–10000	P/H	–	<p>Drop-out for load shedding and reconnection based on power</p> <p>Factory setting = 10000 kW</p>
0x2643	9796	RW	1	s	INT16U	10–3600	P/H	–	<p>Drop-out time delay for load shedding and reconnection based on power</p> <p>Factory setting = 10 s</p>
0x2644	9797	RW	–	–	INT16U	–	H	–	<p>Waveform capture setting:</p> <p>0 = no waveform capture</p> <p>0x0100 = waveform capture into the Fault Waveform Capture file at the end of the time delay.</p>
0x2645	9798	RW	–	–	INT16U	–	P/H	–	<p>M2C/M6C programmable contact setting:</p> <p>Bit set to 1 = contact closed at the end of the time delay</p> <p>Bit set to 0 = contact open at the end of the time delay (factory setting)</p>
								0	Always set to 0 (trip disabled for this type of alarm)
								1–7	Reserved
								8	Contact 1
								9	Contact 2
								10	Contact 3
								11	Contact 4
								12	Contact 5
								13	Contact 6
								14–15	Reserved



# Configuration of the M2C/M6C Programmable Contacts

## General Description

The M2C and M6C programmable contacts may be used to signal pick-up value overruns or status changes:

- M2C has two contacts, 1 and 2
- M6C has six contacts, 1 to 6

The M2C/M6C programmable contacts can be configured:

- locally via the HMI of the MicroLogic P/H trip unit
- remotely via the communication interface

The remote configuration of each contact can be allowed or forbidden by the local configuration via the HMI of the MicroLogic P/H trip unit with a firmware version > 2009 AJ.

## Remote Configuration Status

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2647	9800	R	–	–	INT16U	0–1	P/H	Remote configuration status:  0 = indicates that remote configuration of the contact is not authorized (factory setting).  1 = indicates that remote configuration of the contact is authorized.  Remote configuration status can be modified only locally via the HMI of MicroLogic P/H trip unit.

## M2C/M6C Programmable Contact Registers

The settings of the M2C/M6C programmable contacts are in the contact registers:

Contact Number	Contact Addresses	Contact Registers
1	0x2648–0x264E	9801–9807
2	0x264F–0x2655	9808–9814
3	0x2656–0x265C	9815–9821
4	0x265D–0x2663	9822–9828
5	0x2664–0x266A	9829–9835
6	0x266B–0x2671	9836–9842

## M2C/M6C Programmable Contact 1 Description

The order and the description of the M2C/M6C programmable contacts are the same as that of contact 1:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2648	9801	RW	–	–	INT16U	0–4	–	Output mode
							E/P/H	0 = normal (non-latching) mode (factory setting)

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
								Contact closed each time for as long as the assigned alarm remains active.
							P/H	1 = latching mode  Contact closed for each assigned alarm and remains activated until the alarm is reset by the user (through the command interface or by a reset on the trip unit).
							P/H	2 = time delay mode  Contact closed for a set time for each assigned alarm. It is opened at the end of the time delay whether the alarm is still active or not. The alarm must change status at least once to open the contact again.
							E/P/H	3 = forced to 1  The contact remains closed and is not controlled by the alarm status.
							E/P/H	4 = forced to 0  The contact remains open and is not controlled by the alarm status.
0x2649	9802	RW	10	s	INT16U	10– 3600	P/H	Contact activation time delay for time-delay mode  Factory setting: 3600 (360 s)
0x264A– 0x264D	9803– 9806	RW	–	–	OCTET STRING	0x00– 0x7F	P/H	Contact name in ASCII (A–Z and 0–9) using 4 registers  Update via the trip unit not possible  Factory setting: ‘set up !’
0x264E	9807	RW	–	–	INT16U	1000– 1031	E/P/H	Owner alarm number for the contact 1.  Factory setting = 0x8000 (no owner)

## Type of Programmable Contacts

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2672	9843	R	–	–	INT16U	0–6	E/P/H	0 = none
							E/P/H	2 = M2C
							P/H	6 = M6C

## Event Assignment to M2C/M6C Programmable Contacts

The M2C/M6C programmable contacts can be associated to a basic or advanced protection parameter event.

Depending on the protection parameter, a specific register can contain the programmable contact number which opens or closes at the end of the protection time delay (register 8763 as example).

## Measurement Parameters

### System Type

The setup ENVT (External Neutral Voltage Tap) presence command (command code = 46472) configures the content of the system type register.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0CF1	3314	R-WC	–	–	INT16U	30, 31, 40, 41	E/P/H	System type  Factory setting: <ul style="list-style-type: none"> <li>40 with MicroLogic E trip unit</li> <li>41 with MicroLogic P and H trip units</li> </ul>

Determining system type:

If...	Then...	Result
the system type is a three-pole circuit breaker with external neutral current transformer and without external neutral voltage tap	system type = 30	<ul style="list-style-type: none"> <li>Measurements of the phase-to-phase voltages are available.</li> <li>Measurements of the phase-to-neutral voltages are not available.</li> <li>Measurement of the neutral current is available.</li> <li>3 wattmeters method is not possible.</li> </ul>
the system type is a three-pole circuit breaker without external neutral current transformer and without external neutral voltage tap	system type = 31	<ul style="list-style-type: none"> <li>Measurements of the phase-to-phase voltages are available.</li> <li>Measurements of the phase-to-neutral voltages are not available.</li> <li>Measurement of the neutral current is not available.</li> <li>3 wattmeters method is not possible.</li> </ul>
the system type is a three-pole circuit breaker without external neutral current transformer and with external neutral voltage tap	system type = 40	<ul style="list-style-type: none"> <li>Measurements of the phase-to-phase voltages are available.</li> <li>Measurements of the phase-to-neutral voltages are available.</li> <li>Measurement of the neutral current is not available.</li> <li>3 wattmeters method is possible.</li> </ul>
the system type is a three-pole circuit breaker with external neutral current transformer and external neutral voltage tap, or if the system type is 4-pole circuit breaker	system type = 41	<ul style="list-style-type: none"> <li>Measurements of the phase-to-phase voltages are available.</li> <li>Measurements of the phase-to-neutral voltages are available.</li> <li>Measurement of the neutral current is available.</li> <li>3 wattmeters method is possible.</li> </ul>

This table presents the text to choose on the MicroLogic E trip unit display according to the system type determined previously:

If...	Then...
system type = 31	select <b>3W3ct</b>
system type = 40	select <b>4W3ct</b>
system type = 41	select <b>4W4ct</b>

### Power Flow Sign

On MicroLogic P and H trip units, the power flow sign is configured by using the MicroLogic HMI or the power flow sign configuration command (command code = 47240).

On MicroLogic E trip units, the power flow sign is configured by using the MicroLogic HMI only.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0CF3	3316	R-WC	–	–	INT16U	0–1	E/P/H	Power flow sign:  0 = the active power flows from upstream (top) to downstream (bottom) (factory setting).  1 = the active power flows from downstream (bottom) to upstream (top).

## Reactive Power Sign

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0CF4	3317	RW	–	–	INT16U	0–1	E/P/H	Sign convention for the reactive power:  0 = alternate IEEE convention  1 = IEEE and IEC convention (factory setting) <sup>(1)</sup>
(1) With MicroLogic E trip unit, only IEC convention.								

## Power Factor Sign

The power factor sign configuration command (command code = 47241) configures the content of the power factor sign register.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0CF5	3318	R-WC	–	–	INT16U	0–2	E/P/H	Sign convention for the power factor and the fundamental power factor ( $\cos\phi$ ):  0 = IEC convention  1 = alternate IEEE convention  2 = IEEE convention (factory setting) <sup>(1)</sup>
(1) With MicroLogic E trip unit, only IEC convention.								

## Reactive Power Calculation Convention

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0CF6	3319	R	–	–	INT16U	0–1	H	Reactive power calculation convention:  0 = fundamental alone  1 = harmonics included (factory setting)

## Energy Accumulation Mode

The energy accumulation mode configuration command (command code = 47242) configures the content of the energy accumulation mode register.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0CFB	3324	R-WC	–	–	INT16U	0–1	E/P/H	Energy accumulation mode:  0 = absolute accumulation (factory setting) <sup>(1)</sup>  Ep = Epln + EpOut Eq = EqIn + EqOut  1 = signed accumulation  Ep = Epln – EpOut Eq = EqIn – EqOut
(1) With MicroLogic E trip unit, only absolute computation is available.								

## Demand Time

The current demand configuration command (command code 47243) configures the content of registers 3351 and 3352.

The power demand configuration command (command code 47244) configures the content of registers 3354 and 3355.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0D16	3351	RW	–	–	INT16U	0–1	E/P/H	Current demand calculation method (window type):  0 = block interval, sliding  1 = thermal, sliding (factory setting) <sup>(1)</sup>
0x0D17	3352	R-WC	x1	min	INT16U	5–60	E/P/H	Duration of the current demand calculation window, adjustable in steps of 1 minute.  The factory setting is 15 minutes <sup>(2)</sup> .
0x0D19	3354	R-WC	–	–	INT16U	0–5	E/P/H	Power demand calculation method (window type):  0 = sliding (block interval) (factory setting)  1 = sliding (thermal) <sup>(1)</sup>  2 = block (block interval)  5 = synchronized to communication
0x0D1A	3355	R-WC	x1	min	INT16U	5–60	E/P/H	Duration of the power demand calculation window, adjustable in steps of 1 minute.  The factory setting is 15 minutes.
(1) With MicroLogic E trip unit, only the thermal sliding option is available.								
(2) The duration in minutes of the current demand calculation window set in this register is used for the maximum current I <sub>A</sub> , I <sub>B</sub> , and I <sub>C</sub> and I <sub>N</sub> 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.								

## Nominal Voltage

The setup nominal primary voltage V<sub>n</sub> display command (command code = 47245) configures the content of the nominal voltage register.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x258F	9616	R-WC	1	V	INT16U	100–1150	E/P/H	Nominal primary voltage Vn on the voltage transformer. Factory setting = 690 V
0x2590	9617	RW	1	V	INT16U	100–690	P/H	Nominal secondary voltage on the voltage transformer. Factory setting = 690 V

# Time-Stamped Information

## General Description

The time-stamped information enables the user to know all the dates related to important information.

The time-stamped information table describes:

- the current date
- the last current demand and corresponding dates
- the last power demand and corresponding dates
- the last reset and corresponding dates
- the last k-factor demand peak and corresponding dates
- the last current demand peak and corresponding dates

## Current Date

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0BB7– 0x0BBA	3000– 3003	R	–	–	XDATE	–	P/H	Current date of the metering manager
0x2327– 0x232A	9000– 9003	R	–	–	XDATE	–	E/P/H	Current date of the protection manager

## Last Current Demand

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0BBC– 0x0BBE	3005–3007	R	–	–	DATE	–	E/P/H	Date of last current demand maximum I <sub>A</sub> (register 2204)
0x0BBF– 0x0BC1	3008–3010	R	–	–	DATE	–	E/P/H	Date of last current demand maximum I <sub>B</sub> (register 2205)
0x0BC2– 0x0BC4	3011–3013	R	–	–	DATE	–	E/P/H	Date of last current demand maximum I <sub>C</sub> (register 2206)
0x0BC5– 0x0BC7	3014–3016	R	–	–	DATE	–	E/P/H	Date of last current demand maximum on the neutral (register 2207) <sup>(1)</sup>
(1) Value is not available when the system type in register 3314 is 31 or 40. Refer to System Type, page 175.								

## Last Power Demand

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0BC8– 0x0BCA	3017– 3019	R	–	–	DATE	–	E/P/H	Date of last active power demand maximum (register 2224)
0x0BCB– 0x0BCD	3020– 3022	R	–	–	DATE	–	P/H	Date of last reactive power demand maximum (register 2230)
0x0BCE– 0x0BD0	3023– 3025	R	–	–	DATE	–	E/P/H	Date of last apparent power demand maximum (register 2236)

## Last Reset

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0BD1– 0x0BD3	3026– 3028	R	–	–	DATE	–	P/H	Date of last reset of current demand maximum values
0x0BD4– 0x0BD6	3029– 3031	R	–	–	DATE	–	P/H	Date of last reset of power demand maximum values
0x0BD7– 0x0BD9	3032– 3034	R	–	–	DATE	–	P/H	Date-Time of last min. registers reset (1300–1599) <sup>(1)</sup>
0x0BDA– 0x0BDC	3035– 3037	R	–	–	DATE	–	P/H	Date-Time of last max. registers reset (1600–1899) <sup>(1)</sup>
0x0BDD– 0x0BDF	3038– 3040	R	–	–	DATE	–	P/H	Date of last reset of energy meters
0x2331– 0x2333	9010– 9012	R	–	–	DATE	–	P/H	Date of last reset of the maximum phase, ground-fault, and earth-leakage currents
0x236D– 0x236F	9070– 9072	R	–	–	DATE	–	P/H	Date of last reset of the trip history (last 10 faults)
0x2370– 0x2372	9073– 9075	R	–	–	DATE	–	P/H	Date of last reset of the alarm history (last 10 alarms)

(1) This register is updated whenever any of the min. registers are reset. Command interface authorizes user to clear min. of current rms and unbalance values, voltage rms and unbal values, frequency, P/Q/S/PF, fundamental quantities and THD, voltage crest and 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.

## Last K-Factor Demand Peak

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0BE0– 0x0BE2	3041–3043	R	–	–	DATE	–	P/H	Date of appearance of last K-factor demand peak (phase A)
0x0BE3– 0x0BE5	3044–3046	R	–	–	DATE	–	P/H	Date of appearance of last K-factor demand peak (phase B)
0x0BE6– 0x0BE8	3047–3049	R	–	–	DATE	–	P/H	Date of appearance of last K-factor demand peak (phase C)
0x0BE9– 0x0BEB	3050–3052	R	–	–	DATE	–	P/H	Date of appearance of last K-factor demand peak (Neutral) <sup>(1)</sup>

(1) Value is not available when the system type in register 3314 is 31 or 40. Refer to *System Type*, page 175.

## Last Current Demand Peak

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0BEC– 0x0BEE	3053– 3055	R	–	–	DATE	–	P/H	Date of appearance of last I <sup>2</sup> demand peak (phase A)
0x0BEF– 0x0BF1	3056– 3058	R	–	–	DATE	–	P/H	Date of appearance of last I <sup>2</sup> demand peak (phase B)
0x0BF2– 0x0BF4	3059– 3061	R	–	–	DATE	–	P/H	Date of appearance of last I <sup>2</sup> demand peak (phase C)
0x0BF5– 0x0BF7	3062– 3064	R	–	–	DATE	–	P/H	Date of appearance of last I <sup>2</sup> demand peak (Neutral) <sup>(1)</sup>

(1) Value is not available when the system type in register 3314 is 31 or 40. Refer to *System Type*, page 175.



## Maintenance Indicators

### Rate of Wear Counter

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 characteristics of the circuit breaker have not been defined. In this case, see **Breaker selection** in the **MicroLogic setup** menu on the MicroLogic HMI, in registers 9846–9853, page 137.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2385	9094	R	1	%	INT16U	0–32767	P/H	Phase A contact wear indicator <sup>(1)</sup>
0x2386	9095	R	1	%	INT16U	0–32767	P/H	Phase B contact wear indicator <sup>(1)</sup>
0x2387	9096	R	1	%	INT16U	0–32767	P/H	Phase C contact wear indicator <sup>(1)</sup>
0x2388	9097	R	1	%	INT16U	0–32767	P/H	Neutral contact wear indicator <sup>(1)</sup>

(1) Factory setting = 0x8000.

### Load Profile Counters

The load profile counters (only available with the BCM ULP module) report the number of hours for each range of current in the MicroLogic trip unit. If the load profile counters reach the maximum value 4 294 967 295 and a new load profile event occurs, then the load profile counters are reset to 0.

A read request of eight registers is necessary to read the load profile counters.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x74B7– 0x74B8	29880– 29881	R	1	Hour	INT32U	0–4 294 967 295	A/E/P/H	Number of hours for 0–49% of the nominal current range
0x74B9– 0x74BA	29882– 29883	R	1	Hour	INT32U	0–4 294 967 295	A/E/P/H	Number of hours for 50–79% of the nominal current range
0x74BB– 0x74BC	29884– 29885	R	1	Hour	INT32U	0–4 294 967 295	A/E/P/H	Number of hours for 80–89% of the nominal current range
0x74BD– 0x74BE	29886– 29887	R	1	Hour	INT32U	0–4 294 967 295	A/E/P/H	Number of hours for 90–100% of the nominal current range

## Miscellaneous

### Nominal Current

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x222D	8750	R	1	A	INT16U	0–8000	A/E/P/H	Rated circuit breaker current  Factory setting = 100 A (circuit breaker sensor plug not present)

### Protection Manager Measurements

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2263	8804	R	–	–	INT16U	0–65535	P/H	Protection Manager (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.
0x2280	8833	R	10	%In	INT16U	0–16000	P/H	Maximum fault current (trip) recorded on phase A since last reset <sup>(4)</sup>  Factory setting = 0x8000 (no fault recorded or circuit breaker type not entered)
0x2281	8834	R	10	%In	INT16U	0–16000	P/H	Maximum fault current (trip) recorded on phase B since last reset <sup>(4)</sup>  Factory setting = 0x8000 (no fault recorded or circuit breaker type not entered)
0x2282	8835	R	10	%In	INT16U	0–16000	P/H	Maximum fault current (trip) recorded on phase C since last reset <sup>(4)</sup>  Factory setting = 0x8000 (no fault recorded or circuit breaker type not entered)
0x2283	8836	R	10	%In	INT16U	0–16000	P/H	Maximum fault current (trip) recorded on the neutral since last reset <sup>(4)</sup>  Factory setting = 0x8000 (no fault recorded or circuit breaker code not supplied)
0x2284	8837	R	1	%Ir	INT16U	0–32767	A/P/H	RMS current on phase A expressed as a % of the Ir long-time pick-up value
0x2285	8838	R	1	%Ir	INT16U	0–32767	A/P/H	RMS current on phase B expressed as a % of the Ir long-time pick-up value
0x2286	8839	R	1	%Ir	INT16U	0–32767	A/P/H	RMS current on phase C expressed as a % of the Ir long-time pick-up value
0x2287	8840	R	1	%Ir	INT16U	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) <sup>(1)</sup>

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x2288	8841	R	1	%Ig	INT16U	0–32767	A/P/H	"Residual" ground-fault current expressed as a % of the Ig ground-fault protection pick-up value <sup>(2)</sup>
0x2289	8842	R	100	%Idn	INT16U	0–32767	A/P/H	Earth-leakage current expressed as a % of the I <sub>ΔN</sub> earth-leakage protection pick-up value <sup>(3)</sup>

(1) Value not accessible when configuration register 9618 selects "no external CT".

(2) Accessible only with MicroLogic 6.0 trip unit.

(3) Accessible only with MicroLogic 7.0 trip unit.

(4) 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 P/H trip units user guides*).

## Battery Status

The following table represents the battery charge status:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x228A	8843	R	1	%	INT16U	0–100	A/E/P/H	Battery-charge indicator: 100 % = U > 2800 mV 50 % = 2200 < U < 2800 mV 0 % = U < 2200 mV

## Time Remaining Until Long-Time Tripping

Time remaining until long-time tripping is evaluated every second. If another protection is tripped, then time remaining until long-time tripping continues to be evaluated.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x22A0– 0x22A1	8865– 8866	R	10	s	MOD 10000	–	P/H	Time remaining until long-time tripping

## Phase Rotation

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x22A7	8872	R	–	–	INT16U	–	P/H	Phase rotation: 0 = ABC (123) 1 = ACB (132)

## Language

This register sets the language used by the trip unit. It may be modified through the trip unit keypad. The factory setting is English but it may be factory set if necessary.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x258D	9614	RW	–	–	INT16U	–	P/H	0	French

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
								1	US English
								2	UK English
								3	German
								4	Spanish
								5	Italian
								7	Chinese
								8	Russian
								9	Optional language available on order from Schneider Electric
								10–15	Reserved

## Nominal Frequency

This register rates the circuit breaker operating frequency required by the protection manager to disable phase rotation protection for 400 Hz distribution system.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x258E	9615	RW	–	–	INT16U	–	P/H	0	50 / 60 Hz (factory setting)
								1–2	Reserved
								3	400 Hz
								4–15	Reserved

# MicroLogic Trip Unit Files

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# File Mechanism

## Overview

The MicroLogic trip unit stores events and waveform in different files.

## Access

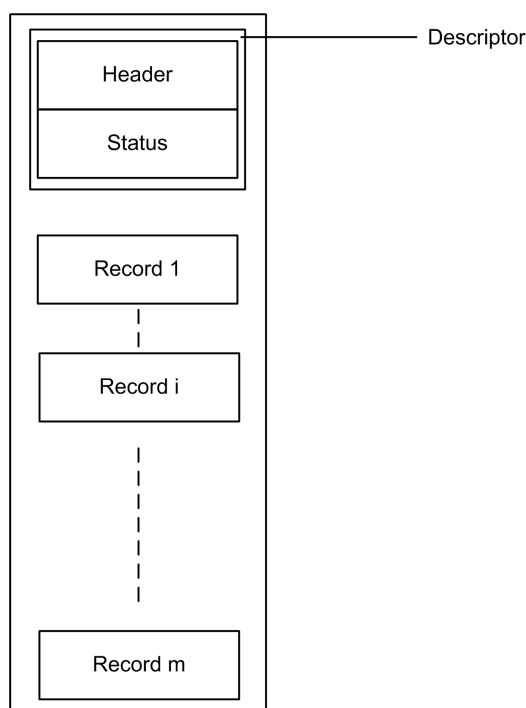
These files can be read with the Modbus function code 20 (0x14): Read file record.

There are two types of files:

- files with dynamic number of records added in a FIFO stack and managed with sequence registers. In this case, the record number of the last record is defined with these sequence registers.
- files with a fixed number  $n$  of records. In this case, all record numbers and their descriptions are detailed. The Modbus function 20 (0x14) is handled  $n$  times on the  $n$  desired records numbers.

## Structure

The following graphic shows the structure of a file:



A file is made up of records, with a maximum of 100 records. All records in a file have the same structure and size.

The descriptor is made up of the following two read zones:

- one read zone for file configuration (Header) that gives information about the size of file and records
- one read zone for file characteristics (Status) that gives information about record numbers

Descriptors are updated each time new record is added to the file.

## Sequence Registers Description

The file characteristics (Status) make available to the supervisor two sequence registers that indicate the first and last records added in the file. They enable the supervisor to determine whether certain records were deleted before they could be read.

The sequence number for the last record increments from 1 to 8000 each time a new record is added to the file.

When the file is full (maximum of 100 records), the new record overwrites the oldest record. The sequence number for the last record continues to increment normally. When the oldest record is overwritten, the sequence number for the first record also increments.

