Easergy P5

User Manual

Communication

07/2020

Version: P5/EN M/33A

www.se.com

Legal Information

Table of Contents

Safety information and password protection

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 manual 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 death or serious injury if the instructions are not followed.

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

DANGER

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

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

WARNING

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

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

CAUTION

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

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

NOTICE

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

Failure to follow these instructions can result in equipment damage.

User qualification

Electrical equipment should be installed, operated, serviced, and maintained only by trained and 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, installation, and operation of electrical equipment and has received safety training to recognise and avoid the hazards involved.

Use the password protection feature in order to protect untrained person interacting with the Easergy P5 protection relay.

Introduction

Protocols used and data exchanged

The Easergy P5 protection relays have been designed for easy data exchange and integration in any system architecture with serial links (daisy chain) or Ethernet.

The protocols used for exchange of data on the Easergy P5 protection relay are as follows:

- IEC 61850
- DNP3
- IEC 60870-5-101
- IEC 60870-5-103
- EtherNet/IP
- Modbus slave
- Modbus master

The data types that can be exchanged through these protocols are listed:

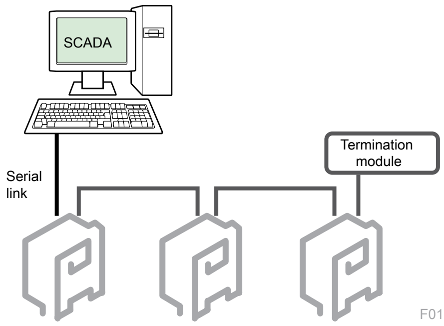
Port	Ethernet					
Protocol	**IEC 61850**	**EtherNet/IP**	**sFTP**	**DNP3**	**Modbus slave**	**GetSet**
Real time data						
Measurement	✓	✓		✓	✓	✓
Alarms and status	✓	✓		✓	✓	✓
Controls	✓	✓		✓	✓	✓
Time-stamped events	✓	✓		✓	✓	✓
Logged data						
Disturbance records	✓		✓	✓		
Sequence of event record files			✓			
Device management						
Setting group change	✓	✓		✓	✓	✓
Settings	✓				✓	✓

Port	Serial				
Protocol	**DNP3**	**Modbus slave**	**Modbus master**	**IEC 60870–5–103**	**IEC 60870–5–101**
Real time data					
Measurement	✓	✓	✓	✓	✓
Alarms and status	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓
Time-stamped events	✓	✓	✓	✓	✓
Logged data					
Disturbance records	✓			✓	
Sequence of event record files					
Device management					
Setting group change	✓	✓		✓	✓
Settings		✓		✓	

Architecture

Serial network architecture

This architecture allows the connection of HMI/SCADA to a set of Easergy P5 protection relays using a multi-drop serial communication link with master-slave communication.



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Ethernet network architectures

This architecture allows the connection of a set of Easergy P5 protection relays directly on an Ethernet network.

> **NOTE:** It is possible to mix any three of four Ethernet protocols, including the IEC 61850 protocol, on the same Ethernet network.

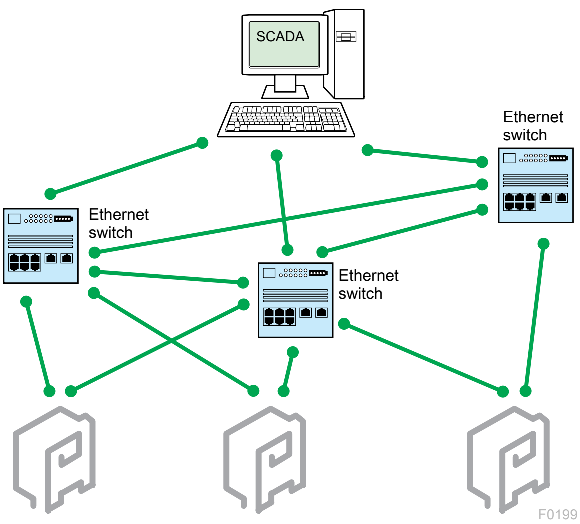
This allows to use the Generic Object Oriented Substation Event (GOOSE) messages between relays together with another protocol for communication to Supervisory Control and Data Acquisition (SCADA).

It is also possible to connect Easergy P5 protection relays to more than one control system, using the same Ethernet communication port with one of the chosen protocols.