When the sequence number reaches 8000, the next sequence number will be 1.

## Read File Record Example

The Read File Record function is used to access in a standardized manner the file information. This example presents a request to read the most recent record in the event log of the protection manager.

The following table shows how to read the event log of the file number 20 (0x0014). This file is made up of 100 records. Each record is made up of 9 registers, thus the record length is 9 (0x0009). The Modbus address of the Modbus slave is 47 = 0x2F.

Master Request		Slave Reply	
Field Name	Example	Field Name	Example
Modbus slave address	0x2F	Modbus slave address	0x2F
Function code	0x14	Function code	0x14
Data length in bytes	0x07	Data length in bytes	0x14
Reference type	0x06	File reply length	0x13
File number	0x0014	Reference type	0x06
Record number	0x1234	Record data	9x2 bytes data
Record length	0x0009	CRC (MSB)	0xXX
CRC (MSB)	0xXX	CRC (LSB)	0xXX
CRC (LSB)	0xXX	–	

The sequence number of last record in the file (the most recent) is the content of register 9921. Consider 0x1234 for the content of register 9921.

# Protection Event Log

## General Description

The system stores the events that concern the protection manager (trips, alarms) in the file number 20.

This file is made up of 100 records and each record is made up of nine registers.

## File Header

The following table describes the file header content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x26AB	9900	RW	–	–	INT16U	–	P/H	File status: 0x0000 = file disabled 0xFFFF = file enabled (factory setting)
0x26AC	9901	R	–	–	INT16U	–	P/H	Type of file: 20 = protection event log
0x26AD	9902	R	1	–	INT16U	–	P/H	Size of a file = 100 records
0x26AE	9903	R	1	–	INT16U	–	P/H	Size of a record = 9 registers
0x26AF	9904	R	–	–	INT16U	1	P/H	File filling mode: 0 = circular

## File Status

The following table describes the file status content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x26BB	9916	R	1	–	INT16U	–	P/H	Size of a file = 100 records
0x26BC	9917	R	1	–	INT16U	–	P/H	Size of a record = 9 registers
0x26BD	9918	R	1	–	INT16U	–	P/H	0x0000 = file OK 0x000A = record size smaller than expected 0x0014 = record size larger than expected 0x001E = insufficient memory 0x00FA = internal error 0x00FD = corrupted allocation table 0x00FE = configuration zero 0x00FF = invalid configuration 0xFC00 = invalid file number 0xFD00 = invalid record number 0xFE00 = file not supported 0xFF00 = cannot allocate file
0x26BE	9919	R	1	–	INT16U	0–100	P/H	Number of records in the file
0x26BF	9920	R	1	–	INT16U	0–8000	P/H	Sequence number of first record in the file (the oldest)



Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x26C0	9921	R	1	–	INT16U	0–8000	P/H	Sequence number of last record in the file (the most recent)
0x26C1– 0x26C3	9922– 9924	R	–	–	DATE	–	P/H	Date the last file was reset.  Factory setting = 0x8000 0x8000 0x8000

## Protection Event Record

The following table shows the format of 1 record in the protection event log.

Registers	Type	Bits	Description
1–4	XDATE	–	Event date
5	INT16U	–	Event number: alarm code, page 143 or trip code, page 145
6	INT16U	–	Event characteristics for protection event log <sup>(1)</sup>
7	INT16U	0–7	1 = event of the over type 2 = alarm of the under type 3 = alarm of the minimum type 4 = alarm of the maximum type 5 = alarm of the assorted type
		8–11	1 = start of an event 2 = end of an alarm
		12–15	Alarms 1100–1106 have a priority 3. For other alarms, the value contained in these 4 bits represents the priority linked to the event (if applicable and depending on the alarm configuration).
8	INT16U	–	Logging register associated to the alarm <sup>(2)</sup>
9	INT16U	–	Action register associated to the alarm <sup>(2)</sup>

(1) For event numbers 1000–1004, the data is the value of the fault current interrupted by the circuit breaker.  
For all other protection events, this value is forced to 32768.

(2) Registers 8 and 9 are a copy of the alarm configuration registers at the moment the event occurred. These registers depend entirely on the user configurations. For the events 1100–1106, these registers are forced to 32768.

# Metering Event Log

## General Description

The system stores the events that concern the metering manager (analog predefined alarms 1 to 53) in the file 10.

This file is made up of 100 records and each record is made up of nine registers.

## File Header

The following table describes the file header content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1BFB	7164	RW	–	–	INT16U	–	H	File status: 0x0000 = file disabled 0xFFFF = file enabled (factory setting)
0x1BFC	7165	R	–	–	INT16U	–	H	Type of file: 10 = metering event log
0x1BFD	7166	R	1	–	INT16U	–	H	Size of a file = 100 records
0x1BFE	7167	R	1	–	INT16U	–	H	Size of a record = 9 registers
0x1BFF	7168	R	–	–	INT16U	1	H	File filling mode: 0 = circular

## File Status

The following table describes the file status content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1C0B	7180	R	1	–	INT16U	–	H	Size of a file = 100 records
0x1C0C	7181	R	1	–	INT16U	–	H	Size of a record = 9 registers
0x1C0D	7182	R	1	–	INT16U	–	H	0x0000 = file OK 0x000A = record size smaller than expected 0x0014 = record size larger than expected 0x001E = insufficient memory 0x00FA = internal error 0x00FD = corrupted allocation table 0x00FE = configuration zero 0x00FF = invalid configuration 0xFC00 = invalid file number 0xFD00 = invalid record number 0xFE00 = file not supported 0xFF00 = cannot allocate file
0x1C0E	7183	R	1	–	INT16U	0–100	H	Number of records in the file
0x1C0F	7184	R	1	–	INT16U	0–8000	H	Sequence number of first record in the file (the oldest)

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1C10	7185	R	1	–	INT16U	0–8000	H	Sequence number of last record in the file (the most recent)
0x1C11– 0x1C13	7186–7188	R	–	–	DATE	–	H	Date the last file was reset. Factory setting = 0x8000 0x8000 0x8000

## Metering Event Record

The following table shows the format of one record in the metering log:

Registers	Type	Bits	Description
1–4	XDATE	–	Event date
5	INT16U	–	Event number: analog predefined alarms 1–53, page 147
6	INT16U	–	Extreme value
7	INT16U	0–7	1 = alarm of the over type 2 = alarm of the under type 3 = alarm of the equal to type 4 = alarm of the different from type 5 = all other alarms
		8–11	1 = start of an alarm 2 = end of an alarm
		12–15	Alarms 1100–1106 have a priority 3. For other alarms, the value contained in these 4 bits represents the priority linked to the event (if applicable and depending on the alarm configuration).
8	INT16U	–	Logging register associated to the alarm <sup>(1)</sup>
9	INT16U	–	Action register associated to the alarm <sup>(1)</sup>
(1) Registers 8 and 9 are a copy of the alarm configuration registers at the moment the event occurred. These registers depend entirely on the user configurations. For the events 1100–1106, these registers are forced to 32768.			

# Maintenance Protection Event Log

## General Description

The system stores the events that concern the maintenance protection manager (power-up, M6C programmable contacts, maximum peak fault current, and so on) in the file number 21.

This file is made up of 20 records and each record is made up of six registers.

This maintenance event log has been implemented on MicroLogic P trip unit with firmware Plogic2002AA and above.

## File Header

The following table describes the file header content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x26CB	9932	RW	–	–	INT16U	–	H	File status: 0x0000 = file disabled 0xFFFF = file enabled (factory setting)
0x26CC	9933	R	–	–	INT16U	–	H	Type of file: 21 = maintenance protection event log
0x26CD	9934	R	1	–	INT16U	–	H	Size of a file = 20 records
0x26CE	9935	R	1	–	INT16U	–	H	Size of a record = 6 registers
0x26CF	9936	R	–	–	INT16U	1	H	File filling mode: 1 = disabled if log is full

## File Status

The following table describes the file status content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x26DB	9948	R	1	–	INT16U	–	H	Size of a file = 20 records
0x26DC	9949	R	1	–	INT16U	–	H	Size of a record = 6 registers
0x26DD	9950	R	1	–	INT16U	–	H	0x0000 = file OK 0x000A = record size smaller than expected 0x0014 = record size larger than expected 0x001E = insufficient memory 0x00FA = internal error 0x00FD = corrupted allocation table 0x00FE = configuration zero 0x00FF = invalid configuration 0xFC00 = invalid file number 0xFD00 = invalid record number 0xFE00 = file not supported 0xFF00 = cannot allocate file
0x26DE	9951	R	1	–	INT16U	20	H	Number of records in the file = 20

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x26DF	9952	R	1	–	INT16U	1	P/H	Sequence number of first record in the file (the oldest) = 1
0x26E0	9953	R	1	–	INT16U	20	P/H	Sequence number of last record in the file (the most recent) = 20
0x26E1– 0x26E3	9954– 9956	R	–	–	DATE	–	H	Date the last file was reset.  Factory setting = 0x8000 0x8000 0x8000

## Maintenance Protection Event Record

The maintenance protection event log has a fixed number of records and all record has a fixed number of registers:

Record Number	Registers	Type	Description
1	1–4	XDATE	Last power loss
	5–6	–	Reserved
2	1–3	DATE	Date/time of last counter reset
	4	INT16U	Number of output operations for relay 1
	5–6	–	Reserved
3–6	1–3	DATE	Date/time of last counter reset
	4	INT16U	Number of output operations for relay 2–5
	5–6	–	Reserved
7	1–3	DATE	Date/time of last counter reset
	4	INT16U	Number of output operations for relay 6
	5–6	–	Reserved
8	1–3	DATE	Date/time of last record updated
	4	INT16U	Worst contact wear
	5–6	–	Reserved
9	1–3	DATE	Date/time of last record updated
	4	INT16U	Maximum reverse power
	5–6	–	Reserved
10	1–3	DATE	Date/time of last record updated
	4	INT16U	Battery indicator, page 183
	5–6	–	Reserved
11	1–3	DATE	Date/time of last record updated
	4	INT16U	Number of power losses
	5–6	–	Reserved
12–15	1–6	–	Reserved
16	1–3	DATE	Date/time of last record updated
	4	INT16U	Number of maximum resets
	5–6	–	Reserved
17	1–6	–	Reserved
18	1–3	DATE	Date/time of last record updated
	4	INT16U	Maximum peak fault current breaker ever opened
	5–6	–	Reserved
19–20	1–6	–	Reserved

# Maintenance Metering Event Log

## General Description

The system stores the events that concern the maintenance metering manager (counter reset, and so on) in file number 12.

This file is made up of 20 records and each record is made up of six registers.

## File Header

The following table describes the file header content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1C3B	7228	RW	–	–	INT16U	–	H	File status: 0x0000 = file disabled 0xFFFF = file enabled (factory setting)
0x1C3C	7229	R	–	–	INT16U	–	H	Type of file: 12 = maintenance metering event log
0x1C3D	7230	R	1	–	INT16U	–	H	Size of a file = 20 records
0x1C3E	7231	R	1	–	INT16U	–	H	Size of a record = 6 registers
0x1C3F	7232	R	–	–	INT16U	1	H	File filling mode: 1 = disabled if log is full

## File Status

The following table describes the file status content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1C4B	7244	R	1	–	INT16U	–	H	Size of a file = 20 records
0x1C4C	7245	R	1	–	INT16U	–	H	Size of a record = 6 registers
0x1C4D	7246	R	1	–	INT16U	–	H	0x0000 = file OK 0x000A = record size smaller than expected 0x0014 = record size larger than expected 0x001E = insufficient memory 0x00FA = internal error 0x00FD = corrupted allocation table 0x00FE = configuration zero 0x00FF = invalid configuration 0xFC00 = invalid file number 0xFD00 = invalid record number 0xFE00 = file not supported 0xFF00 = cannot allocate file
0x1C4E	7247	R	1	–	INT16U	20	H	Number of records in the file = 20
0x1C4F	7248	R	1	–	INT16U	1	H	Sequence number of first record in the file (the oldest) = 1

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1C50	7249	R	1	–	INT16U	20	H	Sequence number of last record in the file (the most recent) = 20
0x1C51– 0x1C53	7250– 7252	R	–	–	DATE	–	H	Date the last file was reset. Factory setting = 0x8000 0x8000 0x8000

## Maintenance Metering Event Record

The maintenance metering event log has a fixed number of records and all record has a fixed number of registers:

Record Number	Registers	Type	Description
1	1–3	DATE	Date/time of last counter reset
	4	INT16U	Number of minimum resets
	5–6	–	Reserved
2	1–3	DATE	Date/time of last counter reset
	4	INT16U	Number of maximum resets
	5–6	–	Reserved
3	1–3	DATE	Date/time of last counter reset
	4	INT16U	Number of peak current demand resets
	5–6	–	Reserved
4	1–3	DATE	Date/time of last counter reset
	4	INT16U	Number of peak power demand resets
	5–6	–	Reserved
5	1–3	DATE	Date/time of last counter reset
	4	INT16U	Number of energy resets
	5–6	–	Reserved
6–20	1–6	–	Reserved

# Minimum/Maximum Event Log

## General Description

The system stores the events that concern the metering manager (minimum and maximum values for the Real-Time measurements 1000–1136) in the file number 11.

This file is made up of 136 records and each record is made up of eight registers.

This file contains the minimum and maximum values reached by the real-time measurements, page 123.

## File Header

The following table describes the file header content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1C1B	7196	RW	–	–	INT16U	–	H	File status: 0x0000 = file disabled 0xFFFF = file enabled (factory setting)
0x1C1C	7197	R	–	–	INT16U	–	H	Type of file: 11 = minimum/maximum metering event log
0x1C1D	7198	R	1	–	INT16U	–	H	Size of a file = 136 records
0x1C1E	7199	R	1	–	INT16U	–	H	Size of a record = 8 registers
0x1C1F	7200	R	–	–	INT16U	1	H	File filling mode: 1 = disabled if log is full

## File Status

The following table describes the file status content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1C2B	7212	R	1	–	INT16U	–	H	Size of a file = 136 records
0x1C2C	7213	R	1	–	INT16U	–	H	Size of a record = 8 registers
0x1C2D	7214	R	1	–	INT16U	–	H	0x0000 = file OK 0x000A = record size smaller than expected 0x0014 = record size larger than expected 0x001E = insufficient memory 0x00FA = internal error 0x00FD = corrupted allocation table 0x00FE = configuration zero 0x00FF = invalid configuration 0xFC00 = invalid file number 0xFD00 = invalid record number 0xFE00 = file not supported 0xFF00 = cannot allocate file



Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1C2E	7215	R	1	–	INT16U	136	H	Number of records in the file = 136 (real-time zone size)
0x1C2F	7216	R	1	–	INT16U	1	H	Sequence number of first record in the file (the oldest) = 1
0x1C30	7217	R	1	–	INT16U	20	H	Sequence number of last record in the file (the most recent) = 136
0x1C31– 0x1C33	7218– 7220	R	–	–	DATE	–	H	Date the last file was reset.  Factory setting = 0x8000 0x8000 0x8000

## Minimum/Maximum Event Record

The minimum/maximum event log has a fixed number of records and all record has a fixed number of registers:

Record Number	Registers	Type	Description
1	1	INT16U	Last minimum value (register 1300)
	2–4	DATE	Date/time of last minimum value
	5	INT16U	Last maximum value (register 1600)
	6–8	DATE	Date/time of last maximum value
2	1	INT16U	Last minimum value (register 1301)
	2–4	DATE	Date/time of last minimum value
	5	INT16U	Last maximum value (register 1601)
	6–8	DATE	Date/time of last maximum value
3–135	1	INT16U	Last minimum value (register 130x)
	2–4	DATE	Date/time of last minimum value
	5	INT16U	Last maximum value (register 160x)
	6–8	DATE	Date/time of last maximum value
136	1	INT16U	Last minimum value (register 1435)
	2–4	DATE	Date/time of last minimum value
	5	INT16U	Last maximum value (register 1735)
	6–8	DATE	Date/time of last maximum value

# Waveform Capture

## General Description

The system stores the variables  $V_{AN}$ ,  $V_{BN}$ ,  $V_{CN}$ ,  $I_A$ ,  $I_B$ ,  $I_C$ ,  $I_N$  during four cycles (64 points per cycles) in the file number 5.

This file consists of a fixed number of records (29). All records are of similar size that is 64 registers wide.

The capture is triggered as follows:

- manually (user request) by using the command Forcelog (see the *MasterPact Legacy Modbus User Guide*)
- automatically attached to analog predefined alarms (1 to 53) by setting the log action to 1, page 147

## File Header

The following table describes the file header content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1BDB	7132	RW	–	–	INT16U	–	H	File status: 0x0000 = file disabled 0xFFFF = file enabled (factory setting)
0x1BDC	7133	R	–	–	INT16U	–	H	Type of file: 5 = waveform capture
0x1BDD	7134	R	1	–	INT16U	–	H	Size of a file = 29 records
0x1BDE	7135	R	1	–	INT16U	–	H	Size of a record = 64 registers
0x1BDF	7136	R	–	–	INT16U	1	H	File filling mode: 0 = circular 1 = disabled if log is full
0x1BE0	7137	R	1	–	INT16U	–	H	Number of cycle segments: 1 = 4 cycles for waveform capture
0x1BE1	7138	R	1	–	INT16U	–	H	Number of cycles before capture: 2 = waveform capture and fault waveform capture
0x1BE2	7139	R	1	–	INT16U	–	H	Number of points per cycle: 64 = waveform capture

## File Status

The following table describes the file status content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x1BEB	7148	R	1	–	INT16U	–	H	Size of a file = 29 records
0x1BEC	7149	R	1	–	INT16U	–	H	Size of a record = 64 registers
0x1BED	7150	R	1	–	INT16U	–	H	0x0000 = file OK 0x000A = record size smaller than expected 0x0014 = record size larger than expected

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
								0x001E = insufficient memory 0x00FA = internal error 0x00FD = corrupted allocation table 0x00FE = configuration zero 0x00FF = invalid configuration 0xFC00 = invalid file number 0xFD00 = invalid record number 0xFE00 = file not supported 0xFF00 = cannot allocate file
0x1BEE	7151	R	1	–	INT16U	–	H	Number of records in the file = 29
0x1BEF	7152	R	1	–	INT16U	–	H	Sequence number of first record in the file (the oldest) = 1
0x1BF0	7153	R	1	–	INT16U	–	H	Sequence number of last record in the file (the most recent) = 29
0x1BF1– 0x1BF3	7154– 7156	R	–	–	DATE	–	H	Date the last file was reset.  Factory setting = 0x8000 0x8000 0x8000

## Waveform Record

The waveform capture has a fixed number of records and all record has a fixed number of registers:

Record Number	Registers	Type	Description
1	1–4	XDATE	Extended date/time
	5–11	–	Reserved
	12	INT16U	ID of fault WFC trigger: Alarm number 1000 to 1031, page 145
	13	–	System type: 31, 40 or 41, page 175
	14	A	Circuit breaker nominal current
	15	SFIXPT	Voltage multiplier for phase A
	16	INT16	Voltage offset for phase A
	17	SFIXPT	Voltage multiplier for phase B
	18	INT16	Voltage offset for phase B
	19	SFIXPT	Voltage multiplier for phase C
	20	INT16	Voltage offset for phase C
	21	SFIXPT	Current multiplier for phase A
	22	INT16	Current offset for phase A
	23	SFIXPT	Current multiplier for phase B
	24	INT16	Current offset for phase B
	25	SFIXPT	Current multiplier for phase C
	26	INT16	Current offset for phase C
	27	SFIXPT	Current multiplier for neutral
	28	INT16	Current offset for neutral
	29	INT16U	Scaling factor used for SFIXPT math on voltage samples
	30	INT16U	Scaling factor used for SFIXPT math on phase-current samples

Record Number	Registers	Type	Description
	31	INT16U	Scaling factor used for SFIXPT math on neutral-current samples
	32–64	–	Not used
2–4	1–64	INT16U	Voltage $V_{AN}$ sample points (16 points - 12 cycles)
5–7	1–64	INT16U	Voltage $V_{BN}$ sample points (16 points - 12 cycles)
8–10	1–64	INT16U	Voltage $V_{CN}$ sample points (16 points - 12 cycles)
11–13	1–64	INT16U	Current $I_A$ sample points (16 points - 12 cycles)
14–16	1–64	INT16U	Current $I_B$ sample points (16 points - 12 cycles)
17–19	1–64	INT16U	Current $I_C$ sample points (16 points - 12 cycles)
20–22	1–64	INT16U	Current $I_N$ sample points (16 points - 12 cycles) Valid only with system type 41

## Voltage Calculation

Apply the following rules to derive the voltages:

- on phase A:  

$$\text{Sample (Volt)} = [(\text{sample} - \text{mean value of Voltage V1N sample points}) \times \text{register number 15 of first record}] / (1000 \times \text{register number 29 of first record}).$$
- on phase B:  

$$\text{Sample (Volt)} = [(\text{sample} - \text{mean value of Voltage V2N sample points}) \times \text{register number 17 of first record}] / (1000 \times \text{register number 29 of first record}).$$
- on phase C:  

$$\text{Sample (Volt)} = [(\text{sample} - \text{mean value of Voltage V3N sample points}) \times \text{register number 19 of first record}] / (1000 \times \text{register number 29 of first record}).$$

## Current Calculation

Apply the following rules to derive the currents:

- on phase A:  

$$\text{Sample (Ampere)} = [(\text{sample} - \text{mean value of Current I1 sample points}) \times \text{register number 21 of first record}] / ((1000 \times \text{register number 30 of first record}) / \text{Circuit breaker nominal current}).$$
- on phase B:  

$$\text{Sample (Ampere)} = [(\text{sample} - \text{mean value of Current I2 sample points}) \times \text{register number 23 of first record}] / ((1000 \times \text{register number 30 of first record}) / \text{Circuit breaker nominal current}).$$
- on phase C:  

$$\text{Sample (Ampere)} = [(\text{sample} - \text{mean value of Current I3 sample points}) \times \text{register number 25 of first record}] / ((1000 \times \text{register number 30 of first record}) / \text{Circuit breaker nominal current}).$$
- on neutral:  

$$\text{Sample (Ampere)} = [(\text{sample} - \text{mean value of Current IN sample points}) \times \text{register number 27 of first record}] / ((1000 \times \text{register number 31 of first record}) / \text{Circuit breaker nominal current}).$$

# Fault Waveform Capture

## General Description

The system stores the variables  $V_{AN}$ ,  $V_{BN}$ ,  $V_{CN}$ ,  $I_A$ ,  $I_B$ ,  $I_C$ ,  $I_N$  during 12 cycles (16 points per cycles) in the file number 22.

This file consists of a fixed number of records (22). All records are of similar size that is 64 registers wide.

The capture is triggered automatically attached to alarms (1000–1030) by setting the log action to 1, page 145.

## File Header

The following table describes the file header content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x26EB	9964	RW	–	–	INT16U	–	H	File status: 0x0000 = file disabled 0xFFFF = file enabled (factory setting)
0x26EC	9965	R	–	–	INT16U	–	H	Type of file: 22 = fault waveform capture
0x26ED	9966	R	1	–	INT16U	–	H	Size of a file = 22 records
0x26EE	9967	R	1	–	INT16U	–	H	Size of a record = 64 registers
0x26EF	9968	R	–	–	INT16U	1	H	File filling mode: 0 = circular 1 = disabled if log is full
0x26F0	9969	R	1	–	INT16U	–	H	Number of cycle segments: 1 = 12 cycles for fault waveform capture
0x26F1	9970	R	1	–	INT16U	–	H	Number of cycles before capture: 2 = waveform capture and fault waveform capture
0x26F2	9971	R	1	–	INT16U	–	H	Number of points per cycle: 16 = fault waveform capture

## File Status

The following table describes the file status content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x26FB	9980	R	1	–	INT16U	–	H	Size of a file = 22 records
0x26FC	9981	R	1	–	INT16U	–	H	Size of a record = 64 registers
0x26FD	9982	R	1	–	INT16U	–	H	0x0000 = file OK 0x000A = record size smaller than expected 0x0014 = record size larger than expected 0x001E = insufficient memory 0x00FA = internal error 0x00FD = corrupted allocation table

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
								0x00FE = configuration zero 0x00FF = invalid configuration 0xFC00 = invalid file number 0xFD00 = invalid record number 0xFE00 = file not supported 0xFF00 = cannot allocate file
0x26FE	9983	R	1	–	INT16U	–	H	Number of records in the file = 22
0x26FF	9984	R	1	–	INT16U	–	P/H	Sequence number of first record in the file (the oldest) = 1
0x2700	9985	R	1	–	INT16U	–	P/H	Sequence number of last record in the file (the most recent) = 22
0x2701– 0x2703	9986– 9988	R	–	–	DATE	–	H	Date the last file was reset.  Factory setting = 0x8000 0x8000 0x8000

## Fault Waveform Record

The fault waveform capture has a fixed number of records and all record has a fixed number of registers:

Record Number	Registers	Type	Description
1	1–4	XDATE	Extended date/time
	5–11	–	Reserved
	12	INT16U	ID of fault WFC trigger: Alarm number 1000 to 1031, page 145
	13	–	System type: 31, 40 or 41, page 175
	14	A	Circuit breaker nominal current
	15	SFIXPT	Voltage multiplier for phase A
	16	INT16	Voltage offset for phase A
	17	SFIXPT	Voltage multiplier for phase B
	18	INT16	Voltage offset for phase B
	19	SFIXPT	Voltage multiplier for phase C
	20	INT16	Voltage offset for phase C
	21	SFIXPT	Current multiplier for phase A
	22	INT16	Current offset for phase A
	23	SFIXPT	Current multiplier for phase B
	24	INT16	Current offset for phase B
	25	SFIXPT	Current multiplier for phase C
	26	INT16	Current offset for phase C
	27	SFIXPT	Current multiplier for neutral
	28	INT16	Current offset for neutral
	29	INT16U	Scaling factor used for SFIXPT math on voltage samples
	30	INT16U	Scaling factor used for SFIXPT math on phase current samples
	31	INT16U	Scaling factor used for SFIXPT math on neutral current samples
	32–64	–	Not used
2–4	1–64	INT16U	Voltage $V_{AN}$ sample points (16 points - 12 cycles)

Record Number	Registers	Type	Description
5–7	1–64	INT16U	Voltage $V_{BN}$ sample points (16 points - 12 cycles)
8–10	1–64	INT16U	Voltage $V_{CN}$ sample points (16 points - 12 cycles)
11–13	1–64	INT16U	Current $I_A$ sample points (16 points - 12 cycles)
14–16	1–64	INT16U	Current $I_B$ sample points (16 points - 12 cycles)
17–19	1–64	INT16U	Current $I_C$ sample points (16 points - 12 cycles)
20–22	1–64	INT16U	Current $I_N$ sample points (16 points - 12 cycles) Valid only with system type 41

## Voltage Calculation

Apply the following rules to derive the voltages:

- on phase A:  

$$\text{Sample (Volt)} = [(\text{sample} - \text{register number 16 of first record}) \times \text{register number 15 of first record}] / \text{register number 29 of first record}.$$
- on phase B:  

$$\text{Sample (Volt)} = [(\text{sample} - \text{register number 18 of first record}) \times \text{register number 17 of first record}] / \text{register number 29 of first record}.$$
- on phase C:  

$$\text{Sample (Volt)} = [(\text{sample} - \text{register number 20 of first record}) \times \text{register number 19 of first record}] / \text{register number 29 of first record}.$$

## Current Calculation

Apply the following rules to derive the currents:

- on phase A:  

$$\text{Sample (Ampere)} = [(\text{sample} - \text{register number 22 of first record}) \times \text{register number 21 of first record}] / \text{register number 30 of first record}.$$
- on phase B:  

$$\text{Sample (Ampere)} = [(\text{sample} - \text{register number 24 of first record}) \times \text{register number 23 of first record}] / \text{register number 30 of first record}.$$
- on phase C:  

$$\text{Sample (Ampere)} = [(\text{sample} - \text{register number 26 of first record}) \times \text{register number 25 of first record}] / \text{register number 30 of first record}.$$
- on neutral:  

$$\text{Sample (Ampere)} = [(\text{sample} - \text{register number 27 of first record}) \times \text{register number 28 of first record}] / \text{register number 31 of first record}.$$

# MicroLogic Trip Unit Commands

## What’s in This Chapter

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Measurement Configuration Commands ..... 206

## Introduction

This section describes the MicroLogic trip unit commands.



# List of MicroLogic Trip Unit Commands and Error Codes

## List of Commands

The following table lists the available MicroLogic trip unit commands, their corresponding command codes, and user profiles. Follow the command execution procedures accordingly , page 56:

Command	Command Code	User Profile
Set up ENVT presence , page 206	46472	Administrator
Reset minimum/maximum , page 206	46728	Administrator or Operator
Power flow sign configuration , page 207	47240	Administrator
Power factor sign configuration , page 207	47241	Administrator
Energy accumulation mode configuration , page 208	47242	Administrator
Current demand configuration , page 208	47243	Administrator
Power demand configuration , page 209	47244	Administrator
Set up nominal voltage Vn display , page 209	47245	Administrator

For additional commands related to protection settings, refer to *MasterPact Modbus Legacy User Guide*.

## Error Codes

Error codes generated by MicroLogic trip units are the generic error codes , page 59.

## Measurement Configuration Commands

### Set Up ENVT Presence

The user can read the ENVT (External Neutral Voltage Tap) presence parameters at register 3314, page 175.

To set up ENVT presence, the user must set up the command registers the following way:

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F3F	8000	–	–	INT16U	46472	E/P/H	Command code = <b>46472</b>
0x1F40	8001	–	–	INT16U	12	E/P/H	Number of parameters (bytes) = 12
0x1F41	8002	–	–	INT16U	4609	E/P/H	Destination = 4609 (0x1201)
0x1F42	8003	–	–	INT16U	1	E/P/H	Security type of the command
0x1F43	8004	–	–	OCTET STRING	–	E/P/H	Password of the command: Administrator user profile password
0x1F44	8005	–	–				
0x1F45	8006	–	–	INT16U	0–1	E/P/H	0 = ENVT is not present 1 = ENVT is present

### Reset Minimum/Maximum

The reset minimum/maximum command resets the minimum values of real-time measurements (registers 1300 to 1599) and the maximum values of real-time measurements (registers 1600 to 1899), page 123.

The reset minimum/maximum command resets the energy measurements (registers 2000 to 2027), page 124.

The reset minimum/maximum command resets the peak demand measurements (registers 2200 to 2241), page 126.

To reset minimum/maximum values of measurements, the user must set up the command registers the following way:

Address	Register	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x1F3F	8000	–	–	INT16U	46728	–	–	Command code = <b>46728</b>
0x1F40	8001	–	–	INT16U	12	–	–	Number of parameters (bytes) = 12
0x1F41	8002	–	–	INT16U	4609	–	–	Destination = 4609 (0x1201)
0x1F42	8003	–	–	INT16U	1	–	–	Security type of the command
0x1F43	8004	–	–	OCTET STRING	–	–	–	Password of the command: Administrator or Operator user profile password
0x1F44	8005	–	–					
0x1F45	8006	–	–	INT16U	–	–	–	Reset minimum/maximum of metering variables: <ul style="list-style-type: none"> <li>To reset the metering variable, set the bit to 1.</li> <li>To keep the current values, set the bit to 0.</li> </ul>
						A/E/P/H	0	Reset minimum/maximum current ( $I_A$ , $I_B$ , $I_C$ , $I_N$ , $I_{max}$ , $I_g$ , $I_{\Delta n}$ , $I_{avg}$ , and $I_{unbal}$ )
						E/P/H	1	Reset minimum/maximum voltage ( $V_{AB}$ , $V_{AC}$ , $V_{BC}$ , $V_{AN}$ , $V_{BN}$ , $V_{CN}$ , $V_{avgL-L}$ , $V_{avgL-N}$ , and $V_{unbal}$ )

Address	Register	X	Unit	Type	Range	A/E/P/H	Bit	Description
						E/P/H	2	Reset minimum/maximum power (active power, reactive power, apparent power, and distortion power)
						E/P/H	3	Reset minimum/maximum power factor and $\cos\phi$
						E/P/H	4	Reset minimum/maximum total harmonic distortion (THD)
						E/P/H	5	Reset peak of current demand
						E/P/H	6	Reset peak of active power, reactive power, and apparent power demand
						E/P/H	7	Reset minimum/maximum frequency
						–	8	Not applicable
						E/P/H	9	Reset energy (active, reactive, apparent)
						–	10–15	Reserved

## Power Flow Sign Configuration

The user can read the power flow sign configuration at register 3316 , page 175.

To set the power flow sign parameters, the user must set up the command registers the following way:

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F3F	8000	–	–	INT16U	47240	P/H	Command code = <b>47240</b>
0x1F40	8001	–	–	INT16U	12	P/H	Number of parameters (bytes) = 12
0x1F41	8002	–	–	INT16U	4609	P/H	Destination = 4609 (0x1201)
0x1F42	8003	–	–	INT16U	1	P/H	Security type of the command
0x1F43 0x1F44	8004 8005	–	–	OCTET STRING	–	P/H	Password of the command: Administrator user profile password
0x1F45	8006	–	–	INT16U	0–1	P/H	Power flow sign:  0 = the active power flows from upstream (top) to downstream (bottom) (factory setting)  1 = the active power flows from downstream (bottom) to upstream (top).

## Power Factor Sign Configuration

The user can read the power factor sign configuration at register 3318, page 176.

To set the power factor sign parameters, the user must set up the command registers the following way:

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F3F	8000	–	–	INT16U	47241	E	Command code = <b>47241</b>
0x1F40	8001	–	–	INT16U	12	E	Number of parameters (bytes) = 12
0x1F41	8002	–	–	INT16U	4609	E	Destination = 4609 (0x1201)

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F42	8003	–	–	INT16U	1	E	Security type of the command
0x1F43	8004	–	–	OCTET STRING	–	E	Password of the command: Administrator user profile password
0x1F44	8005	–	–				
0x1F45	8006	–	–	INT16U	0–2	E	Sign convention for the power factor and the fundamental power factor (cosφ):  0 = IEC convention 2 = IEEE convention (factory setting)

## Energy Accumulation Mode Configuration

The user can read the energy accumulation mode configuration at register 3324, page 176.

To set the energy accumulation mode parameters, the user must set up the command registers the following way:

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F3F	8000	–	–	INT16U	47242	E/P/H	Command code = <b>47242</b>
0x1F40	8001	–	–	INT16U	12	E/P/H	Number of parameters (bytes) = 12
0x1F41	8002	–	–	INT16U	4609	E/P/H	Destination = 4609 (0x1201)
0x1F42	8003	–	–	INT16U	1	E/P/H	Security type of the command
0x1F43	8004	–	–	OCTET STRING	–	E/P/H	Password of the command: Administrator user profile password
0x1F44	8005	–	–				
0x1F45	8006	–	–	INT16U	0–1	E/P/H	Energy accumulation mode:  0 = absolute accumulation (factory setting)  1 = signed accumulation

## Current Demand Configuration

The user can read the duration of the current demand calculation window at register 3352, page 177.

The user can read the current demand parameters from register 2200 to 2207, page 126.

To start current demand, the user must set up the command registers the following way:

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F3F	8000	–	–	INT16U	47243	E/P/H	Command code = <b>47243</b>
0x1F40	8001	–	–	INT16U	12	E/P/H	Number of parameters (bytes) = 12
0x1F41	8002	–	–	INT16U	4609	E/P/H	Destination = 4609 (0x1201)
0x1F42	8003	–	–	INT16U	1	E/P/H	Security type of the command

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F43 0x1F44	8004 8005	–	–	OCTET STRING	–	E/P/H	Password of the command: Administrator user profile password
0x1F45	8006	–	Min	INT16U	5–60	E/P/H	Duration of the current demand calculation window, adjustable in step of 1.  The factory setting is 15 minutes (sliding).

## Power Demand Configuration

The user can read the power demand calculation method from register 3354 to 3355, page 177.

The user can read the power demand parameters from register 2224 to 2237, page 127.

To start power demand, the user must set up the command registers the following way:

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F3F	8000	–	–	INT16U	47244	E/P/H	Command code = <b>47244</b>
0x1F40	8001	–	–	INT16U	14	E/P/H	Number of parameters (bytes) = 14
0x1F41	8002	–	–	INT16U	4609	E/P/H	Destination = 4609 (0x1201)
0x1F42	8003	–	–	INT16U	1	E/P/H	Security type of the command
0x1F43 0x1F44	8004 8005	–	–	OCTET STRING	–	E/P/H	Password of the command: Administrator user profile password
0x1F45	8006	–	–	INT16U	0–5	E/P/H	Power demand calculation method (window type):  0 = sliding (factory setting)  2 = fixed  5 = synchronized to communication
0x1F46	8007	–	Min	INT16U	5–60	E/P/H	Duration of the power demand calculation window, adjustable in step of 1.  The factory setting is 15 minutes.

## Set Up Nominal Primary Voltage Vn Display

The user can read the nominal voltage at register 9616, page 177.

To set the nominal primary voltage Vn display parameters, the user must set up the command registers the following way:

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F3F	8000	–	–	INT16U	47245	E/P/H	Command code = <b>47245</b>
0x1F40	8001	–	–	INT16U	12	E/P/H	Number of parameters (bytes) = 12
0x1F41	8002	–	–	INT16U	4609	E/P/H	Destination = 4609 (0x1201)
0x1F42	8003	–	–	INT16U	1	E/P/H	Security type of the command

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F43	8004	–	–	OCTET STRING	–	E/P/H	Password of the command: Administrator user profile password
0x1F44	8005						
0x1F45	8006	–	V	INT16U	0–65535	E/P/H	Nominal primary voltage Vn (factory setting = 690 V)

# BCM ULP Module Data for MasterPact NT/NW and PowerPact P- and R-Frame Circuit Breakers

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# BCM ULP Module Registers

## What's in This Chapter

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## BCM ULP Module Identification

### Product Identification

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0202	515	R	–	–	INT16U	15139	A/E/P/H	Product identification = 15139 for the BCM ULP module

### BCM ULP Module Identifier

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0215– 0x0216	534– 535	RW	–	–	OCTET STRING	0x0000– 0x7F7F	A/E/P/H	Short identifier of BCM ULP module coded over 4 ASCII characters  Factory setting = 0x0000
0x0217– 0x021E	536–543	RW	–	–	OCTET STRING	0x0000– 0x7F7F	A/E/P/H	Long identifier of BCM ULP module coded over 16 ASCII characters  Factory setting = 0x0000

### BCM ULP Module Firmware Version

The BCM ULP module firmware version starts with a V character and has the following format: VX.Y.Z.

The firmware version is coded as follows:  $VX.Y.Z = VX*1000 + Y*100 + Z*10$

For example if the value of the register is equal to 2000, the BCM ULP module firmware version is equal to V2.0.0.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0240	577	R	–	–	INT16U	–	A/E/P/H	BCM ULP module firmware version

# Circuit Breaker Status

## Tripping Cause

The tripping cause register indicates the current status of the trip.

- If the trip bit is set to 0, then the trip is not active.
- If the trip bit is set to 1, then the trip is active.

The bit is reset as soon as the circuit breaker is closed again.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x0289	650	R	–	–	INT16U	–	–	–	Tripping cause for basic protection functions
							A/E/P/H	0	Long-time protection I <sub>r</sub>
							P/H	1	Short-time protection I <sub>sd</sub>
							A/E	1	Short-time protection I <sub>sd</sub> or Instantaneous-protection I <sub>i</sub>
							P/H	2	Instantaneous-protection I <sub>i</sub>
							A/E/P/H	3	Ground-fault protection I <sub>g</sub>
							A/P/H	4	Earth-leakage protection (Vigi)
							A/E/P/H	5	Integrated Instantaneous protection
							A/E	6	Other protection
							P/H		Internal failure (temperature)
							A/E/P/H	7	Internal failure (overvoltage)
							P/H	8	Other protection (see register 651)
							–	9–14	Reserved
							A/E/P/H	15	If this bit is at 1, bits 0 to 14 are not valid.
0x028A	651	R	–	–	INT16U	–	–	–	Tripping cause for advanced protection functions
							P/H	0	Current unbalance
							P/H	1	Overcurrent phase A
							P/H	2	Overcurrent phase B
							P/H	3	Overcurrent phase C
							P/H	4	Overcurrent on neutral
							P/H	5	Undervoltage
							P/H	6	Overvoltage
							P/H	7	Voltage unbalance
							P/H	8	Overpower
							P/H	9	Reverse power
							P/H	10	Underfrequency
							P/H	11	Overfrequency
							P/H	12	Phase rotation

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
							P/H	13	Load shedding based on current
							P/H	14	Load shedding based on power
							–	15	If this bit is at 1, bits 0 to 14 are not valid.

## Inhibit Close Order

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x0291	658	R	–	–	INT16U	–	A/E/P/H	–	Validity of each bit in the inhibit close order status register
0x0292	659	R	–	–	INT16U	–	A/E/P/H	–	Inhibit close order status
								0	Inhibit close order activated by IO module
								1	Inhibit close order activated by remote controller
								2–15	Reserved

## Local/Remote Mode

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0293	660	R	–	–	INT16U	0–1	A/E/P/H	Mode selected in FDM121 or IO: 0 = Remote mode (factory setting) 1 = Local mode

## Circuit Breaker Status

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
0x0294	661	R	–	–	INT16U	–	A/E/P/H	–	Circuit breaker status register
								0	OF status indication contact 0 = The circuit breaker is open. 1 = The circuit breaker is closed.
								1	SD trip indication contact 0 = Circuit breaker is not tripped. 1 = Circuit breaker is tripped due to electrical default or shunt trip or push-to-trip.  Bit always equal to 0 for MasterPact and PowerPact P- and R-frame circuit breakers with motor operator.
								2	SDE fault trip indication contact 0 = Circuit breaker is not tripped on electrical default. 1 = Circuit breaker is tripped due to electrical fault (including ground-fault test and earth-leakage test).
								3	CH spring charged contact (only with MasterPact)

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Bit	Description
									0 = Spring discharged 1 = Spring charged Bit always equal to 0 for PowerPact P- and R-frame circuit breakers.
								4	Reserved
								5	PF ready to close contact (only with MasterPact) circuit breakers 0 = Not ready to close 1 = Ready to close Bit always equal to 0 for PowerPact P- and R-frame circuit breakers.
								6	Distinction between PowerPact P- and R-frame and MasterPact NT/NW circuit breakers 0 = PowerPact P- and R-frame 1 = MasterPact NT/NW
								7	Distinction between PowerPact P- and R-frame circuit breaker and PowerPact P- and R-frame circuit breaker with motor operator 0 = PowerPact P- and R-frame 1 = PowerPact P- and R-frame with motor operator
								8–15	Reserved

## Auto/Manu

This register displays the actual mode used: Auto/Manu. These modes can be modified only locally through the HMI of MicroLogic P/H trip unit.

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x029D	670	R	–	–	INT16	0...1	A/E/P/H	0 = Manu: opening and closing of the circuit breaker via the communication are disabled. 1 = Auto: opening and closing of the circuit breaker via the communication are enabled (factory setting).

## Legacy Dataset Activation

Legacy dataset is available only if the BCM ULP module firmware version is greater or equal to V2.0.0 (register 577 must be greater or equal to 2000).

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x031F	800	RW	–	–	–	0...1	A/E/P/H	Legacy dataset activation 0 = Not activated 1 = Activated Factory setting = 0 if firmware version smaller than V3.0.0 Factory setting = 1 if firmware version greater or equal to V3.0.0

**NOTE:** If the BCM ULP module firmware version is greater or equal to V3.0.0, in 2 Wire + ULP configuration, the value of this register is always 1 and cannot be changed.

## Communication Parameter

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0325	806	RW	–	–	–	0–1	A/E/P/H	4 Wire / 2 Wire + ULP communication parameter  0 = 4 Wire  1 = 2 Wire + ULP  Factory setting = 0 if BCM ULP module firmware version smaller than V4.0.0  Factory setting = 1 if BCM ULP module firmware version greater or equal to V4.0.0

## Energy Reduction Maintenance Switch (ERMS)

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0326	807	R	–	–	INT16U	–	P/H	ERMS mode register validity: validity of each bit of the ERMS mode register.  0 = Invalid  1 = Valid
0x0327	808	R	–	–	INT16U	–	P/H	ERMS mode:  Bit 0 = 0: ERMS mode OFF Bit 0 = 1: ERMS mode ON Bit 1 = 0: ERMS not degraded mode Bit 1 = 1: ERMS degraded mode
0x0328– 0x0329	809–810	R	–	A	INT32U	2 x In– 15 x In (limited to Ii settings)	P/H	ERMS setting: pickup value for ERMS setting  2 x In up to present Ii (instantaneous pickup current) setting.  Factory setting = 2 x In
0x032A– 0x032B	811–812	R	–	–	–	–	–	Reserved

## Contact Wear

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x032C	813	R	–	–	INT16U	0–300	P/H	Contact wear threshold

# Time-Stamped Information

## General Description

The time-stamped information enables to know all the dates relative to important information (date of last trip, date of last actuation of MX, XF release).