Easergy P5 protection relays handle the IEC 61850 station bus, in compliance with standards IEC 61850-6, 7-1, 7-2, 7-3, 7-4 and 8-1 Edition 1 or Edition 2, according to configuration.

Other supported protocols:

- Secured File Transfer Protocol (sFTP) for file transfer
- Simple Network Management Protocol (SNMP) for network management
- Simple Network Time Protocol (SNTP) for time synchronization
- Secured Hypertext Transfer Protocol (HTTPS) for Web HMI
- GetSet, which is an ASCII protocol used by eSetup Easergy Pro, which is secured by TLS



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Connections

The Easergy P5 protection relays can be connected to an Ethernet switch using:

- 10/100BASE-T copper wire (radial connection).
- 100BASE-FX multi-mode fibre optic (radial or ring connection).

To optimise system performance, Schneider Electric recommends:

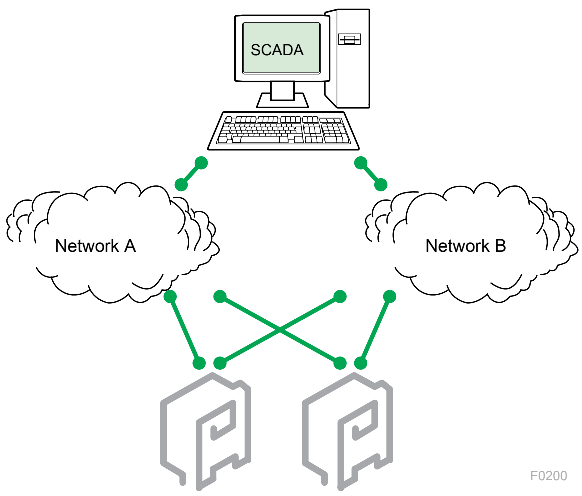
- to build a fault-tolerant communications backbone by implementing a fibre optic ring
- to use IEC 61850 compatible managed switches
- to use VLANs for prioritized messages
- to configure meaningful destination MAC address and APPID to enable network filtering
- to minimize the content of GOOSE datasets

Parallel Redundancy Protocol (PRP)

The principle of Parallel Redundancy Protocol (PRP) is to transmit frames in parallel on two independent network infrastructures: A and B.

The receiving device is in charge of discarding the second (redundant) frame once it is received.

PRP provides a 0 ms recovery time in case of a communication failure, but this quality is achieved at the cost of a double communication network.

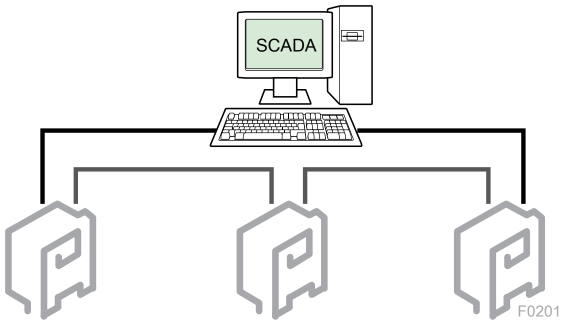


High-availability Seamless Redundancy (HSR)

High-availability Seamless Redundancy (HSR) is typically used in ring architectures.

Frames are transmitted on the ring on both directions and the receiving device discards the redundant frames.

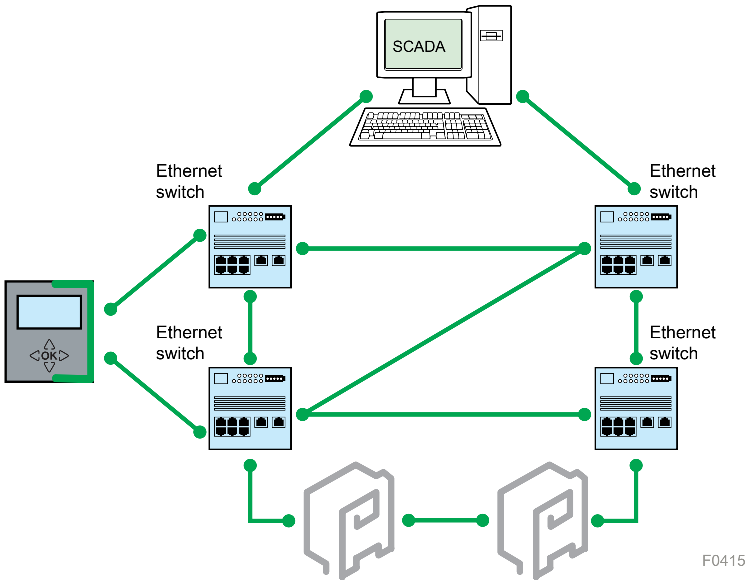
HSR provides a 0 ms recovery time and is a cheaper alternative compared to PRP.



Rapid Spanning Tree Protocol (RSTP)

The principle of Rapid Spanning Tree Protocol (RSTP) is to virtually switch off all links that are not necessary at a given time, changing the meshed topology into a tree topology.

The main advantage of RSTP is that it is widespread, and works on any network topology. On the other hand, RSTP may take a considerable time to reconfigure the network in case of a network failure, which may exceed the requirements of automations.



Communication ports

Ethernet communication slot

The Ethernet communication slot can accommodate one of the following options:

- Dual port copper (RJ45) Ethernet module with RSTP redundancy management.
- Dual port fibre optic (multimode glass fibre) Ethernet module with RSTP redundancy management.
- Dual port fibre optic (multimode glass fibre) Ethernet module with PRP/HSR advanced redundancy management (this option is a double width module which spans over the serial slot space and is therefore not compatible with the use of a serial communication module).

Communication module	IP selection	
	RSTP = 1	RSTP = 0
1 Ethernet module (Slot M)	IP1	IP1, IP2
1 Ethernet module (Slot L)	IP3	
2 Ethernet modules (Slot M, Slot L)	IP1, IP3	IP1, IP2, IP3
1 PRP/HSR module (Slot M and N)	IP1	
1 PRP/HSR module, 1 Ethernet module (Slot M and N, Slot L)	IP1, IP3	

Each IP address includes network number and host number. For example, when IP = 192.168.1.21, the network number is 192.168.1 and the host number is 21. The network number of IP1, IP2 and IP3 shall not be the same for Easergy P5 communication configuration. For example, IP1 = 192.168.1.21, IP2 = 192.168.2.31 and IP3 = 192.168.10.31 are workable, while IP1 = 192.168.1.21 and IP2 = 192.168.1.31 are incorrect.

Ethernet port configuration

The parameters for the port can be set from the front panel, from the COMMUNICATION menu of eSetup Easergy Pro, or from the Web HMI. Up to 3 different protocols can be used simultaneously, using the same IP address and MAC address but different IP port numbers.

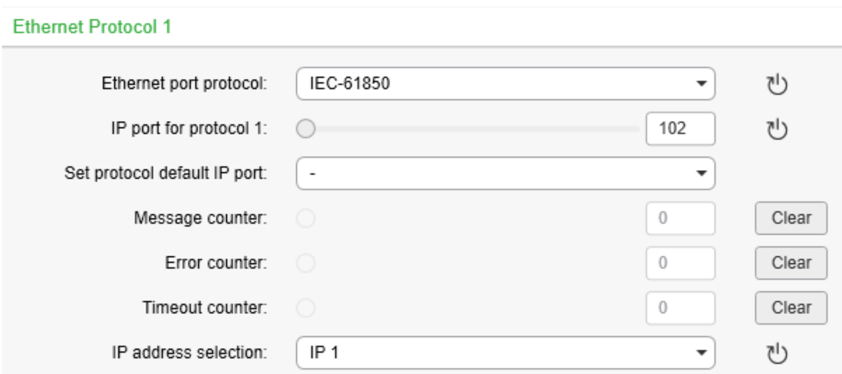


Table 1 - Ethernet protocol 1 configuration parameters

Parameter	Value	Description	Note
Ethernet port protocol	None ModBusTcps DNP3 IEC-61850 EthernetIP	Select the protocol of the Ethernet port	Set
IP port for protocol 1		Set the IP port number of the protocol 1	Set
Set protocol default IP port	– Default	Select the default IP port number: 502 for ModBus Tcps 20000 for DNP3 102 for IEC 61850 44818 for EthernetIP	Set
IP address selection	IP1 IP2 IP3	Choose the Ethernet module to be used [1]	Set

Set = an editable parameter (password needed)

1. IP1/IP2 means to select the Ethernet module to be used on Slot M; IP3 means to select the Ethernet module to be used on Slot L. If Slot M is used as RSTP mode or PRP/HSR module is selected, then IP2 is invisible.