## Date of Last Event

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x029E– 0x02A0	671–673	R	–	–	DATE	–	A/E/P/H	Date of last actuation of MX auxiliary
0x02A2– 0x02A4	675–677	R	–	–	DATE	–	A/E/P/H	Date of last actuation of XF auxiliary
0x02A6– 0x02A9	679–682	R	–	–	XDATE	–	A/E/P/H	Current date of BCM ULP module
0x02AB– 0x02AD	684–686	R	–	–	DATE	–	A/E/P/H	Date of last circuit breaker opening
0x02AE– 0x02B0	687–689	R	–	–	DATE	–	A/E/P/H	Date of last circuit breaker closing
0x02B1– 0x02B3	690–692	R	–	–	DATE	–	A/E/P/H	Date of last trip without an electrical fault
0x02B4– 0x02B6	693–695	R	–	–	DATE	–	A/E/P/H	Date of last trip with an electrical fault
0x02B7– 0x02B9	696–698	R	–	–	DATE	–	A/E/P/H	Date of last “PF ready to close” status
0x02BA– 0x02BC	699–701	R	–	–	DATE	–	A/E/P/H	Date of last “End of opening order” event.  This event occurs when: <ul style="list-style-type: none"> <li>• there is no action on the opening pushbutton on the front of the device</li> <li>• the fault-trip reset pushbutton is in (the device is reset)</li> <li>• the MN undervoltage release is powered (if present)</li> </ul>
0x02BD– 0x02BF	702–704	R	–	–	DATE	–	A/E/P/H	Date of last “CH spring charged” status

## Counters

### General Description

The BCM ULP module has counters that help managing the circuit breaker.

The BCM ULP module counters have the following properties:

- All the counters are saved in non-volatile memory to prevent data loss in case of power loss.
- The cumulating OF counter is read only. It stops incrementing when it reaches the maximum value of 65535.
- All counters (except the cumulating OF counter) can be preset to any value from 0 to 65535. The counters automatically cycle from 65535 to 0.
- A threshold is associated to the OF counter and to the close circuit breaker command counter.

The thresholds can be set to any value from 0 to 65534. The factory setting is 5000. An alarm is generated when a counter reaches the threshold.

### BCM ULP Module Counters

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0229	554	R	–	–	INT16U	0–65535	A/E/P/H	Counter for the number of times the BCM ULP module is energized
0x022A	555	R	–	–	INT16U	0–65535	A/E/P/H	Counter for the number of times the BCM ULP module is reset whether following power loss or not

### Counter Thresholds

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0243	580	RW	–	–	INT16U	0–65535	A/E/P/H	OF counter threshold Factory setting = 5000
0x0244	581	RW	–	–	INT16U	0–65535	A/E/P/H	Close command counter threshold Factory setting = 5000

### Circuit Breaker Operation Counters

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0295	662	R	–	–	INT16	0–65535	A/E/P/H	Cumulating OF counter (non-resettable open to close counter)
0x0296	663	RW	–	–	INT16	0–65535	A/E/P/H	OF counter (resettable open to close counter)
0x0297	664	RW	–	–	INT16	0–65535	A/E/P/H	SD counter (close to SD position)
0x0298	665	RW	–	–	INT16	0–65535	A/E/P/H	SDE counter (close to SDE position)

## MX and XF Release Counters

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x02A1	674	R	–	–	INT16U	0–65535	A/E/P/H	MX actuation counter
0x02A5	678	R	–	–	INT16U	0–65535	A/E/P/H	XF actuation counter



# Trip History

## General Description

The trip history registers describe the last 17 encountered trips. The trip history format corresponds to a series of 17 records saved in a FIFO (first-in first-out) stack. The last record erases the oldest. Each record is composed of seven registers describing one trip.

## Trip Record Number

A read request of 7x(n) registers is necessary to read the last n trip records, where 7 is the number of registers for each trip record.

For example, a read request of 7x3 = 21 registers is necessary to read the last three trip records of the trip history:

- The first seven registers describe the first trip record.
- The next seven registers describe the second trip record.
- The last seven registers describe the third trip record.

Address	Register	Description
0x0095–0x009B	150–156	Trip record 0
0x009C–0x00A2	157–163	Trip record 1
0x00A3–0x00A9	164–170	Trip record 2
0x00AA–0x00B0	171–177	Trip record 3
0x00B1–0x00B7	178–184	Trip record 4
0x00B8–0x00BE	185–191	Trip record 5
0x00BF–0x00C5	192–198	Trip record 6
0x00C6–0x00CC	199–205	Trip record 7
0x00CD–0x00D3	206–212	Trip record 8
0x00D4–0x00DA	213–219	Trip record 9
0x00DB–0x00E1	220–226	Trip record 10
0x00E2–0x00E8	227–233	Trip record 11
0x00E9–0x00EF	234–240	Trip record 12
0x00F0–0x00F6	241–247	Trip record 13
0x00F7–0x00FD	248–254	Trip record 14
0x00FE–0x0104	255–261	Trip record 15
0x0105–0x010B	262–268	Trip record 16

## Trip Record

A read request of seven registers is necessary to read a trip record.

The order and the description of the trip record registers are the same as that of the trip record 1:

Trip Record 1 (Most Recent Trip Record)								
Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x0095	150	R	1	–	INT16U	0–65535	E/P/H	Trip code
0x0096– 0x0098	151–153	R	1	–	ULP	–	E/P/H	Date of event (trip or acknowledge)
0x0099	154	R	1	–	INT16U	1–2	E/P/H	Event type MSB = 0 (reserved) Event occurrence: LSB = 1 Event completion: LSB = 2
0x009A	155	–	–	–	–	–	–	Reserved
0x009B	156	–	–	–	–	–	–	Reserved

## Trip Codes

Trip Code	Description
1000 (0x03E8)	Trip due to long-time protection I <sub>r</sub>
1001 (0x03E9)	Trip due to short-time protection I <sub>sd</sub>
1002 (0x03EA)	Trip due to instantaneous protection I <sub>i</sub>
1003 (0x03EB)	Trip due to ground-fault protection I <sub>g</sub>
1004 (0x03EC)	Trip due to earth-leakage protection IΔ <sub>n</sub>
1005 (0x03ED)	Trip due to integrated instantaneous protection I >>
1006–1007 (0x03EE–0x03EF)	Reserved
1008 (0x03F0)	Trip due to advanced protection
1009 (0x03F1)	Trip due to extended advanced protection
1010–1015 (0x03F2–0x03F7)	Reserved
1016 (0x3F8)	Current unbalance
1017 (0x3F9)	I <sub>A</sub> maximum demand
1018 (0x3FA)	I <sub>B</sub> maximum demand
1019 (0x3FB)	I <sub>C</sub> maximum demand
1020 (0x3FC)	I <sub>N</sub> maximum demand
1021 (0x3FD)	Undervoltage
1022 (0x3FE)	Overvoltage
1023 (0x3FF)	Voltage unbalance
1024 (0x400)	Reserved
1025 (0x401)	Reverse power
1026 (0x402)	Underfrequency
1027 (0x403)	Overfrequency
1028 (0x404)	Phase rotation
1029 (0x405)	Current load shedding
1030 (0x406)	Power load shedding

# BCM ULP Module Files

## What’s in This Chapter

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# Circuit Breaker Manager Event Log

## General Description

The system stores the events that concern circuit breaker control (for example opening or closing of the contacts) in the file number 30.

This file is made up of 100 records and each record is made up of five registers.

This file is reset in case of 24 Vdc power loss on the BCM ULP module or change of the communication parameter 4W/2W + ULP.

## File Header

The following table describes the file header content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x02CD	718	R	–	–	INT16U	–	A/E/P/H	File status: 0x0000 = file disabled 0xFFFF = file enabled (factory setting)
0x02CE	719	R	–	–	INT16U	–	A/E/P/H	Type of file = 30
0x02CF	720	R	–	–	INT16U	–	A/E/P/H	File allocation = 0xFFFF
0x02D0	721	R	1	–	INT16U	–	A/E/P/H	Size of a record = 5 registers
0x02D1	722	R	–	–	INT16U	–	A/E/P/H	File filling mode: 0 = circular

## File Status

The following table describes the file status content:

Address	Register	RW	X	Unit	Type	Range	A/E/P/H	Description
0x02DD	734	R	1	–	INT16U	100	A/E/P/H	Size of a file = 100 records
0x02DE	735	R	1	–	INT16U	5	A/E/P/H	Size of a record = 5 registers
0x02E0	737	R	1	–	INT16U	0–100	A/E/P/H	Number of records in the file
0x02E1	738	R	1	–	INT16U	0–8000	A/E/P/H	Sequence number of first record in the file (the oldest)
0x02E2	739	R	1	–	INT16U	0–8000	A/E/P/H	Sequence number of last record in the file (the most recent)
0x02E3– 0x02E5	740–742	R	–	–	DATE	–	P/H	Date of the last file reset Factory setting = 0x8000 0x8000 0x8000

## Event Record

The following table shows the format of 1 record in the event log of the circuit breaker:

Registers	Type	Description
1–4	XDATE	Event date
5	INT16U	Event number (see table below)

## Events

The following table shows the events in the event log of the circuit breaker:

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

# BCM ULP Module Commands

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# List of BCM ULP Module Commands and Error Codes

## List of Commands

The following table lists the available BCM ULP module commands, their corresponding command codes and user profiles. Follow the command execution procedures accordingly , page 56.

Command	Command Code	User Profile
Open circuit breaker , page 228	904	Administrator or Operator
Close circuit breaker , page 228	905	Administrator or Operator
Enable/Inhibit close order , page 228	910	Administrator or Operator

## Error Codes

In addition to generic error codes , page 59, the BCM ULP module commands generate the following error codes returned in register 8021:

Error Code	Description
4759 (0x1297)	Circuit breaker tripped. It must be reset before the command.
4760 (0x1298)	Circuit breaker already closed.
4761 (0x1299)	Circuit breaker already open.
4763 (0x129B)	FDM121 in local control mode. Remote commands not allowed.
4766 (0x129E)	Previous command still in progress.
4767 (0x12A0)	Inhibit close order enabled.
4777 (0x12A9)	Already in the asked state (valid only for enable/inhibit close order).

Any other positive error code means an internal error.

## Circuit Breaker Control Commands

### Open Circuit Breaker

To open the circuit breaker, the user must set up the command registers the following way:

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F3F	8000	–	–	INT16U	904	A/E/P/H	Command code = <b>904</b>
0x1F40	8001	–	–	INT16U	10	A/E/P/H	Number of parameters (bytes) = 10
0x1F41	8002	–	–	INT16U	4609	A/E/P/H	Destination = 4609 (0x1201)
0x1F42	8003	–	–	INT16U	1	A/E/P/H	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	–	OCTET STRING	–	A/E/P/H	Password of the command: Administrator or Operator user profile password

### Close Circuit Breaker

To close the circuit breaker, the user must set up the command registers the following way:

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F3F	8000	–	–	INT16U	905	A/E/P/H	Command code = <b>905</b>
0x1F40	8001	–	–	INT16U	10	A/E/P/H	Number of parameters (bytes) = 10
0x1F41	8002	–	–	INT16U	4609	A/E/P/H	Destination = 4609 (0x1201)
0x1F42	8003	–	–	INT16U	1	A/E/P/H	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	–	OCTET STRING	–	A/E/P/H	Password of the command: Administrator or Operator user profile password

### Enable/Inhibit a Circuit Breaker Close Order

To enable or inhibit a close order of the circuit breaker, the user must set up the command register the following way:

Address	Register	X	Unit	Type	Range	A/E/P/H	Description
0x1F3F	8000	–	–	INT16U	910	A/E/P/H	Command code = <b>910</b>
0x1F40	8001	–	–	INT16U	13	A/E/P/H	Number of parameters (bytes) = 13
0x1F41	8002	–	–	INT16U	4609	A/E/P/H	Destination = 4609 (0x1201)
0x1F42	8003	–	–	INT16U	1	A/E/P/H	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	–	OCTET STRING	–	A/E/P/H	Password of the command: Administrator or Operator user profile password
0x1F45	8006	–	–	INT16U	1	A/E/P/H	<ul style="list-style-type: none"> <li>0 = Enable close order</li> <li>1 = Inhibit close order</li> </ul>
0x1F46	8007	–	–	INT16U	–	A/E/P/H	Origin of the command:  256 = command sent via communication interface (IFM or IFE interface)



# IO Module Data for MasterPact NT/NW and PowerPact P- and R-Frame Circuit Breakers

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# IO Module Registers

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## Introduction

This section describes the IO module registers.

Registers 13824 to 15719 are held by the IO 1.

Registers 16824 to 18719 are held by the IO 2:

- The registers of the parameters of IO 2 are equal to the registers of the parameters of IO 1 plus 3000.  
**Example:**
  - Register 14599 holds the digital input status register of the IO 1.
  - Register 17599 holds the digital input status register of the IO 2.
- The order of the registers is the same as that of the IO 1.
- The characteristics (access type, size, range, and unit) are the same as those of the registers of IO 1.
- Registers 15360 to 16109 containing the predefined application are specific to the IO 1 because they hold the predefined applications.

# Analog Inputs

## Analog Input Register Mapping

The following table describes the analog inputs and corresponding registers and addresses of the IO module.

IO Module	Analog Input Addresses	Analog Input Registers
IO 1	0x35FF–0x3668	13824–13929
IO 2	0x41B7–0x4220	16824–16929

## Analog Input Registers of IO 1

The order and the description of the analog input registers of IO 2 are the same as those of IO 1.

Address	Register	RW	Unit	Type	Range	Description
0x35FF–0x3600	13824–13825	–	–	–	–	Reserved
0x3601–0x3602	13826–13827	R	°C	FLOAT32	-50–250	Analog input sensor Pt100 temperature value (updated once every 1 s)
0x3603	13828	R	–	INT16U	0–1	Data quality of the analog input <ul style="list-style-type: none"> <li>0 = Valid</li> <li>1 = Invalid</li> </ul>
0x3604	13829	–	–	–	–	Reserved
0x3605–0x3608	13830–13833	R	–	DATETIME	–	Timestamp of the last change of +/- 1 °C of the analog data value
0x3609–0x360C	13834–13837	–	–	–	–	Reserved
0x360D–0x360E	13838–13839	R	°C	FLOAT32	-50–250	Analog input Pt100 maximum value
0x360F–0x3610	13840–13841	R	°C	FLOAT32	-50–250	Analog input Pt100 minimum value
0x3611–0x3614	13842–13845	R	–	DATETIME	–	Timestamp of minimum value of analog input value recorded
0x3615–0x3618	13846–13849	R	–	DATETIME	–	Timestamp of maximum value of analog input value recorded
0x3619–0x361C	13850–13853	R	–	DATETIME	–	Timestamp of last reset of min/max values of analog input value recorded
0x361D–0x361E	13854–13855	R	–	INT32U	0–65534	Switchboard temperature threshold 1 counter This counter increments every time threshold 1 is exceeded.
0x361F–0x3620	13856–13857	R	–	INT32U	0–65534	Switchboard temperature threshold 2 counter This counter increments every time threshold 2 is exceeded.
0x3621–0x3622	13858–13859	R	–	INT32U	0–65534	Switchboard temperature threshold 3 counter This counter increments every time threshold 3 is exceeded.
0x3623–0x363A	13860–13883	R	–	OCTET STRING	–	Analog input identification coded over 45 ASCII characters <sup>(1)</sup>
0x363B	13884	R	–	INT16U	0–2	Analog input type <sup>(1)</sup> <ul style="list-style-type: none"> <li>0 = Analog input is not valid (factory setting)</li> <li>1 = Not applicable</li> <li>2 = Pt100</li> </ul>
0x363C	13885	–	–	–	–	Reserved

Address	Register	RW	Unit	Type	Range	Description
0x363D– 0x363E	13886– 13887	R	°C	FLOAT32	-50–250	Switchboard temperature threshold 1 pick-up value (Pt100) <sup>(1)</sup> Factory setting = 50 °C
0x363F– 0x3640	13888– 13889	R	s	FLOAT32	1–3600	Switchboard temperature threshold 1 pick-up time delay (Pt100) <sup>(1)</sup> Factory setting = 10 s
0x3641– 0x3642	13890– 13891	R	°C	FLOAT32	-50–250	Switchboard temperature threshold 1 drop-out value (Pt100) <sup>(1)</sup> Factory setting = 45 °C
0x3643– 0x3644	13892– 13893	R	s	FLOAT32	1–3600	Switchboard temperature threshold 1 drop-out time delay (Pt100) <sup>(1)</sup> Factory setting = 10 s
0x3645– 0x3646	13894– 13895	R	°C	FLOAT32	-50–250	Switchboard temperature threshold 2 pick-up value (Pt100) <sup>(1)</sup> Factory setting = 60 °C
0x3647– 0x3648	13896– 13897	R	s	FLOAT32	1–3600	Switchboard temperature threshold 2 pick-up time delay (Pt100) <sup>(1)</sup> Factory setting = 10 s
0x3649– 0x364A	13898– 13899	R	°C	FLOAT32	-50–250	Switchboard temperature threshold 2 drop-out value (Pt100) <sup>(1)</sup> Factory setting = 55 °C
0x364B– 0x364C	13900– 13901	R	s	FLOAT32	1–3600	Switchboard temperature threshold 2 drop-out time delay (Pt100) <sup>(1)</sup> Factory setting = 10 s
0x364D– 0x364E	13902– 13903	R	°C	FLOAT32	-50–250	Switchboard temperature threshold 3 pick-up value (Pt100) <sup>(1)</sup> Factory setting = 70 °C
0x364F– 0x3650	13904– 13905	R	s	FLOAT32	1–3600	Switchboard temperature threshold 3 pick-up time delay (Pt100) <sup>(1)</sup> Factory setting = 10 s
0x3651– 0x3652	13906– 13907	R	°C	FLOAT32	-50–250	Switchboard temperature threshold 3 drop-out value (Pt100) <sup>(1)</sup> Factory setting = 65 °C
0x3653– 0x3654	13908– 13909	R	s	FLOAT32	1–3600	Switchboard temperature threshold 3 drop-out time delay (Pt100) <sup>(1)</sup> Factory setting = 10 s
0x3655– 0x3656	13910– 13911	R	Ω	FLOAT32	200–650	Motor temperature sensor fault threshold
0x3657– 0x3668	13912– 13929	–	–	–	–	Reserved

(1) Value set using the EcoStruxure Power Commission software.

## Digital Inputs

### Digital Input Register Mapping

Each digital input description is made up of 80 registers. The order and the description of the digital inputs 2, 3, 4, 5, and 6 are the same as those of digital input 1.

IO Module	Digital Input Number	Digital Input Addresses	Digital Input Registers
IO 1	I1	0x3669–0x36B8	13930–14009
	I2	0x36B9–0x3708	14010–14089
	I3	0x3709–0x3758	14090–14169
	I4	0x3759–0x37A8	14170–14249
	I5	0x37A9–0x37F8	14250–14329
	I6	0x37F9–0x3848	14330–14409
IO 2	I1	0x4221–0x4270	16930–17009
	I2	0x4271–0x42C0	17010–17089
	I3	0x42C1–0x4310	17090–17169
	I4	0x4311–0x4360	17170–17249
	I5	0x4361–0x43B0	17250–17329
	I6	0x43B1–0x4400	17330–17409

### Digital Input 1 Registers of IO 1

The order and the description of the digital input 1 registers of IO 2 are the same as those of IO 1:

Address	Register	RW	Unit	Type	Range	Bit	Description
0x3669	13930	R	–	INT16U	–	–	Quality of each bit of register 13931: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x366A	13931	R	–	INT16U	–	0	Digital input status: <ul style="list-style-type: none"> <li>0 = Off</li> <li>1 = On</li> </ul>
						1	Digital input forced status: <ul style="list-style-type: none"> <li>0 = Unforced</li> <li>1 = Forced</li> </ul>
						2–15	Reserved
0x366B– 0x366E	13932– 13935	R	–	DATETIME	–	–	Timestamp for the last input transition: <ul style="list-style-type: none"> <li>Last rising edge if input is configured as NO (normally open contact)</li> <li>Last falling edge if input is configured as NC (normally closed contact)</li> </ul> Valid if input signal type is a normal digital input (not valid for pulse digital input).
0x366F– 0x3670	13936– 13937	–	–	–	–	–	Reserved
0x3671– 0x3672	13938– 13939	R	–	INT32U	0–4294967294	–	Input counter value  This counter increments for each rising edge of the input.

Address	Register	RW	Unit	Type	Range	Bit	Description
							Valid if input signal type is normal digital input.
0x3673– 0x3676	13940– 13943	R	–	DATETIME	–	–	Timestamp for the last input change counter preset/reset  Valid if input signal type is normal digital input.
0x3677– 0x3678	13944– 13945	R	–	INT32U	0–4294967294	–	Number of pulses received  Valid if input signal type is pulse digital input.
0x3679– 0x367C	13946– 13949	R	–	INT64	–	–	Resettable value of consumption  Value = pulse weight x number of pulses received  Valid if input signal type is pulse digital input.
0x367D– 0x3680	13950– 13953	R	–	INT64	–	–	Accumulated non-resettable value of consumption  Valid if input signal type is pulse digital input.
0x3681– 0x3684	13954– 13957	R	–	DATETIME	–	–	Timestamp of last resettable consumption value reset  Valid if input signal type is pulse digital input.
0x3685– 0x3686	13958– 13959	R	W	FLOAT32	–	–	Power calculation  Valid if <ul style="list-style-type: none"> <li>Input signal type is pulse digital input</li> <li>the pulse input is from Energy pulse counter</li> </ul>
0x3687– 0x369E	13960– 13983	R	–	OCTET STRING	–	–	Digital input identification coded over 45 ASCII characters <sup>(1)</sup>
0x369F– 0x36A0	13984– 13985	R	s	FLOAT32	0.003–1	–	Digital input 1 filter time
0x36A1	13986	R	–	INT16U	0–1	–	Input contact type <sup>(1)</sup> <ul style="list-style-type: none"> <li>0 = NO (normally open contact, factory setting)</li> <li>1 = NC (normally close contact)</li> </ul>
0x36A2	13987	R	–	INT16U	0–1	–	Input signal type <sup>(1)</sup> <ul style="list-style-type: none"> <li>0 = normal digital input (factory setting)</li> <li>1 = pulse digital input</li> </ul>
0x36A3	13988	R	–	INT16U	0–1	–	Pulse polarity <sup>(1)</sup> <ul style="list-style-type: none"> <li>0 = low to high (factory setting)</li> <li>1 = high to low</li> </ul> Valid if input signal type is pulse digital input.
0x36A4	13989	R	–	INT16U	1–4	–	Pulse unit <sup>(1)</sup> <ul style="list-style-type: none"> <li>1 = Wh (Watt-hour, factory setting)</li> <li>2 = VARh (Reactive Volt-Ampere hour)</li> <li>3 = VAh (Volt-Ampere hour)</li> <li>4 = m<sup>3</sup> (cubic meters)</li> </ul> Valid if input signal type is pulse digital input.
0x36A5– 0x36A6	13990– 13991	R	–	FLOAT32	1–16777215	–	Pulse weight <sup>(1) (2)</sup>

Address	Register	RW	Unit	Type	Range	Bit	Description
							Valid if input signal type is pulse digital input. Factory setting = 1.0
0x36A7– 0x36A8	13992– 13993	R	–	INT32U	1–4294967294	–	Input counter threshold value <sup>(1)</sup> Valid if input signal type is normal digital input. Factory setting = 5000
0x36A9– 0x36B8	13994– 14009	–	–	–	–	–	Reserved
<p>(1) Value set by using the EcoStruxure Power Commission software.</p> <p>(2) Examples:</p> <ul style="list-style-type: none"> <li>If each incoming pulse represents 125 kWh, and since consumption data must be expressed in watt-hours, the consumption pulse weight is 125,000.</li> <li>If each incoming pulse represents 1 US gallon, and since consumption data must be expressed in cubic meters, the consumption pulse weight is 0.003785.</li> </ul>							

## Digital Outputs

### Digital Output Register Mapping

Each digital output description is made up of 60 registers. The order and the description of the digital outputs 2 and 3 are the same as those of digital output 1.

IO Module	Digital Output Number	Digital Output Addresses	Digital Output Registers
IO 1	O1	0x3849–0x3884	14410–14469
	O2	0x3885–0x38C0	14470–14529
	O3	0x38C1–0x38FC	14530–14589
IO 2	O1	0x4401–0x443C	17410–17469
	O2	0x443D–0x4478	17470–17529
	O3	0x4479–0x44B4	17530–17589

### Digital Output 1 Registers of IO 1

The order and the description of the digital output 1 registers of IO 2 are the same as those of IO 1:

Address	Register	RW	Unit	Type	Range	Bit	Description
0x3849	14410	R	–	INT16U	–	–	Quality of each bit of register 14411: <ul style="list-style-type: none"><li>0 = Invalid</li><li>1 = Valid</li></ul>
0x384A	14411	R-WC	–	INT16U	–	0	Reserved
						1	Digital output status: <ul style="list-style-type: none"><li>0 = OFF</li><li>1 = ON</li></ul>
		R				2	Digital output forced status: <ul style="list-style-type: none"><li>0 = Unforced</li><li>1 = Forced</li></ul>
						3–15	Reserved
0x384B–0x384E	14412–14415	R	–	DATETIME	–	–	Timestamp for the last output transition: <ul style="list-style-type: none"><li>Last rising edge if output is configured as NO (normally open contact)</li><li>Last falling edge if output is configured as NC (normally closed contact)</li></ul>
0x384F–0x3850	14416–14417	–	–	–	–	–	Reserved
0x3851–0x3852	14418–14419	R	–	INT32U	1-4294967294	–	Output counter  This counter increments for each rising edge of the output.
0x3853–0x3856	14420–14423	R	–	DATETIME	–	–	Timestamp of the last reset for the output counter
0x3857–0x386E	14424–14447	R	–	OCTET STRING	–	–	Digital output identification coded over 45 ASCII characters
0x386F	14448	R	–	INT16U	0–2	–	Output operating mode <sup>(1)</sup> : <ul style="list-style-type: none"><li>0 = Non-latching (factory setting)</li><li>1 = Latched</li><li>2 = Time delayed non-latching</li></ul>
0x3870	14449	R	s	INT16U	0–65534	–	On time for time delayed non-latching mode value <sup>(1)</sup>



Address	Register	RW	Unit	Type	Range	Bit	Description
							The time for the output to remain energized when the output is in time delayed non-latching mode  (Factory setting = 0)
0x3871	14450	R	–	INT16U	0–1	–	Output contact type <sup>(1)</sup> : <ul style="list-style-type: none"> <li>0 = NO (normally open, factory setting)</li> <li>1 = NC (normally close)</li> </ul>
0x3872	14451	R	–	INT16U	0–2	–	Indicates On/Off state of the discrete output when any fall back condition occurs <sup>(1)</sup> : <ul style="list-style-type: none"> <li>0 = OFF (factory setting)</li> <li>1 = ON</li> <li>2 = Freeze</li> </ul>
0x3873– 0x3874	14452– 14453	R	–	INT32U	1-4294967294	–	Output counter threshold value <sup>(1)</sup>  Factory setting = 5000
0x3875	14454	R-WC	–	INT16U	0–2	–	Simple command for output <sup>(1)</sup> : <ul style="list-style-type: none"> <li>0 = No command</li> <li>1 = OFF</li> <li>2 = ON</li> </ul> Valid if simple commands are enabled <sup>(2)</sup> .
0x3876– 0x3884	14455– 14469	–	–	–	–	–	Reserved
(1) Value set using the EcoStruxure Power Commission software.							
(2) Simple commands are enabled by factory setting. The simple commands can be disabled by using the command Enable/Disable commands.							

## Hardware Setting

### Addresses and Registers List

The following table describes the hardware settings addresses, and registers regarding the IO module.

IO Module	Addresses	Registers
IO 1	0x38FD–0x3902	14590–14595
IO 2	0x44B5–0x44BA	17590–17595

### Hardware Setting Registers for IO 1

The order and the description of the hardware setting registers for IO 2 are the same as those of IO 1.

Address	Register	RW	Unit	Type	Range	Description
0x38FD	14590	R	–	INT16U	1–9	Application rotary switch current position: <ul style="list-style-type: none"> <li>• 1 = position 1</li> <li>• 2 = position 2</li> <li>• 3 = position 3</li> <li>• 4 = position 4</li> <li>• 5 = position 5</li> <li>• 6 = position 6</li> <li>• 7 = position 7</li> <li>• 8 = position 8</li> <li>• 9 = position 9</li> </ul>
0x38FE	14591	R	–	INT16U	0–1	Remote setup padlock position: <ul style="list-style-type: none"> <li>• 0 = Unlock</li> <li>• 1 = Lock</li> </ul>
0x38FF	14592	R	–	INT16U	0–1	Dip switch1 position: <ul style="list-style-type: none"> <li>• 0 = IO 1</li> <li>• 1 = IO 2</li> </ul>
0x3900	14593	–	–	–	–	Reserved
0x3901	14594	R	–	INT16U	1–9	Last validated application set by the test button located on the front of the IO module: <ul style="list-style-type: none"> <li>• 1 = position 1</li> <li>• 2 = position 2</li> <li>• 3 = position 3</li> <li>• 4 = position 4</li> <li>• 5 = position 5</li> <li>• 6 = position 6</li> <li>• 7 = position 7</li> <li>• 8 = position 8</li> <li>• 9 = position 9</li> </ul>

Address	Register	RW	Unit	Type	Range	Description
0x3902	14595	R	–	INT16U	1–9	Last validated application set by the EcoStruxure Power Commission software: <ul style="list-style-type: none"> <li>• 1 = position 1</li> <li>• 2 = position 2</li> <li>• 3 = position 3</li> <li>• 4 = position 4</li> <li>• 5 = position 5</li> <li>• 6 = position 6</li> <li>• 7 = position 7</li> <li>• 8 = position 8</li> <li>• 9 = position 9</li> </ul>
0x3903– 0x3904	14596– 14597	–	–	–	–	Reserved

## Digital Input and Output Status

### Addresses and Registers List

The following table describes the digital inputs and outputs status addresses, and registers regarding the IO module.

IO Module	Addresses	Registers
IO 1	0x3905–0x3908	14598–14601
IO 2	0x44BD–0x44C0	17598–17601

### Digital Input and Output Status Registers for IO 1

The order and the description of the digital input and output status registers for IO 2 are the same as those of IO 1.

Address	Register	RW	Unit	Type	Range	Bit	Description
0x3905	14598	R	–	INT16U	–	–	Quality of each bit of register 14599: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x3906	14599	R	–	INT16U	–	–	Digital input status register: <ul style="list-style-type: none"> <li>Input status = 0 when input is OFF</li> <li>Input status = 1 when input is ON</li> </ul>
						0	I1 status
						1	I2 status
						2	I3 status
						3	I4 status
						4	I5 status
						5	I6 status
						6–15	Reserved
0x3907	14600	R	–	INT16U	–	–	Quality of each bit of register 14601: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x3908	14601	R–WC	–	INT16U	–	–	Digital output status register: <ul style="list-style-type: none"> <li>Output status = 0 when output is OFF</li> <li>Output status = 1 when output is ON</li> </ul>
						0	O1 status
						1	O2 status
						2	O3 status
						3–15	Reserved

# IO Module Identification

## Introduction

The order and the description of the IO module identification registers for IO 2 are the same as those of IO 1.

## Addresses and Registers List

The following table describes the identification addresses, and registers regarding the IO module.

IO Module	Addresses	Registers
IO 1	0x392F–0x3982	14640–14723
IO 2	0x44E7–0x453A	17640–17723

## IMU Identification

Identification of the IMU can be set by using the EcoStruxure Power Commission software. When not programmed, the IMU identification registers return 0 (0x0000).

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

Address	Register	RW	Unit	Type	Range	Description
0x3931– 0x3948	14642– 14665	R	–	OCTET STRING	–	IMU name = up to 45 ASCII characters ended by the NULL character 0x00
0x3949– 0x3960	14666– 14689	R	–	OCTET STRING	–	IMU location = up to 45 ASCII characters ended by the NULL character 0x00

## IO Hardware Revision

The hardware revision is an ASCII string using the format XXX.YYY.ZZZ with:

- XXX = major version (000–127)
- YYY = minor version (000–255)
- ZZZ = revision number (000–255)

The NULL character ends the revision number.

Address	Register	RW	Unit	Type	Range	Description
0x3961– 0x3966	14690– 14695	R	–	OCTET STRING	–	Hardware revision

## IO Module Firmware Revision

The firmware revision is an ASCII string using the format XXX.YYY.ZZZ with:

- XXX = major version (000–127)
- YYY = minor version (000–255)
- ZZZ = revision number (000–255)

The NULL character ends the revision number.

Address	Register	RW	Unit	Type	Range	Description
0x3967– 0x396C	14696– 14701	R	–	OCTET STRING	–	Firmware revision

## Current Date and Time

Address	Register	RW	Unit	Type	Range	Description
0x396D– 0x3970	14702– 14705	R	–	DATETIME	–	Current date and time of the IO module in DATETIME format, set by using the EcoStruxure Power Commission software.

## Serial Number

The IO module serial number is composed of a maximum of 11 alphanumeric characters with the following format: PPYYWWDnnnn.

- PP = plant code
- YY = year of fabrication (05–99)
- WW = week of fabrication (01–53)
- D = day of fabrication (1–7)
- nnnn = production number of the device on the day (0001–9999)

A read request of 6 registers is necessary to read the IO module serial number.

Address	Register	RW	Unit	Type	Range	Description
0x3971– 0x397A	14706–14715	R	–	OCTET STRING	–	Serial number
0x3971	14706	R	–	OCTET STRING	–	'PP'
0x3972	14707	R	–	OCTET STRING	'05'–'99'	'YY'
0x3973	14708	R	–	OCTET STRING	'01'–'53'	'WW'
0x3974	14709	R	–	OCTET STRING	'10'–'79'	'Dn'
0x3975	14710	R	–	OCTET STRING	'00'–'99'	'nn'
0x3976	14711	R	–	OCTET STRING	'0'–'9'	'n' (the NULL character ends the serial number)

## Manufacturing Date and Time

Address	Register	RW	Unit	Type	Range	Description
0x397B– 0x397E	14716– 14719	R	–	DATETIME	–	Manufacturing date and time

## Product Identification

Address	Register	RW	Unit	Type	Range	Description
0x392F	14640	R	–	INT16U	15150	Product identification = 15150 for the IO module
0x3930	14641	–	–	–	–	Reserved

Address	Register	RW	Unit	Type	Range	Description
0x397F– 0x3982	14720– 14723	R	–	OCTET STRING	–	Product code = 'LV434063'
0x3D1C– 0x3D3B	15645– 15676	R–WC	–	OCTET STRING	–	User application name
0x3D3C– 0x3D45	15677– 15686	R	–	OCTET STRING	–	Vendor name = 'Schneider Electric'
0x3D46– 0x3D4D	15687– 15694	R	–	OCTET STRING	–	Product range: 'Enerlinx'
0x3D4E– 0x3D5D	15695– 15710	R	–	OCTET STRING	–	Device family: 'IO device'
0x3D5E– 0x3D65	15711– 15718	R	–	OCTET STRING	–	Product model

## Alarm Status

### Addresses and Registers List

The following table describes the alarm status addresses, and registers regarding the IO module.

IO Module	Addresses	Registers
IO 1	0x3989–0x39A6	14730–14759
IO 2	0x4541–0x455E	17730–17759

### Generic Alarm Status for IO 1

The order and the description of the generic alarm status registers for IO 2 are the same as those of IO 1.

Address	Register	RW	Unit	Type	Range	Bit	Description
0x3989	14730	R	–	INT16U	–	–	Quality of each bit of register 14731: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x398A	14731	R	–	INT16U	–	–	IO module history format register
						0	ULP format
						1	TI086 format
						2–15	Reserved
0x398B	14732	R	–	INT16U	–	–	Quality of each bit of register 14733: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x398C	14733	R	–	INT16U	–	–	IO module command type Factory setting = 3, both write command mechanisms are enabled.
						0	1 = Complex commands
						1	1 = Simple commands Simple commands can be disabled by sending a command
						2–15	Reserved
0x398D– 0x3992	14734– 14739	–	–	–	–	–	Reserved
0x3993	14740	R	–	INT16U	–	–	Quality of each bit of register 14741: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x3994	14741	R	–	INT16U	–	–	IO module generic alarm 1 status register.
						0	IO module in STOP mode: IO module is not working and must be replaced.
						1	IO module in ERROR mode: IO module is working in degraded mode.
						2	Threshold overrun on I1 counter
						3	Threshold overrun on I2 counter
						4	Threshold overrun on I3 counter
						5	Threshold overrun on I4 counter
						6	Threshold overrun on I5 counter
						7	Threshold overrun on I6 counter



Address	Register	RW	Unit	Type	Range	Bit	Description
						8	Threshold overrun on O1 counter
						9	Threshold overrun on O2 counter
						10	Threshold overrun on O3 counter
						11	Switchboard temperature threshold 1 overrun
						12	Switchboard temperature threshold 2 overrun
						13	Switchboard temperature threshold 3 overrun
						14–15	Reserved
0x3995	14742	R	–	INT16U	–	–	Quality of each bit of register 14743: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x3996	14743	R	–	INT16U	–	–	IO module generic alarm 2 status register.
						0	User-defined input 1 alarm
						1	User-defined input 2 alarm
						2	User-defined input 3 alarm
						3	User-defined input 4 alarm
						4	User-defined input 5 alarm
						5	User-defined input 6 alarm
						6–15	Reserved

## Cradle and Drawer Management Alarms for IO 1

Address	Register	RW	Unit	Type	Range	Bit	Description
0x3997	14744	R	–	INT16U	–	–	Quality of each bit of register 14745: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x3998	14745	R	–	INT16U	–	–	Cradle management alarms register
						0	Cradle position discrepancy
						1	Disconnection of the circuit breaker from cradle is overdue.
						2	Cradle has reached its maximum number of operation
						3	Remaining service life of cradle is below alarm threshold
						4	New MicroLogic control unit has been detected
						5–7	Reserved
						8	Drawer position discrepancy
						9–15	Reserved

## Motor Alarms for IO 1

Address	Register	RW	Unit	Type	Range	Bit	Description
0x3999	14746	R	–	INT16U	–	–	Quality of each bit of register 14747: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x399A	14747	R	–	INT16U	–	–	IO motor alarms
						0–15	Reserved

## Miscellaneous Application Alarms for IO 1

Address	Register	RW	Unit	Type	Range	Bit	Description
0x399B	14748	R	–	INT16U	–	–	Quality of each bit of register 14749: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x399C	14749	R	–	INT16U	–	–	Other application alarms register
						0	Auxiliary contact of load contactor 1 is not closed.
						1	Auxiliary contact of load contactor 1 is not opened.
						2	Discrepancy with ERMS OFF order and ERMS ON order
						3	Reserved
						4–15	Reserved
0x399D	14750	R	–	INT16U	–	–	Quality of each bit of register 14751: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x399E	14751	R	–	INT16U	–	–	Predefined input alarms register
						0	Earth-leakage trip signal contact (SDV)
						1	Control voltage presence contact
						2	Surge protection status contact
						3	Surge failure contact
						4	Switch-disconnector ON/OFF indication contact (OF)
						5	Fuse blown indication contact
						6	Emergency stop
						7	Switchboard temperature contact
						8	Switchboard ventilation contact
						9	Switchboard door contact
						10–15	Reserved
0x399F	14752	R	–	INT16U	–	–	Quality of each bit of register 14753: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x39A0	14753	R	–	INT16U	–	–	IO module discrepancy alarms register
						0	Critical hardware discrepancy
						1	Critical firmware discrepancy
						2	Non-critical hardware discrepancy
						3	Non-critical firmware discrepancy
						4–15	Reserved
0x39A1– 0x39A6	14754– 14759	–	–	–	–	–	Reserved

## Applications

### IO Application Status

Address	Register	RW	Unit	Type	Range	Bit	Description
0x3927	14632	R	–	INT16U	–	0	Cradle application enabled or disabled: <ul style="list-style-type: none"> <li>0 = Disabled</li> <li>1 = Enabled</li> </ul>
						1–15	Reserved
0x3928	14633	R	–	INT16U	–	–	Quality of each bit of register 14632: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>

### Cradle Management

The table describes the registers related to the cradle management application performed by IO 1 (predefined or user defined application).

The registers 18300–18329 are related to the cradle management application performed by IO 2 (predefined or user defined application).

Address	Register	RW	Unit	Type	Range	Bit	Description
0x3BC3	15300	R-RC	–	INT16U	–	–	Quality of each bit of register 15301: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid</li> </ul>
0x3BC4	15301	R-RC	–	INT16U	–	–	Cradle status
						0–7	Reserved
						8	Device in disconnected position (CD)
						9	Device in connected position (CE)
						10	Device in the test position (CT)
						11–15	Reserved
0x3BC5– 0x3BC6	15302– 15303	R-RC- WC	–	INT32U	0–65534	–	Cradle connected position counter  This counter increments for each rising edge of the cradle connected position
0x3BC7– 0x3BC8	15304– 15305	R-RC- WC	–	INT32U	0–65534	–	Cradle disconnected position counter  This counter increments for each rising edge of the cradle disconnected position
0x3BC9– 0x3BCA	15306– 15307	R-RC- WC	–	INT32U	0–65534	–	Cradle test position counter  This counter increments for each rising edge of the cradle test position
0x3BCB– 0x3BCE	15308– 15311	R-RC	–	DATETIME	–	–	Timestamp of the last change for the cradle connected position
0x3BCF– 0x3BD2	15312– 15315	R-RC	–	DATETIME	–	–	Timestamp of the last change for the cradle disconnected position
0x3BD3– 0x3BD6	15316– 15319	R-RC	–	DATETIME	–	–	Timestamp of the last change for the cradle test position
0x3BD7– 0x3BD8	15320– 15321	R-WC	s	INT32U	–	–	Operating time since last grease maintenance
0x3BD9– 0x3BDA	15322– 15323	R-WC	s	INT32U	–	–	Operating time since last move connected position

Address	Register	RW	Unit	Type	Range	Bit	Description
0x3BDB	15324	R	–	INT16U	0-65534	–	Cradle contact regrease counter
0x3BDC– 0x3BE0	15325– 15329	–	–	–	–	–	Reserved

## Drawer Management

The table describes the registers related to the Drawer management user-defined application performed by IO 1.

The registers 18330–18359 are related to the Drawer management user-defined application performed by IO 2.

Address	Register	RW	Unit	Type	Range	Bit	Description
0x3BE1	15330	R	–	INT16U	–	–	Quality of each bit of register 15331: 0 = Invalid 1 = Valid
0x3BE2	15331	R	–	INT16U	–	–	Drawer status
						0–7	Reserved
						8	Drawer in disconnected position
						9	Drawer in connected position
						10	Drawer in the test position
						11–15	Reserved
0x3BE3– 0x3BE4	15332– 15333	R	–	INT32U	–	–	Drawer connected position counter. This counter increments for each rising edge of the drawer connected position.
0x3BE5– 0x3BE6	15334– 15335	R	–	INT32U	–	–	Drawer disconnected position counter. This counter increments for each rising edge of the drawer disconnected position.
0x3BE7– 0x3BE8	15336– 15337	R	–	INT32U	–	–	Drawer test position counter. This counter increments for each rising edge of the drawer test position.
0x3BE9– 0x3BEC	15338– 15341	R	–	DATETIME	–	–	Timestamp of the last change for the drawer connected position.
0x3BED– 0x3BF0	15342– 15345	R	–	DATETIME	–	–	Timestamp of the last change for the drawer disconnected position.
0x3BF1– 0x3BF4	15346– 15349	R	–	DATETIME	–	–	Timestamp of the last change for the drawer test position.
0x3BF5– 0x3BFE	15350– 15359	–	–	–	–	–	Reserved

## Light Control

The table describes the registers related to the Light control predefined application performed by IO 1.

The registers 18400–18409 are related to the Light control predefined application performed by IO 2.

Address	Register	RW	Unit	Type	Range	Description
0x3C27	15400	R	–	INT16U	0–1	Quality of register 15401: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid (application is configured and running)</li> </ul>
0x3C28	15401	R	–	INT16U	0–1	Light status: <ul style="list-style-type: none"> <li>0 = Reset/OFF</li> <li>1 = Set/ON</li> </ul>
0x3C29– 0x3C2A	15402– 15403	R	s	INT32U	0–54000	Remaining time in ON or OFF state (depending of the light status)
0x3C2B–	15404	R	–	INT16U	0–2	Light simple command <sup>(1)</sup> : <ul style="list-style-type: none"> <li>0 = No command</li> <li>1 = Light OFF</li> <li>2 = Light ON</li> </ul>
0x3C2C– 0x3C30	15405– 15409	–	–	–	–	Reserved
(1) Simple commands are enabled by factory setting. The simple commands can be disabled by using the command Enable/Disable simple commands.						

## Load Control

The table describes the registers related to the Load control predefined application performed by IO 1.

The registers 18410–18419 are related to the Load control predefined application performed by IO 2.

Address	Register	RW	Unit	Type	Range	Description
0x3C31	15410	R	–	INT16U	0–1	Quality of register 15411: <ul style="list-style-type: none"> <li>0 = Invalid</li> <li>1 = Valid (application is configured and running)</li> </ul>
0x3C32	15411	R	–	INT16U	0–1	Load status: <ul style="list-style-type: none"> <li>0 = Reset/OFF</li> <li>1 = Set/ON</li> </ul>
0x3C33– 0x3C34	15412– 15413	R	s	INT32U	0–54000	Remaining time in ON or OFF state (depending of the load status)
0x3C35	15414	R	–	INT16U	0–2	Load simple command <sup>(1)</sup> : <ul style="list-style-type: none"> <li>0 = No command</li> <li>1 = Load OFF</li> <li>2 = Load ON</li> </ul>
0x3C36– 0x3EEC	15415– 16109	–	–	–	–	Reserved
(1) Simple commands are enabled by factory setting. The simple commands can be disabled by using the command Enable/Disable simple commands.						

# IO Module Events

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## Event History

### General Description

The event history registers describe the last 100 encountered events. The event history format corresponds to a series of 100 records. Each record is composed of 5 registers describing one event.

A read request of  $5 \times (n)$  registers is necessary to read the last  $n$  event records, where 5 is the number of registers for each event record.

For example, a read request of  $5 \times 3 = 15$  registers is necessary to read the last 3 event records of the event history:

- The first five registers describe the first event record (most recent event).
- The next five registers describe the second event record.
- The last five registers describe the third event record.

There are two event histories, 1 per IO module.

IO Module	Address	Register	Description
IO 1	0x39A7–0x39AB	14760–14764	Event record 1 (most recent event record)
	0x39AC–0x39B0	14765–14769	Event record 2
	0x39A7+5x(n-1)–0x39AB+5x(n-1)	14760+5x(n-1)–14764+5x(n-1)	Event record n
	0x3B96–0x3B9A	15255–15259	Event record 100
IO 2	0x455F–0x4563	17760–17764	Event record 1 (most recent event record)
	0x4564–0x4568	17765–17769	Event record 2
	0x455F+5x(n-1)–0x4563+5x(n-1)	17760+5x(n-1)–17764+5x(n-1)	Event record n
	0x474E–0x4752	18255–18259	Event record 100

### Event Record

A block request of five registers is necessary to read an event record. The order and the description of the event record registers of IO 2 are the same as those of IO 1:

Event Record 1 (Most Recent Event Record)				
Register	Address	RW	Type	Description
0x39A7	14760	R	INT16U	Event code of IO 1 and IO 2, page 253
0x39A8– 0x39AA	14761– 14763	R	ULP DATE	Date and time of the event, page 69
0x39AB	14764	R	INT16U	Event type MSB = 0 (reserved) Event occurrence: LSB = 1 Event completion: LSB = 2

### Alarm Definition

Alarms are specific events that need to be reset.

The reset mode of an alarm can be:

- automatic: the alarm is reset automatically when the alarm is no more active.
- manual: the alarm is reset manually with the Test/Reset pushbutton located on the front face of the IO module and when the alarm is no more active.
- remote: the alarm is reset remotely with the Reset command sent via the communication and when the alarm is no more active.

Each alarm has a priority level that manages the alarm display on the FDM121 display:

- no priority = N/A (not affected)
- low priority = 1. No alarm display on the FDM121 display
- medium priority = 2. The FDM121 display LED is steady ON.
- high priority = 3. The FDM121 display LED blinks and a pop-up screen informs that the alarm has occurred.



## IO Module Events and Alarms

### IO 1 Events and Alarms

Code	Application	Description	Type	Priority	Reset Mode
1537 (0x0601)	General	IO1 Watchdog reset	Event	Medium	–
1538 (0x0602)	General	IO1 reset to factory setting	Event	Medium	–
1539 (0x0603)	General	IO1 failure (STOP mode)	Alarm	High	Manual or Remote
1540 (0x0604)	General	IO1 failure (ERROR mode)	Alarm	Medium	Manual or Remote
1541 (0x0605)	General	IO1 functional rotary switch position change	Event	Medium	–
1542 (0x0606)	General	IO1 setting locking pad rotary switch position change	Event	Medium	–
1543 (0x0607)	General	IO1 source address dip switch position change	Event	Medium	–
1552 (0x0610)	General	IO1 O1 rising edge (OFF/ON change)	Event	Low	–
1553 (0x0611)	General	IO1 O2 rising edge (OFF/ON change)	Event	Low	–
1554 (0x0612)	General	IO1 O3 rising edge (OFF/ON change)	Event	Low	–
1555 (0x0613)	General	IO1 I1 rising edge (OFF/ON change)	Event	Low	–
1556 (0x0614)	General	IO1 I2 rising edge (OFF/ON change)	Event	Low	–
1557 (0x0615)	General	IO1 I3 rising edge (OFF/ON change)	Event	Low	–
1558 (0x0616)	General	IO1 I4 rising edge (OFF/ON change)	Event	Low	–
1559 (0x0617)	General	IO1 I5 rising edge (OFF/ON change)	Event	Low	–
1560 (0x0618)	General	IO1 I6 rising edge (OFF/ON change)	Event	Low	–
1561 (0x0619)	General	IO1 threshold overrun on I1 counter	Alarm	Medium	Manual or Remote
1562 (0x061A)	General	IO1 threshold overrun on I2 counter	Alarm	Medium	Manual or Remote
1563 (0x061B)	General	IO1 threshold overrun on I3 counter	Alarm	Medium	Manual or Remote
1564 (0x061C)	General	IO1 threshold overrun on I4 counter	Alarm	Medium	Manual or Remote
1565 (0x061D)	General	IO1 threshold overrun on I5 counter	Alarm	Medium	Manual or Remote
1566 (0x061E)	General	IO1 threshold overrun on I6 counter	Alarm	Medium	Manual or Remote
1567 (0x061F)	General	IO1 threshold overrun on O1 counter	Alarm	Medium	Manual or Remote
1568 (0x0620)	General	IO1 threshold overrun on O2 counter	Alarm	Medium	Manual or Remote
1569 (0x0621)	General	IO1 threshold overrun on O3 counter	Alarm	Medium	Manual or Remote

Code	Application	Description	Type	Priority	Reset Mode
1570 (0x0622)	General	IO1 I1 unforced/forced change	Event	Low	–
1571 (0x0623)	General	IO1 I2 unforced/forced change	Event	Low	–
1572 (0x0624)	General	IO1 I3 unforced/forced change	Event	Low	–
1573 (0x0625)	General	IO1 I4 unforced/forced change	Event	Low	–
1574 (0x0626)	General	IO1 I5 unforced/forced change	Event	Low	–
1575 (0x0627)	General	IO1 I6 unforced/forced change	Event	Low	–
1576 (0x0628)	General	IO1 O1 unforced/forced change	Event	Low	–
1577 (0x0629)	General	IO1 O2 unforced/forced change	Event	Low	–
1578 (0x062A)	General	IO1 O3 unforced/forced change	Event	Low	–
1579 (0x062B)	User-defined input acquisition	IO1 user-defined input 1	Alarm	Medium	Manual or Remote
1580 (0x062C)	User-defined input acquisition	IO1 user-defined input 2	Alarm	Medium	Manual or Remote
1581 (0x062D)	User-defined input acquisition	IO1 user-defined input 3	Alarm	Medium	Manual or Remote
1582 (0x062E)	User-defined input acquisition	IO1 user-defined input 4	Alarm	Medium	Manual or Remote
1583 (0x062F)	User-defined input acquisition	IO1 user-defined input 5	Alarm	Medium	Manual or Remote
1584 (0x0630)	User-defined input acquisition	IO1 user-defined input 6	Alarm	Medium	Manual or Remote
1585 (0x0631)	Cooling system	IO1 switchboard temperature threshold 1 overrun	Alarm	Low	Auto
1586 (0x0632)	Cooling system	IO1 switchboard temperature threshold 2 overrun	Alarm	Medium	Manual or Remote
1587 (0x0633)	Cooling system	IO1 switchboard temperature threshold 3 overrun	Alarm	High	Manual or Remote

**NOTE:** The alarm exit priority is fixed in IO module firmware. The value is Low, when available.

## IO 2 Events and Alarms

Code	Application	Description	Type	Priority	Reset Mode
1793 (0x0701)	General	IO2 watchdog reset	Event	Medium	–
1794 (0x0702)	General	IO2 reset to factory settings	Event	Medium	–
1795 (0x0703)	General	IO2 module failure (STOP mode)	Alarm	High	Manual or Remote
1796 (0x0704)	General	IO2 module failure (ERROR mode)	Alarm	Medium	Manual or Remote
1797 (0x0705)	General	IO2 functional rotary switch position change	Event	Medium	–
1798 (0x0706)	General	IO2 setting locking pad rotary switch position change	Event	Medium	–

Code	Application	Description	Type	Priority	Reset Mode
1799 (0x0707)	General	IO2 source address dip switch position change	Event	–	–
1808 (0x0710)	General	IO2 O1 rising edge (OFF/ON change)	Event	Low	–
1809 (0x0711)	General	IO2 O2 rising edge (OFF/ON change)	Event	Low	–
1810 (0x0712)	General	IO2 O3 rising edge (OFF/ON change)	Event	Low	–
1811 (0x0713)	General	IO2 I1 rising edge (OFF/ON change)	Event	Low	–
1812 (0x0714)	General	IO2 I2 rising edge (OFF/ON change)	Event	Low	–
1813 (0x0715)	General	IO2 I3 rising edge (OFF/ON change)	Event	Low	–
1814 (0x0716)	General	IO2 I4 rising edge (OFF/ON change)	Event	Low	–
1815 (0x0717)	General	IO2 I5 rising edge (OFF/ON change)	Event	Low	–
1816 (0x0718)	General	IO2 I6 rising edge (OFF/ON change)	Event	Low	–
1817 (0x0719)	General	IO2 threshold overrun on I1 counter	Alarm	Medium	Manual or Remote
1818 (0x071A)	General	IO2 threshold overrun on I2 counter	Alarm	Medium	Manual or Remote
1819 (0x071B)	General	IO2 threshold overrun on I3 counter	Alarm	Medium	Manual or Remote
1820 (0x071C)	General	IO2 threshold overrun on I4 counter	Alarm	Medium	Manual or Remote
1821 (0x071D)	General	IO2 threshold overrun on I5 counter	Alarm	Medium	Manual or Remote
1822 (0x071E)	General	IO2 threshold overrun on I6 counter	Alarm	Medium	Manual or Remote
1823 (0x071F)	General	IO2 threshold overrun on O1 counter	Alarm	Medium	Manual or Remote
1824 (0x0720)	General	IO2 threshold overrun on O2 counter	Alarm	Medium	Manual or Remote
1825 (0x0721)	General	IO2 threshold overrun on O3 counter	Alarm	Medium	Manual or Remote
1826 (0x0722)	General	IO2 I1 unforced/forced change	Event	Low	–
1827 (0x0723)	General	IO2 I2 unforced/forced change	Event	Low	–
1828 (0x0724)	General	IO2 I3 unforced/forced change	Event	Low	–
1829 (0x0725)	General	IO2 I4 unforced/forced change	Event	Low	–
1830 (0x0726)	General	IO2 I5 unforced/forced change	Event	Low	–
1831 (0x0727)	General	IO2 I6 unforced/forced change	Event	Low	–
1832 (0x0728)	General	IO2 O1 unforced/forced change	Event	Low	–
1833 (0x0729)	General	IO2 O2 unforced/forced change	Event	Low	–
1834 (0x072A)	General	IO2 O3 unforced/forced change	Event	Low	–

Code	Application	Description	Type	Priority	Reset Mode
1835 (0x072B)	User-defined input acquisition	IO2 user-defined input 1	Alarm	Medium	Manual or Remote
1836 (0x072C)	User-defined input acquisition	IO2 user-defined input 2	Alarm	Medium	Manual or Remote
1837 (0x072D)	User-defined input acquisition	IO2 user-defined input 3	Alarm	Medium	Manual or Remote
1838 (0x072E)	User-defined input acquisition	IO2 user-defined input 4	Alarm	Medium	Manual or Remote
1839 (0x072F)	User-defined input acquisition	IO2 user-defined input 5	Alarm	Medium	Manual or Remote
1840 (0x0730)	User-defined input acquisition	IO2 user-defined input 6	Alarm	Medium	Manual or Remote
1841 (0x0731)	Cooling system	IO2 switchboard temperature threshold 1 overrun	Alarm	Low	Auto
1842 (0x0732)	Cooling system	IO2 switchboard temperature threshold 2 overrun	Alarm	Medium	Manual or Remote
1843 (0x0733)	Cooling system	IO2 switchboard temperature threshold 3 overrun	Alarm	High	Manual or Remote

**NOTE:** The alarm exit priority is fixed in IO firmware. The value is Low, when available.

## IO 1 and IO 2 Events and Alarms

Code	Application	Description	Type	Priority	Reset Mode
2304 (0x0900)	Cradle management	Cradle position discrepancy	Alarm	Medium	Manual or Remote
2305 (0x0901)	Cradle management	Cradle connected contact change	Alarm	Low	Manual or Remote
2306 (0x0902)	Cradle management	Cradle disconnected contact change	Alarm	Low	Manual or Remote
2307 (0x0903)	Cradle management	Cradle test contact change	Alarm	Low	Manual or Remote
2308 (0x0904)	Cradle management	Remove device from cradle and put it back	Alarm	Medium	Manual or Remote
2309 (0x0905)	Cradle management	Cradle has reached its maximum number of operations	Alarm	High	Manual or Remote
2310 (0x0906)	Cradle management	Remaining service life of cradle is below alarm threshold	Alarm	Medium	Manual or Remote
2311 (0x0907)	Cradle management	New MicroLogic control unit has been detected.	Alarm	High	Manual or Remote
2432 (0x0980)	Drawer management	Drawer position discrepancy	Alarm	Medium	Manual or Remote
2560 (0x0A00)	Load control	Auxiliary contact of the load contactor 1 is not closed	Alarm	Medium	Manual or Remote
2561 (0x0A01)	Load control	Auxiliary contact of the load contactor 1 is not opened	Alarm	Medium	Manual or Remote
2816 (0x0B00)	Predefined input acquisition	Earth leakage trip signal contact (SDV)	Alarm	Medium	Manual or Remote
2817 (0x0B01)	Predefined input acquisition	Control voltage presence contact	Alarm	Medium	Manual or Remote
2818 (0x0B02)	Predefined input acquisition	Surge protection status contact	Alarm	Medium	Manual or Remote
2819 (0x0B03)	Predefined input acquisition	Surge failure contact	Alarm	Medium	Manual or Remote

Code	Application	Description	Type	Priority	Reset Mode
2820 (0x0B04)	Predefined input acquisition	Switch-disconnector ON/OFF indication contact (OF)	Alarm	Medium	Manual or Remote
2821 (0x0B05)	Predefined input acquisition	Fuse blown indication contact	Alarm	Medium	Manual or Remote
2822 (0x0B06)	Predefined input acquisition	Emergency stop	Alarm	High	Manual or Remote
2823 (0x0B07)	Cooling system	Switchboard temperature contact	Alarm	Medium	Manual or Remote
2824 (0x0B08)	Cooling system	Switchboard ventilation contact	Alarm	Medium	Manual or Remote
2825 (0x0B09)	Cooling system	Switchboard door contact	Alarm	Medium	Manual or Remote
3072 (0x0C00)	Protection settings	Discrepancy with ERMS OFF order and ERMS ON order (MasterPact NT/NW and PowerPact P- and R-frame only)	Alarm	High	Manual or Remote
3328 (0x0D00)	General	Critical hardware modules discrepancy	Alarm	High	Auto
3329 (0x0D01)	General	Critical firmware modules discrepancy	Alarm	High	Auto
3330 (0x0D02)	General	Non-critical hardware modules discrepancy	Alarm	Medium	Auto
3331 (0x0D03)	General	Non-critical firmware modules discrepancy	Alarm	Medium	Auto

# IO Module Commands

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## List of IO Module Commands

### List of Commands

There are two types of command:

- generic commands which work independently of the application selected.
- application commands which are dedicated to an application. A command is only valid if the related application is configured.

The following table lists the available IO module commands, their corresponding application, command codes and user profiles. Follow the command execution procedures accordingly. , page 56

Application	Command	Command code	User profile
Generic	Change output state, page 260	1672	Administrator or Operator
Generic	Reset IO module alarms, page 260	41099	Administrator or Operator
Generic	Enable/Disable simple commands, page 260	41100	Administrator or Operator
Generic	Acknowledge latched output, page 261	41102	Administrator or Operator
Generic	Reset analog input minimum/maximum values, page 261	42890	Administrator or Operator
Cradle and drawer management	Preset cradle/drawer counters, page 262	41352	Administrator or Operator
Cradle and drawer management	Preset cradle/drawer regrease timers, page 262	41353	Administrator or Operator
Light control	Light control, page 263	42120	Administrator or Operator
Load control	Load control, page 263	42376	Administrator or Operator
Pulse counter management	Preset input pulse counter, page 264	42888	Administrator or Operator
Cooling system	Preset switchboard temperature threshold counter, page 265	42889	Administrator or Operator

### IO Module Error Codes

The error codes generated by the IO module are the generic error codes , page 59.

## Generic Commands

### Change Output State

The command is used to change the state of IO module digital outputs assigned as user-defined outputs using the EcoStruxure Power Commission software.

To change the output state, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	1672	Command code = <b>1672</b>
0x1F40	8001	–	INT16U	13	Number of parameters (bytes) = 13
0x1F41	8002	–	INT16U	–	Destination = <ul style="list-style-type: none"> <li>IO 1: 8193 (0x2001)</li> <li>IO 2: 8449 (0x2101)</li> </ul>
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	Password of the command: Administrator or Operator user profile password
0x1F45	8006	–	INT16U	1–3	Output number <ul style="list-style-type: none"> <li>1 = output 1</li> <li>2 = output 2</li> <li>3 = output 3</li> </ul>
0x1F46	8007	–	INT16U	–	Value to set: <ul style="list-style-type: none"> <li>0x0000 = Change output state to 0 (OFF)</li> <li>0x0100 = Change output state to 1 (ON)</li> </ul>

### Reset IO Module Alarm

The alarms can be read from the alarm status register, page 244.

To reset IO module alarms, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	41099	Command code = <b>41099</b>
0x1F40	8001	–	INT16U	10	Number of parameters (bytes) = 10
0x1F41	8002	–	INT16U	–	Destination = <ul style="list-style-type: none"> <li>IO 1: 8193 (0x2001)</li> <li>IO 2: 8449 (0x2101)</li> </ul>
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	Password of the command: Administrator or Operator user profile password

### Enable/Disable Simple Commands

To enable or disable the simple commands, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	41100	Command code = <b>41100</b>
0x1F40	8001	–	INT16U	11	Number of parameters (bytes) = 11



Address	Register	Unit	Type	Range	Description
0x1F41	8002	–	INT16U	–	Destination = <ul style="list-style-type: none"> <li>IO 1: 8193 (0x2001)</li> <li>IO 2: 8449 (0x2101)</li> </ul>
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	Password of the command: Administrator or Operator user profile password
0x1F45	8006	–	INT16U	–	MSB: Enable or disable: <ul style="list-style-type: none"> <li>0 = Disable simple command</li> <li>1 = Enable simple command</li> </ul> LSB: 0 (not used)

## Acknowledge Latched Output

To acknowledge the latched output, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	41102	Command code = <b>41102</b>
0x1F40	8001	–	INT16U	11	Number of parameters (bytes) = 11
0x1F41	8002	–	INT16U	–	Destination = <ul style="list-style-type: none"> <li>IO 1: 8193 (0x2001)</li> <li>IO 2: 8449 (0x2101)</li> </ul>
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	Password of the command: Administrator or Operator user profile password
0x1F45	8006	–	INT16U	–	MSB: <ul style="list-style-type: none"> <li>0x01 = Digital output relay 1</li> <li>0x02 = Digital output relay 2</li> <li>0x03 = Digital output relay 3</li> <li>0xFF = Unlatch all digital output</li> </ul> LSB: 0 (not used)

## Reset Analog Input Minimum/Maximum Values

The analog input maximum and minimum values can be read from the analog input registers, page 231.

To reset the minimum/maximum analog input values, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	42890	Command code = <b>42890</b>
0x1F40	8001	–	INT16U	10	Number of parameters (bytes) = 10
0x1F41	8002	–	INT16U	–	Destination = <ul style="list-style-type: none"> <li>IO 1: 8193 (0x2001)</li> <li>IO 2: 8449 (0x2101)</li> </ul>
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	Password of the command: Administrator or Operator user profile password

## Application Commands

### Preset Cradle/Drawer Counters

The cradle/drawer counter values can be read from the cradle management registers, page 247.

To preset the cradle or drawer counters, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	41352	Command code = <b>41352</b>
0x1F40	8001	–	INT16U	16	Number of parameters (bytes) = 16
0x1F41	8002	–	INT16U	–	Destination = <ul style="list-style-type: none"> <li>• IO 1: 8193 (0x2001)</li> <li>• IO 2: 8449 (0x2101)</li> </ul>
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	Password of the command: Administrator or Operator user profile password
0x1F45	8006	–	INT16U	0–65535	Connected counter reset/preset: <ul style="list-style-type: none"> <li>• 0–65534 = preset value of the connected counter</li> <li>• 65535 (0xFFFF) = do not preset the connected counter</li> </ul>
0x1F46	8007	–	INT16U	0–65535	Disconnected counter reset/preset: <ul style="list-style-type: none"> <li>• 0–65534 = preset value of the disconnected counter</li> <li>• 65535 (0xFFFF) = do not preset the disconnected counter</li> </ul>
0x1F47	8008	–	INT16U	0–65535	Test counter reset/preset: <ul style="list-style-type: none"> <li>• 0–65534 = preset value of the test counter</li> <li>• 65535 (0xFFFF) = do not preset the test counter</li> </ul>

### Preset Regrease Timers

To preset regrease timers, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	41353	Command code = <b>41353</b>
0x1F40	8001	–	INT16U	18	Number of parameters (bytes) = 18
0x1F41	8002	–	INT16U	–	Destination = <ul style="list-style-type: none"> <li>• IO 1: 8193 (0x2001)</li> <li>• IO 2: 8449 (0x2101)</li> </ul>
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	Password of the command: Administrator or Operator user profile password
0x1F45– 0x1F46	8006–8007	–	INT16U	–	Operating time since last grease maintenance <ul style="list-style-type: none"> <li>• 0–157766400 = preset value of regrease timer counter</li> <li>• 4294967295 (0xFFFFFFFF) = No preset</li> </ul>
0x1F47– 0x1F48	8008–8009	–	INT32U	–	Operating time since last move in rack in position (delay from last disconnection) <ul style="list-style-type: none"> <li>• 0–28944000 = preset value of remove timer</li> <li>• 4294967295 (0xFFFFFFFF) = No preset</li> </ul>

## Light Control

The light command status can be read from the light control registers, page 248.

To control the light, set the command registers in the following way:

Address	Register	Unit	Type	Range	Bit	Description
0x1F3F	8000	–	INT16U	42120	–	Command code = <b>42120</b>
0x1F40	8001	–	INT16U	13	–	Number of parameters (bytes) = 13
0x1F41	8002	–	INT16U	–	–	Destination = IO 1: 8193 (0x2001)
0x1F42	8003	–	INT16U	1	–	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	–	Password of the command: Administrator or Operator user profile password
0x1F45	8006	–	INT16U	–	–	MSB: State
					0	<ul style="list-style-type: none"> <li>0 = Light OFF</li> <li>1 = Light ON</li> </ul>
					1	<ul style="list-style-type: none"> <li>0 = without time delay</li> <li>1 = with time delay</li> </ul>
					–	LSB = Timer (MSB) 1–54000 seconds (if bit 1 in set state) Any value 0-0xffff (if bit 1 in reset state)
0x1F46	8007	–	INT16U	–	–	MSB = Timer (LSB) 1 to 54000 seconds (if bit 1 is in set state) Any value 0-0xffff (if bit 1 is in reset state) LSB = 0 (not used)

## Load Control

The load command status can be read from the load control registers, page 249.

To control the load, set the command registers in the following way:

Address	Register	Unit	Type	Range	Bit	Description
0x1F3F	8000	–	INT16U	42376	–	Command code = <b>42376</b>
0x1F40	8001	–	INT16U	13	–	Number of parameters (bytes) = 13
0x1F41	8002	–	INT16U	–	–	Destination = IO 1: 8193 (0x2001)
0x1F42	8003	–	INT16U	1	–	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	–	Password of the command: Administrator or Operator user profile password
0x1F45	8006	–	INT16U	–	–	MSB: State
					0	<ul style="list-style-type: none"> <li>0 = Load OFF</li> <li>1 = Load ON</li> </ul>
					1	<ul style="list-style-type: none"> <li>0 = without time delay</li> <li>1 = with time delay</li> </ul>
					–	LSB = Timer (MSB) 1–54000 seconds (if bit 1 in set state) Any value 0-0xffff (if bit 1 in reset state)

Address	Register	Unit	Type	Range	Bit	Description
0x1F46	8007	–	INT16U	–	–	MSB = Timer (LSB) 1–54000 seconds (if bit 1 in set state) Any value 0-0xffff (if bit 1 in reset state)
					–	LSB = 0 (not used)

## Preset Input Pulse Counters

To preset pulse counters, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	42888	Command code = <b>42888</b>
0x1F40	8001	–	INT16U	34	Number of parameters (bytes) = 34 <b>NOTE:</b> The number of parameters corresponds to the number of bytes of the 17 registers 8001–8015 and 8022–8023. The bytes of the registers 8016–8021 are not counted as command parameters.
0x1F41	8002	–	INT16U	–	Destination = <ul style="list-style-type: none"> <li>IO 1: 8193 (0x2001)</li> <li>IO 2: 8449 (0x2101)</li> </ul>
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	Password of the command: Administrator or Operator user profile password
0x1F45– 0x1F46	8006– 8007	–	INT32U	0–4294967295	I1 pulse counter reset/preset: <ul style="list-style-type: none"> <li>0–4294967294 = preset value of the I1 pulse counter</li> <li>4294967295 (0xFFFFFFFF) = do not preset the I1 pulse counter</li> </ul>
0x1F47– 0x1F48	8008– 8009	–	INT32U	0–4294967295	I2 pulse counter reset/preset: <ul style="list-style-type: none"> <li>0–4294967294 = preset value of the I2 pulse counter</li> <li>4294967295 (0xFFFFFFFF) = do not preset the I2 pulse counter</li> </ul>
0x1F49– 0x1F4A	8010– 8011	–	INT32U	0–4294967295	I3 pulse counter reset/preset: <ul style="list-style-type: none"> <li>0–4294967294 = preset value of the I3 pulse counter</li> <li>4294967295 (0xFFFFFFFF) = do not preset the I3 pulse counter</li> </ul>
0x1F4B– 0x1F4C	8012– 8013	–	INT32U	0–4294967295	I4 pulse counter reset/preset: <ul style="list-style-type: none"> <li>0–4294967294 = preset value of the I4 pulse counter</li> <li>4294967295 (0xFFFFFFFF) = do not preset the I4 pulse counter</li> </ul>
0x1F4D– 0x1F4E	8014– 8015	–	INT32U	0–4294967295	I5 pulse counter reset/preset: <ul style="list-style-type: none"> <li>0–4294967294 = preset value of the I5 pulse counter</li> <li>4294967295 (0xFFFFFFFF) = do not preset the I5 pulse counter</li> </ul>
0x1F4F	8016	–	–	–	Must be set to 0 (factory setting).
0x1F50	8017	–	–	–	Must be set to 8019 (factory setting).
0x1F51	8018	–	–	–	Must be set to 8020 (factory setting).
0x1F52	8019	–	–	–	Must be set to 8021 (factory setting).
0x1F53	8020	–	–	–	Must be set to 0.

Address	Register	Unit	Type	Range	Description
0x1F54	8021	–	–	–	Must be set to 0.
0x1F55– 0x1F56	8022– 8023	–	INT32U	0–4294967295	I6 pulse counter reset/preset: <ul style="list-style-type: none"> <li>0–4294967294 = preset value of the I6 pulse counter</li> <li>4294967295 (0xFFFFFFFF) = do not preset the I6 pulse counter</li> </ul>

## Preset Switchboard Temperature Threshold Counters

To preset switchboard temperature threshold counters, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	42889	Command code = <b>42889</b>
0x1F40	8001	–	INT16U	16	Number of parameters (bytes) = 16
0x1F41	8002	–	INT16U	–	Destination = <ul style="list-style-type: none"> <li>IO 1: 8193 (0x2001)</li> <li>IO 2: 8449 (0x2101)</li> </ul>
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	Password of the command: Administrator or Operator user profile password
0x1F45	8006	–	INT16U	0–65535	Switchboard temperature threshold 1 counter reset/preset: <ul style="list-style-type: none"> <li>0–65534 = preset value of the switchboard temperature threshold 1 counter</li> <li>65535 (0xFFFF) = do not preset the counter</li> </ul>
0x1F46	8007	–	INT16U	0–65535	Switchboard temperature threshold 2 counter reset/preset: <ul style="list-style-type: none"> <li>0–65534 = preset value of the switchboard temperature threshold 2 counter</li> <li>65535 (0xFFFF) = do not preset the counter</li> </ul>
0x1F47	8008	–	INT16U	0–65535	Switchboard temperature threshold 3 counter reset/preset: <ul style="list-style-type: none"> <li>0–65534 = preset value of the switchboard temperature threshold 3 counter</li> <li>65535 (0xFFFF) = do not preset the counter</li> </ul>

# IFM Interface Data for MasterPact NT/NW Circuit Breakers

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# IFM Interface Registers

## What’s in This Chapter

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## IFM Interface Identification

### IFM Interface Firmware Revision

The IFM interface firmware revision starts at register 11776 and has a maximum length of eight registers.

The firmware revision is an ASCII string using the format XXX.YYY.ZZZ with:

- XXX = major version (000–127)
- YYY = minor version (000–255)
- ZZZ = revision number (000–255)

The NULL character ends the revision number.

Address	Register	RW	Unit	Type	Range	Description
0x2DDF– 0x2DEE	11744– 11759	R	–	OCTET STRING	–	Device family
0x2DEF– 0x2DF6	11760– 11767	R	–	OCTET STRING	–	Product range
0x2DF7– 0x2DFE	11768– 11775	R	–	OCTET STRING	–	Product model
0x2DFF– 0x2E04	11776– 11781	R	–	OCTET STRING	–	Firmware revision

### Serial Number for IFM Interface TRV00210 or STRV00210

The serial number of IFM interface TRV00210 or STRV00210 is composed of a maximum of 11 alphanumeric characters with the following format: PPYYWWDnnnn.

- PP = plant code
- YY = year of fabrication (05–99)
- WW = week of fabrication (01–53)
- D = day of fabrication (1–7)
- nnnn = production number of the device on the day (0001–9999)

A read request of six registers is necessary to read the IFM interface serial number.

Address	Register	RW	Unit	Type	Range	Description
0x2E07	11784	R	–	OCTET STRING	–	'PP'
0x2E08	11785	R	–	OCTET STRING	'05'–'99'	'YY'
0x2E09	11786	R	–	OCTET STRING	'01'–'53'	'WW'
0x2E0A	11787	R	–	OCTET STRING	D: '1'–'7' n: '0'–'9'	'Dn'
0x2E0B	11788	R	–	OCTET STRING	'00'–'99'	'nn'
0x2E0C	11789	R	–	OCTET STRING	'0'–'9'	'n' (the NULL character ends the serial number)



## Serial Number for IFM Interface LV434000

The serial number of IFM interface LV434000 is composed of a maximum of 17 alphanumeric characters with the following format: PPPPPYYWWDLnnnn0.

- PPPPPP = plant code (example: BATAM plant code is 0000HL)
- YY = year of fabrication (05–99)
- WW = week of fabrication (01–53)
- D = day of fabrication (1–7)
- L = line or machine number (0-9 or a-z)
- nnnn = production number of the device on the day (0001–9999)

A read request of ten registers is necessary to read the IFM interface serial number.

Address	Register	RW	Unit	Type	Range	Description
0x2E5C-0x2E5E	11869-11871	R	–	OCTET STRING	–	'PPPPPP'
0x2E5F	11872	R	–	OCTET STRING	'05'–'99'	'YY'
0x2E60	11873	R	–	OCTET STRING	'01'–'53'	'WW'
0x2E61	11874	R	–	OCTET STRING	D: '1'–'7' L: '0'–'9' or 'a'–'z'	'DL'
0x2E62	11875	R	–	OCTET STRING	'00'–'99'	'nn'
0x2E63	11876	R	–	OCTET STRING	'00'–'99'	'nn'
0x2E64-0x2E65	11877-11878	R	–	OCTET STRING	'0'	'0' (the NULL character ends the serial number)

## Current Date and Time

Address	Register	RW	Unit	Type	Range	Description
0x2E73–0x2E76	11892–11895	R-WC	–	DATETIME	–	Current date and time in DATETIME format
0x2E77–0x2E78	11896–11897	R	Seconds	INT32U	0x00–0xFFFF-FFF	Number of seconds counted since last start

## Product Identification

Address	Register	RW	Unit	Type	Range	Description
0x2E7C	11901	R	–	INT16U	–	Product identification = 15146 for the IFM interface

## Hardware Revision for IFM Interface LV434000

The hardware revision of IFM interface LV434000 starts at register 11922 and has a maximum length of ten registers.

The hardware revision is an ASCII string using the format XXX.YYY.ZZZ with:

- XXX = major version (000–127)
- YYY = minor version (000–255)

- ZZZ = revision number (000–255)

The NULL character ends the revision number.

Address	Register	RW	Unit	Type	Range	Description
0x2E91– 0x2E96	11922– 11927	R	–	OCTET STRING	–	Hardware revision

## Read Device Identification

The Read Device Identification function is used to access in a standardized manner the information required to identify a device clearly. The description is made up of a set of objects (ASCII character strings).

A complete description of the Read Device Identification function is available at [www.modbus.org](http://www.modbus.org).

The coding for the identification of the IFM interface is the following:

Name	Type	Description
Vendor name	OCTET STRING	'Schneider Electric' (18 characters)
Product code	OCTET STRING	'LV434000' or 'TRV00210' (1) or 'STRV00210'
Firmware revision	OCTET STRING	'XXX.YYY.ZZZ' from IFM interface revision 002.002.000
Vendor URL	OCTET STRING	'https://www.se.com' (33 characters)
Product name	OCTET STRING	'ULP/Modbus-SL communication interface module'
(1) Product code returns 'TRV00210-L' when IFM interface TRV00210 is loaded with IFM legacy firmware. For more information, refer to <i>MasterPact Modbus Legacy User Guide</i> .		

## IMU Identification

Identification of the IMU can be set by using the [EcoStruxure Power Commission software](#), page 18. When not programmed, the IMU identification registers return 0 (0x0000).

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

Address	Register	RW	Unit	Type	Range	Description
0x2E18– 0x2E2E	11801– 11823	R	–	OCTET STRING	–	IMU name = up to 45 ASCII characters ended by the NULL character 0x00
0x2E2F– 0x2E38	11824– 11833	R	–	OCTET STRING	–	Vendor name = 'Schneider Electric'
0x2E39– 0x2E42	11834– 11843	R	–	OCTET STRING	–	Product Code = 'TRV00210' or 'LV434000'
0x2E43– 0x2E44	11844– 11845	R	–	OCTET STRING	–	Reserved
0x2E45– 0x2E5B	11846– 11868	R	–	OCTET STRING	–	IMU location = up to 45 ASCII characters ended by the NULL character 0x00

## Modbus Network Parameters

### Modbus Locking Pad Position

Address	Register	RW	Unit	Type	Range	Description
0x2E72	11891	R	–	INT16U	1–3	Modbus locking pad position <ul style="list-style-type: none"> <li>1 = Modbus locking pad is on the locked position</li> <li>3 = Modbus locking pad is on the open position</li> </ul>

### Validity Duration of Data

Address	Register	RW	Unit	Type	Range	Description
0x306A	12395	R	s	INT16U	5–300 (in step of 5 s)	Duration of validity of data in the dataset

### Auto-Speed Sensing State

Address	Register	RW	Unit	Type	Range	Description
0x306E	12399	R	–	INT16U	0–1	Auto-Speed sensing state <ul style="list-style-type: none"> <li>0 = Auto-Speed sensing is disabled</li> <li>1 = Auto-Speed sensing is enabled (factory setting)</li> </ul>

### IFM Interface Modbus Address

Address	Register	RW	Unit	Type	Range	Description
0x306F	12400	R	–	INT16U	1–99	IFM interface Modbus address

### Modbus Parity

Address	Register	RW	Unit	Type	Range	Description
0x3070	12401	R	–	INT16U	1–3	Modbus parity <ul style="list-style-type: none"> <li>1 = no parity (none)</li> <li>2 = even parity (factory setting)</li> <li>3 = odd parity</li> </ul>

### Modbus Baud Rate

Address	Register	RW	Unit	Type	Range	Description
0x3071	12402	R	–	INT16U	5–8	Modbus Baud rate <ul style="list-style-type: none"> <li>5 = 4800 Baud</li> <li>6 = 9600 Baud</li> <li>7 = 19200 Baud (factory setting)</li> <li>8 = 38400 Baud</li> </ul>

## Number of Stop Bits

Address	Register	RW	Unit	Type	Range	Description
0x3072	12403	R	–	INT16U	0–5	Number of stop bits <ul style="list-style-type: none"> <li>• 0 = no change</li> <li>• 1 = standard Modbus</li> <li>• 2 = 1/2 stop bit</li> <li>• 3 = 1 stop bit</li> <li>• 4 = 1 and 1/2 stop bit</li> <li>• 5 = 2 stop bits</li> </ul>

# IFM Interface Commands

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# List of IFM Interface Commands

## List of Commands

The following table lists the IFM interface commands, their corresponding command codes and user profiles. Follow the command execution procedures accordingly, page 56.

Command	Command code	User profile
Get current time, page 275	768	No password required
Set absolute time, page 275	769	No password required
Read IMU name and location, page 276	1024	No password required
Write IMU name and location, page 276	1032	Administrator
Set validity duration of data, page 277	41868	Administrator, Services, Engineer, or Operator

## Error Codes

Error codes generated by the IFM interface are the generic error codes, page 59.

# IFM Interface Commands

## Get Current Time

The get current time command is not hardware protected. When the arrow of the Modbus locking pad (located on the front panel of the IFM interface) points to the closed padlock, the get current time command is still enabled.

To get the current time for all modules, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	768	Command code = <b>768</b>
0x1F40	8001	–	INT16U	10	Number of parameters (bytes) = 10
0x1F41	8002	–	INT16U	768	Destination = 768 (0x0300)
0x1F42	8003	–	INT16U	0	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	0	Password of the command = 0 (no password required)

The following registers contain the time data:

- Register 8023 holds the month in the MSB, the day in the LSB.
- Register 8024 holds the year offset in the MSB (add 2000 to get the year) and the hour in the LSB.
- Register 8025 holds the minutes in the MSB, the seconds in the LSB.
- Register 8026 holds the milliseconds.

## Set Absolute Time

The set absolute time command is not hardware protected. When the arrow of the Modbus locking pad (located on the front panel of the IFM interface) points to the closed padlock, the set absolute time command is still enabled.

To set the absolute time for all the IMU modules, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	769	Command code = <b>769</b>
0x1F40	8001	–	INT16U	18	Number of parameters (bytes) = 18
0x1F41	8002	–	INT16U	768	Destination = 768 (0x0300)
0x1F42	8003	–	INT16U	0	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	0	Password of the command = 0 (no password required)
0x1F45	8006	–	INT16U	–	MSB = month (1–12) LSB = day in the month (1–31)
0x1F46	8007	–	INT16U	–	MSB = year (0–99, 0 meaning year 2000) LSB = hour (0–23)
0x1F47	8008	–	INT16U	–	MSB = minute (0–59) LSB = second (0–59)
0x1F48	8009	ms	INT16U	0–999	Milliseconds (0–999)

In case of 24 Vdc power loss, date and time counter is reset and will restart at January 1 2000. It is therefore mandatory to set absolute time for all the IMU modules after recovering the 24 Vdc power supply.

Furthermore, due to the clock drift of each IMU module, it is mandatory to set absolute time for all the IMU modules periodically. Recommended period is at least every 15 minutes.

## Read IMU Name and Location

The FDM121 display displays the IMU name but it is limited to the first 14 characters.

To read the IMU name and location, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	1024	Command code = <b>1024</b>
0x1F40	8001	–	INT16U	16	Number of parameters (bytes) = 16
0x1F41	8002	–	INT16U	768	Destination = 768 (0x0300)
0x1F42	8003	–	INT16U	0	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	0	Password of the command = 0 (no password required)
0x1F45– 0x1F46	8006– 8007	–	INT32U	–	17039489 = read IMU name (load 0x0104 into register 8006, 0x0081 into 8007) 17039490 = read IMU location (load 0x0104 into register 8006, 0x0082 into 8007)
0x1F47	8008	–	INT16U	2048	2048

The IMU name and location are returned to command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F53	8020	–	INT16U	1024	Last Command Code
0x1F54	8021	–	INT16U	–	Command status 0 = command succeeded Otherwise, command failed
0x1F55	8022	–	INT16U	–	Number of bytes returned (0 if command failed)
0x1F56	8023	–	OCTET STRING	–	If command succeeded MSB = first character of IMU name or location LSB = second character of IMU name or location
0x1F57– 0x1F6D	8024–8046	–	OCTET STRING	–	Depends on the length of the IMU name or location and ends by the NULL character 0x00

## Write IMU Name and Location

The IMU name and location can be read from register 11801 to 11868.

The FDM121 display displays the IMU name but it is limited to the first 14 characters.

To write the IMU name and location, the user must set up the command registers the following way:



Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	1032	Command code = <b>1032</b>
0x1F40	8001	–	INT16U	16–62	Number of parameters (bytes) = depends on the length of the IMU name or location (up to 46 characters)
0x1F41	8002	–	INT16U	0	Destination = 0 (0x0000)
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	Password of the command: Administrator user profile password
0x1F45– 0x1F46	8006– 8007	–	INT32U	–	17039489 = write IMU name (load 0x0104 into register 8006, 0x0081 into 8007)  17039490 = write IMU location (load 0x0104 into register 8006, 0x0082 into 8007)
0x1F47	8008	–	INT16U	2048	2048
0x1F48	8009	–	OCTET STRING	–	MSB = First character of the IMU name or location  LSB = Second character of the IMU name or location
0x1F49– 0x1F5F	8010–8038	–	OCTET STRING	–	Depends on the length of the IMU name or location and ends by the NULL character 0x00

## Set Validity Duration of Data

This command allows to set the validity duration of data in the standard and legacy datasets.

The validity duration of data can be read in a register [Validity Duration of Data](#), page 271.

To set the validity duration of data, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	41868	Command code = 41868
0x1F40	8001	–	INT16U	12	Number of parameters (bytes) = 12
0x1F41	8002	–	INT16U	769	Destination = 769 (0x0301)
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43– 0x1F44	8004–8005	–	OCTET STRING	–	Password of the command: Administrator, Services, Engineer, or Operator user profile password
0x1F45	8006	s	INT16U	5–300 (in step of 5 s)	Validity duration of data  Factory setting: 10 s

# IFE Interface Data for MasterPact NT/NW and PowerPact P- and R-Frame Circuit Breakers

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# IFE Interface Registers

## What's in This Chapter

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## IFE Interface Identification and Status Registers

### IFE Interface Firmware Revision

The IFE interface firmware revision starts at register 11776 and has a maximum length of eight registers.

The firmware revision is an ASCII string using the format XXX.YYY.ZZZ with:

- XXX = major version (000–127)
- YYY = minor version (000–255)
- ZZZ = revision number (000–255)

The NULL character ends the revision number.

Address	Register	RW	Unit	Type	Range	Description
0x2DDF– 0x2DEE	11744–11759	R	–	OCTET STRING	–	Device family
0x2DEF– 0x2DF6	11760–11767	R	–	OCTET STRING	–	Product range
0x2DF7– 0x2DFE	11768–11775	R	–	OCTET STRING	–	Product model
0x2DFF– 0x2E04	11776–11781	R	–	OCTET STRING	–	Firmware revision

### IFE Interface Hardware Revision

The IFE interface hardware revision starts at register 11784 and has a maximum length of eight registers.

The hardware revision is an ASCII string using the format XXX.YYY.ZZZ with:

- XXX = major version (000–127)
- YYY = minor version (000–255)
- ZZZ = revision number (000–255)

The NULL character ends the revision number.

Address	Register	RW	Unit	Type	Range	Description
0x2E07– 0x2E0C	11784– 11789	R	–	OCTET STRING	–	Hardware revision

### IMU Identification

Identification of the IMU can be set by using the EcoStruxure Power Commission software. When not programmed, the IMU identification registers return 0 (0x0000).

Address	Register	RW	Unit	Type	Range	Description
0x2E2F– 0x2E38	11824– 11833	R-WC	–	OCTET STRING	–	User application name set by using: <ul style="list-style-type: none"> <li>the EcoStruxure Power Commission software</li> <li>the IFE webpages</li> </ul> Device name used for acquiring the IP address using DHCP and also the friendly name on DPWS device discovery.  <b>Example:</b> 'IFE-0A129F'  Maximum length is 64 characters
0x2E18– 0x2E2E	11801– 11823	R		OCTET STRING	–	IMU name (for MasterPact NT/NW, ComPact NS/ NSX and PowerPact only)
0x2E2F– 0x2E38	11824– 11833	R	–	OCTET STRING	–	Vendor name = 'Schneider Electric'
0x2E39– 0x2E42	11834– 11843	R	–	OCTET STRING	–	Product code: <ul style="list-style-type: none"> <li>'LV434001' or 'LV434010' = IFE-Ethernet com Modbus TCP/IP</li> <li>'LV434002' or 'LV434011' = IFE-Ethernet com Modbus TCP/IP master</li> </ul>
0x2E43– 0x2E44	11844– 11845	–	–	–	–	Reserved
0x2E45– 0x2E5B	11846– 11868	R-RC- WC	–	OCTET STRING	–	IMU location (for MasterPact NT/NW, ComPact NS/ NSX and PowerPact only) = up to 45 ASCII characters ended by the NULL character 0x00

## Locking Pad Position

Address	Register	RW	Unit	Type	Range	Description
0x2E72	11891	R	–	INT16U	1,3	Locking pad position <ul style="list-style-type: none"> <li>1 = locking pad is in the locked position</li> <li>3 = locking pad is in the unlocked position</li> </ul>

## Current Date and Time

Address	Register	RW	Unit	Type	Range	Description
0x2E73– 0x2E76	11892– 11895	R-WC	–	DATETIME	–	Current date and time in DATETIME format
0x2E77– 0x2E78	11896– 11897	R	Seconds	INT32U	0x00– 0xFFFFF- FF	Number of seconds counted since last start

## Product Identification

Address	Register	RW	Unit	Type	Range	Description
0x2E7C	11901	R	–	INT16U	17100– 17101	Product identification: <ul style="list-style-type: none"> <li>17100 for IFE Ethernet interface for one circuit breaker ('LV434001' or 'LV434010')</li> <li>17101 for IFE Ethernet switchboard server ('LV434002' or 'LV434011')</li> </ul>

## Validity Duration of Data

Address	Register	RW	Unit	Type	Range	Description
0x306A	12395	R	s	INT16U	5–300 (in step of 5 s)	Duration of validity of data in the dataset

## Read Device Identification

The Read Device Identification function is used to access in a standardized manner the information required to identify a device clearly. The description is made up of a set of objects (ASCII character strings).

A complete description of the Read Device Identification function is available at [www.modbus.org](http://www.modbus.org).

The coding for the identification of the IFE interface is the following:

Name	Type	Description
Vendor name	OCTET STRING	'Schneider Electric' (18 characters)
Product code	OCTET STRING	<ul style="list-style-type: none"> <li>'LV434001' or 'LV434010'</li> <li>'LV434002' or 'LV434011'</li> </ul>
Firmware revision	OCTET STRING	'XXX.YYY.ZZZ'
Vendor URL	OCTET STRING	'www.se.com' (26 characters)
Product name	OCTET STRING	<ul style="list-style-type: none"> <li>For IFE Ethernet interface for one circuit breaker (LV434001 or LV434010): 'Ethernet interface for LV breakers'</li> <li>For IFE Ethernet switchboard server (LV434002 or LV434011): 'Ethernet interface for LV breakers + gateway'</li> </ul>
Family	OCTET STRING	'Gateway and server'
Range	OCTET STRING	'Enerlin'X'
Model	OCTET STRING	'IFE Ethernet interface' or 'IFE/Gateway'
Product ID	INT16U	Product ID of the core of IMU: <ul style="list-style-type: none"> <li>17100 = IFE without gateway</li> <li>17101 = IFE with gateway</li> </ul>

## MAC Address of the IFE Server

Address	Register	RW	Unit	Type	Range	Description
0x2E7D– 0x2E7F	11902– 11904	R	–	INT16U	–	MAC address of the IFE interface coded over 3 registers (6 bytes) in hexadecimal.  <b>Example:</b> The MAC address 00:80:F4:02:12:34 (or 00-80-F4-02-12-34) is coded in hexadecimal as follows: 0080F4021234 (0x00 0x80 0xF4 0x02 0x12 0x34).

## Manufacturing Date and Time

Address	Register	RW	Unit	Type	Range	Description
0x2E89– 0x2E8C	11914– 11917	R	–	DATETIME	–	Manufacturing date and time

## IFE Interface Serial Number

The IFE interface serial number is composed of a maximum of 11 alphanumeric characters with the following format: PPYYWWDnnnn.

- PP = plant code
- YY = year of fabrication (05–99)
- WW = week of fabrication (01–53)
- D = day of fabrication (1–7)
- nnnn = production number of the device on the day (0001–9999)

A read request of 6 registers is necessary to read the IFE interface serial number.

Address	Register	RW	Unit	Type	Range	Description
0x02E91	11922	R	–	OCTET STRING	–	'PP'
0x02E92	11923	R	–	OCTET STRING	'05'–'99'	'YY'
0x02E93	11924	R	–	OCTET STRING	'01'–'53'	'WW'
0x02E94	11925	R	–	OCTET STRING	D: '1'–'7' n: '0'–'9'	'Dn'
0x02E95	11926	R	–	OCTET STRING	'00'–'99'	'nn'
0x02E96	11927	R	–	OCTET STRING	'0'–'9'	'n' (the NULL character ends the serial number)

## Modbus Parameters of the IFE Server

These parameters are valid for the IFE switchboard server only.

Address	Register	RW	Unit	Type	Range	Description
0x306F	12400	R	–	INT16U	–	Modbus address of IFE server (always 255)
0x3070	12401	R	–	INT16U	1–3	Modbus parity: <ul style="list-style-type: none"> <li>• 1 = no parity</li> <li>• 2 = even parity (factory setting)</li> <li>• 3 = odd parity</li> </ul>
0x3071	12402	R	–	INT16U	5–8	Modbus Baud rate: <ul style="list-style-type: none"> <li>• 5 = 4800 Baud</li> <li>• 6 = 9600 Baud</li> <li>• 7 = 19,200 Baud (factory setting)</li> <li>• 8 = 38,400 Baud</li> </ul>
0x3072	12403	R	–	INT16U	1,3,5	Number of stop bits: <ul style="list-style-type: none"> <li>• 1 = Auto (factory setting)</li> <li>• 3 = 1 stop bit</li> <li>• 5 = 2 stop bits</li> </ul>

## Time Synchronization

Address	Register	RW	Unit	Type	Range	Description
0x3098– 0x30B7	12441– 12472	R	–	OCTET STRING	–	The type of source use for time synchronization: <ul style="list-style-type: none"> <li>• 'Auto–SNTP'</li> <li>• 'Manual–Modbus'</li> <li>• 'Manual–ULP'</li> <li>• 'Manual–Webpage'</li> </ul>
0x30B8– 0x30BB	12473– 12476	R	–	DATETIME	–	Date and time of last time synchronization
0x30BC– 0x30BD	12477– 12478	R	s	FLOAT32	–	Time since last time synchronization
0x30BE	12479	R	–	INT16U	0–2	Status of automatic time synchronization: <ul style="list-style-type: none"> <li>• 0 = SNTP disabled</li> <li>• 1 = SNTP failed</li> <li>• 2 = SNTP succeeded</li> </ul>
0x30BF	12480	R	–	INT16	–	SNTP fails count



## IP Network Parameters

### Network Parameters

Address	Register	RW	Unit	Type	Range	Description
0x27FF– 0x2800	10240– 10241	R	–	INT32	0–1	Network configuration mode: <ul style="list-style-type: none"> <li>0 = IPv4 only</li> <li>1 = IPv4 and IPv6</li> </ul>

### IPv4 Parameters

Address	Register	RW	Unit	Type	Range	Description
0x2823– 0x2824	10276– 10277	R-WC	–	INT32U	0–2	IPv4 address acquisition mode, set by using the EcoStruxure Power Commission software: <ul style="list-style-type: none"> <li>0 = Static</li> <li>1 = BootP</li> <li>2 = DHCP</li> </ul>
0x2825– 0x2826	10278– 10279	R	–	INT32U	–	IPv4 address acquisition status: <ul style="list-style-type: none"> <li>0 = IP acquisition successful</li> <li>1 = IP acquisition in progress</li> <li>2 = Acquired IP address is duplicated</li> <li>3 = Error in IP acquisition</li> </ul>
0x2827– 0x2828	10280– 10281	R-WC	–	INT32U	–	IPv4 address of IFE interface <b>Example:</b> 169.254.1.1 Register 10280 = 0xA9FE Register 10281 = 0x0101
0x2829– 0x282A	10282– 10283	R-WC	–	INT32U	–	IPv4 subnet mask <b>Example:</b> 255.255.0.0 Register 10282 = 0xFFFF Register 10283 = 0x0000
0x282B– 0x282C	10284– 10285	R-WC	–	INT32U	–	IPv4 default gateway address <b>Example:</b> 169.154.1.1 Register 10284 = 0xA9FE Register 10285 = 0x0101
0x282D– 0x2846	10286– 10311	–	–	–	–	Reserved

# IFE Interface Commands

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## List of IFE Interface Commands

### List of Commands for IFE Interfaces

The following table lists the IFE interface commands, their corresponding command codes and user profiles. Follow the command execution procedures accordingly , page 56.

Command	Command code	User profile
Get current time, page 288	768	No password required
Set absolute time, page 288	769	No password required
Read IMU name and location, page 289	1024	No password required
Write IMU name and location, page 289	1032	Administrator
Set validity duration of data, page 290	41868	Administrator, Services, Engineer, or Operator

### Error Codes

Error codes generated by the IFE interface are the generic error codes , page 59.

## IFE Interface Generic Commands

### Get Current Time

The get current time command is not hardware protected. The get current time command is still enabled when the locking pad located on the front panel on the IFE interface is in locked position.

To get the current time for all modules, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	768	Command code = <b>768</b>
0x1F40	8001	–	INT16U	10	Number of parameters (bytes) = 10
0x1F41	8002	–	INT16U	8704	Destination = 8704 (0x2200)
0x1F42	8003	–	INT16U	0	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	0	Password of the command = 0 (no password required)

The following registers contain the time data:

- Register 8023 holds the month in the MSB, the day in the LSB.
- Register 8024 holds the year offset in the MSB (add 2000 to get the year) and the hour in the LSB.
- Register 8025 holds the minutes in the MSB, the seconds in the LSB.
- Register 8026 holds the milliseconds.

### Set Absolute Time

The set absolute time command is still enabled when the locking pad located on the front panel on the IFE interface is in locked position.

To set the absolute time for all the IMU modules, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	769	Command code = <b>769</b>
0x1F40	8001	–	INT16U	18	Number of parameters (bytes) = 18
0x1F41	8002	–	INT16U	8704	Destination = 8704 (0x2200)
0x1F42	8003	–	INT16U	0	Security type of the command
0x1F43– 0x1F44	8004–8005	–	OCTET STRING	0	Password of the command = 0 (no password required)
0x1F45–0x1F48	8006–8009	–	XDATE	–	Current date/time

**NOTE:** Date and time counter is reset and will restart at January 1, 2000 in case of 24 Vdc power loss. It is therefore mandatory to set absolute time for all the IMU modules after recovering the 24 Vdc power supply.

**NOTE:** If the IFE interface is not configured in SNTP mode it is mandatory to set absolute time for all the IMU modules periodically, due to the clock drift of each IMU module. Recommended period is at least every 15 minutes.

## Read IMU Name and Location

To read the IMU name and location, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	1024	Command code = <b>1024</b>
0x1F40	8001	–	INT16U	16	Number of parameters (bytes) = 16
0x1F41	8002	–	INT16U	8704	Destination = 8704 (0x2200)
0x1F42	8003	–	INT16U	0	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	0	Password of the command = 0 (no password required)
0x1F45– 0x1F46	8006– 8007	–	INT32U	–	<ul style="list-style-type: none"> <li>17039489 = read IMU name (load 0x0104 into register 8006, 0x0081 into 8007)</li> <li>17039490 = read IMU location (load 0x0104 into register 8006, 0x0082 into 8007)</li> </ul>
0x1F47	8008	–	INT16U	2048	2048

The IMU name and location is returned to command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F53	8020	–	INT16U	1024	Last command code
0x1F54	8021	–	INT16U	–	Command status: <ul style="list-style-type: none"> <li>0 = command succeeded</li> <li>Otherwise = command failed</li> </ul>
0x1F55	8022	–	INT16U	–	Number of bytes returned (0 if command failed)
0x1F56	8023	–	OCTET STRING	8704	If command succeeded: <ul style="list-style-type: none"> <li>MSB = first character of IMU name or location</li> <li>LSB = second character of IMU name or location</li> </ul>
0x1F57– 0x1F6D	8024–8046	–	OCTET STRING	–	Depends on the length of the IMU name or location and ends by the NULL character 0x00

## Write IMU Name and Location

The IMU name and location can be read from registers 11801 to 11868, page 280.

To write the IMU name and location, set the command registers the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	1032	Command code = <b>1032</b>
0x1F40	8001	–	INT16U	16–62	Number of parameters (bytes) = depends on the length of the IMU name or location (up to 46 characters)
0x1F41	8002	–	INT16U	0	Destination = 0 (0x0000)
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43– 0x1F44	8004– 8005	–	OCTET STRING	–	Password of the command: Administrator user profile password
0x1F45– 0x1F46	8006– 8007	–	INT32U	–	<ul style="list-style-type: none"> <li>17039489 = User application name (load 0x0104 into register 8006, 0x0081 into 8007)</li> <li>17039490 = IMU location (load 0x0104 into register 8006, 0x0082 into 8007)</li> </ul>
0x1F46	8008	–	INT16U	2048	2048

Address	Register	Unit	Type	Range	Description
0x1F48	8009	–	OCTET STRING	–	<ul style="list-style-type: none"> <li>MSB = First character of the IMU name or location</li> <li>LSB = Second character of the IMU name or location</li> </ul>
0x1F49– 0x1F5F	8010– 8038	–	OCTET STRING	–	Depends on the length of the IMU name or location and ends by the NULL character 0x00

## Set Validity Duration of Data

This command allows to set the validity duration of data in the standard and legacy datasets.

The validity duration of data can be read in a register [Validity Duration of Data](#), page 282.

To set the validity duration of data, set the command registers in the following way:

Address	Register	Unit	Type	Range	Description
0x1F3F	8000	–	INT16U	41868	Command code = 41868
0x1F40	8001	–	INT16U	12	Number of parameters (bytes) = 12
0x1F41	8002	–	INT16U	8705	Destination = 8705 (0x2201)
0x1F42	8003	–	INT16U	1	Security type of the command
0x1F43–0x1F44	8004– 8005	–	OCTET STRING	–	Password of the command: Administrator, Services, Engineer, or Operator user profile password
0x1F45	8006	s	INT16U	5–300 (in step of 5 s)	Validity duration of data Factory setting: 10 s

# Appendices

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## Introduction

The appendix lists the Modbus registers by ascending order, with cross references to the corresponding pages of the manual.

# Cross References to Modbus Registers for MasterPact NT/NW and PowerPact P- and R-Frame Circuit Breakers

## What’s in This Chapter

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## Introduction

The cross references table gives the list of Modbus registers in ascending order, with cross references to the corresponding pages of the guide.



# Cross References to Modbus Registers for MasterPact NT/ NW and PowerPact M-, P-, and R- Frame Circuit Breakers

## General Description

The following table gives cross references to the Modbus registers used by the communication modules. The registers are listed in ascending order.

## Cross References Table

Address	Register	Module	Description	Page
0x0095–0x009B	150–156	BCM ULP module	Trip history	Trip History, page 221
0x0202	515	BCM ULP module	Product identification	Product Identification, page 213
0x0215–0x021E	534–543	BCM ULP module	BCM ULP module identifier	BCM ULP Module Identifier, page 213
0x0229–0x022A	554–555	BCM ULP module	BCM ULP module counters	BCM ULP Module Counters, page 219
0x0240	577	BCM ULP module	Firmware version	BCM ULP Module Firmware Version, page 213
0x0243–0x0244	580–581	BCM ULP module	Counter thresholds	Counter Thresholds, page 219
0x0289–0x028A	650–651	BCM ULP module	Tripping cause	Tripping Cause, page 214
0x0291–0x0292	658–659	BCM ULP module	Inhibit close order	Inhibit Close Order, page 215
0x0293	660	BCM ULP module	Local/remote mode	Local/Remote Mode, page 215
0x0294	661	BCM ULP module	Circuit breaker status	Circuit Breaker Status, page 215
0x0295–0x0298	662–665	BCM ULP module	Circuit breaker operation counters	Circuit Breaker Operation Counters, page 219
0x029D	670	BCM ULP module	Auto/Manu mode	Auto/Manu, page 216
0x029E–0x02A0	671–673	BCM ULP module	Date of last actuation of MX auxiliary	Date of Last Event, page 218
0x02A1	674	BCM ULP module	MX actuation counter	MX and XF Release Counters, page 220
0x02A2	675	BCM ULP module	Date of last actuation of XF auxiliary	Date of Last Event, page 218
0x02A5	678	BCM ULP module	XF actuation counter	MX and XF Release Counters, page 220
0x02A6–0x02A9	679–682	BCM ULP module	Current date of BCM ULP module	Date of Last Event, page 218
0x02AB–0x02BD	684–702	BCM ULP module	Date of last event	Date of Last Event, page 218
0x031F	800	BCM ULP module	Legacy dataset activation	Legacy Dataset Activation, page 216
0x0325	806	BCM ULP module	Communication parameter	Communication Parameter, page 217
0x0326–0x032B	807–812	BCM ULP module	Energy Reduction Maintenance Switch (ERMS)	Energy Reduction Maintenance Switch (ERMS), page 217

Address	Register	Module	Description	Page
0x032C	813	BCM ULP module	Contact wear	Contact Wear, page 217
0x03E7–0x03F6	1000–1015	MicroLogic trip unit	Voltage and voltage unbalance (real time-measurements)	Voltage, page 115
0x03F7–0x0407	1016–1032	MicroLogic trip unit	Current and current unbalance (real time-measurements)	Current, page 116
0x0409–0x0414	1034–1045	MicroLogic trip unit	Active, reactive, and apparent power (real time-measurements)	Active Power, page 117
0x0415–0x041C	1046–1053	MicroLogic trip unit	Power factor and fundamental power factor (real time-measurements)	Power Factor, page 118
0x041D	1054	MicroLogic trip unit	Frequency (real time-measurements)	Frequency, page 118
0x041F–0x0424	1056–1061	MicroLogic trip unit	Fundamental voltage (real time-measurements)	Fundamental Voltage, page 118
0x042B–0x042E	1068–1071	MicroLogic trip unit	Fundamental current (real time-measurements)	Fundamental Current, page 119
0x0433–0x0436	1076–1079	MicroLogic trip unit	Fundamental active power (real time-measurements)	Fundamental Active Power, page 119
0x0437–0x043A	1080–1083	MicroLogic trip unit	Fundamental reactive power (real time-measurements)	Fundamental Reactive Power, page 119
0x043B–0x043E	1084–1087	MicroLogic trip unit	Fundamental apparent power (real time-measurements)	Fundamental Apparent Power, page 120
0x043F–0x0442	1088–1091	MicroLogic trip unit	Distortion power (real time-measurements)	Distortion Power, page 120
0x0443–0x044C	1092–1101	MicroLogic trip unit	Total harmonic distortion in relation to the fundamental (THD) (real time-measurements)	Total Harmonic Distortion in Relation to the Fundamental (THD), page 120
0x044D–0x0456	1102–1111	MicroLogic trip unit	Total harmonic distortion in relation to the RMS Value (thd) (real time-measurements)	Total Harmonic Distortion in Relation to the RMS Value (thd), page 121
0x0457–0x0459	1112–1114	MicroLogic trip unit	Voltage to current phase shift (real time-measurements)	Voltage-to-Current Phase Shift, page 121
0x045A–0x045D	1115–1118	MicroLogic trip unit	K-Factor (real time-measurements)	K-Factor, page 122
0x045E–0x0467	1119–1128	MicroLogic trip unit	Peak factor (real time-measurements)	Peak Factor, page 122
0x046C–0x046E	1133–1135	MicroLogic trip unit	Voltage-to-voltage phase shift (real time-measurements)	Voltage-to-Voltage Phase Shift, page 122
0x0513–0x0522	1300–1315	MicroLogic trip unit	Voltage (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x0523–0x0533	1316–1332	MicroLogic trip unit	Current (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x0535–0x0540	1334–1345	MicroLogic trip unit	Active, reactive, and apparent power (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x0541–0x0548	1346–1353	MicroLogic trip unit	Power factor (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x0549–0x054A	1354–1355	MicroLogic trip unit	Frequency (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x054B–0x0551	1356–1362	MicroLogic trip unit	Fundamental voltage (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123

Address	Register	Module	Description	Page
0x0557–0x055B	1368–1372	MicroLogic trip unit	Fundamental current (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x055F–0x0562	1376–1379	MicroLogic trip unit	Fundamental active power (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x0563–0x0566	1380–1383	MicroLogic trip unit	Fundamental reactive power (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x0567–0x056A	1384–1387	MicroLogic trip unit	Fundamental apparent power (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x056B–0x056E	1388–1391	MicroLogic trip unit	Distortion power (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x056–0x0578	1392–1401	MicroLogic trip unit	Total harmonic distortion in relation to the fundamental (THD) (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x0579–0x0582	1402–1411	MicroLogic trip unit	Total harmonic distortion in relation to the RMS Value (thd) (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x0583–0x0585	1412–1414	MicroLogic trip unit	Voltage to current phase shift (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x0586–0x0589	1415–1418	MicroLogic trip unit	K-Factor (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x058A–0x0593	1419–1428	MicroLogic trip unit	Peak factor (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x0598–0x059A	1433–1435	MicroLogic trip unit	Voltage-to-voltage phase shift (minimum of real-time measurement)	Minimum of Real-Time Measurements, page 123
0x063F–0x064E	1600–1615	MicroLogic trip unit	Voltage (maximum of real-time measurement)	Maximum of Real-Time Measurements, page 123
0x064F–0x065F	1616–1632	MicroLogic trip unit	Current (maximum of real-time measurement)	Maximum of Real-Time Measurements, page 123
0x0661–0x066C	1634–1645	MicroLogic trip unit	Active, reactive, and apparent power (maximum of real-time measurement)	Maximum of Real-Time Measurements, page 123
0x066D–0x0674	1646–1653	MicroLogic trip unit	Power factor (maximum of real-time measurement)	Maximum of Real-Time Measurements, page 123
0x0675–0x0676	1654–1655	MicroLogic trip unit	Frequency (maximum of real-time measurement)	Maximum of Real-Time Measurements, page 123
0x0677–0x067D	1656–1662	MicroLogic trip unit	Fundamental voltage (maximum of real-time measurement)	Maximum of Real-Time Measurements, page 123
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