Table 2 - Ethernet port configuration parameters

Parameter	Value	Description	Note
MAC address		Display the MAC address	
IP Address	n.n.n.n	IP address	Set
Network mask	n.n.n.n	Network mask	Set
Gateway	n.n.n.n	Gateway IP address	Set
Ethernet port 1 status	Link on / Link off	Display the link status of Ethernet Port 1	
Ethernet port 2 status	Link on / Link off	Display the link status of Ethernet Port 2	
Enable HTTPS server	Yes / No	If this option is enabled, HTTP server can be used	Set
IP address selection	IP1 IP2 IP3	Choose the Ethernet module to be used [2]	Set
NTP server	n.n.n.n	Network time protocol server	Set
NTP server (Backup)	n.n.n.n	Network time protocol server to be used if NTP server does not respond	Set
IP address selection	IP1 IP2 IP3	Choose the Ethernet module to be used [2]	Set
TCP keep alive interval	0 - 20 s	TCP keepalive interval in seconds	Set[3]

If Ethernet module with PRP/HSR is selected, then additional parameters are shown.

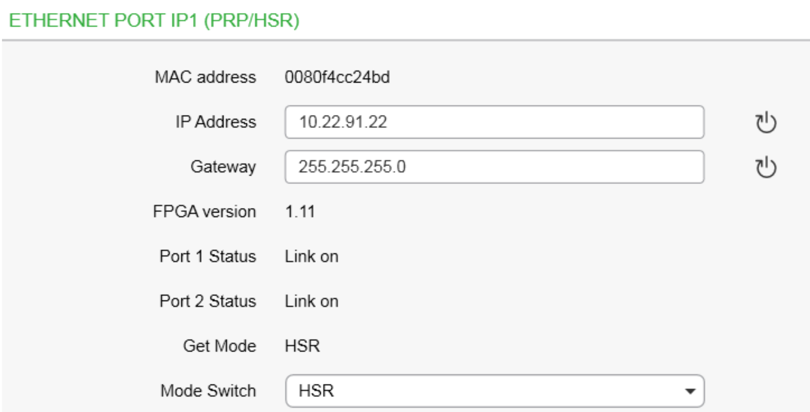


Table 3 - Additional Ethernet port configuration parameters for channel redundancy

Parameter	Value	Description	Note
FPGA version		Display the Field Programmable Gate Array (FPGA) version of the Ethernet module	
Get mode		Display the used protocol	
Mode Switch	PRP / HSR	Switch the protocol to be used	Set

2. IP1/IP2 means to select the Ethernet module to be used on Slot M; IP3 means to select the Ethernet module to be used on Slot L. If Slot M is used as RSTP mode or PRP/HSR module is selected, then IP2 is invisible.
3. Keepalive: The Keepalive parameter sets the time in seconds between two keepalive packets which are sent from the IED. The setting range for this parameter is between zero (0) and 20 seconds; with the exception that zero (0) means actually 120 seconds (2 minutes). The purpose of a keep alive's packet is to send a probe packet to a connected client for checking the status of the TCP-connection when no other packet is being sent, e.g. the client does not poll data from the IED. If the keepalive packet is not acknowledged, then the IED will close the TCP connection. The Connection must be restarted from the client side.

Serial communication slot

The Serial communication slot can accommodate one of the following options:

- RS-485 (two and four wires) serial communication module, with RJ45 connection
- Fibre optic serial communication module

Serial port configuration

The parameters for the remote port can be set from the front panel or via protocol, using COMMUNICATION menu of eSetup Easergy Pro or Web HMI.

Only one serial port can be used and one serial communication protocol can be selected.

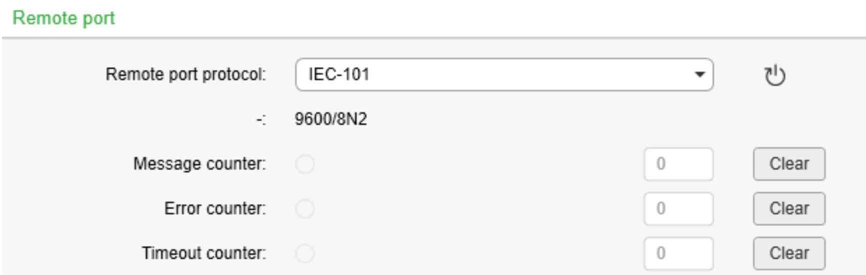


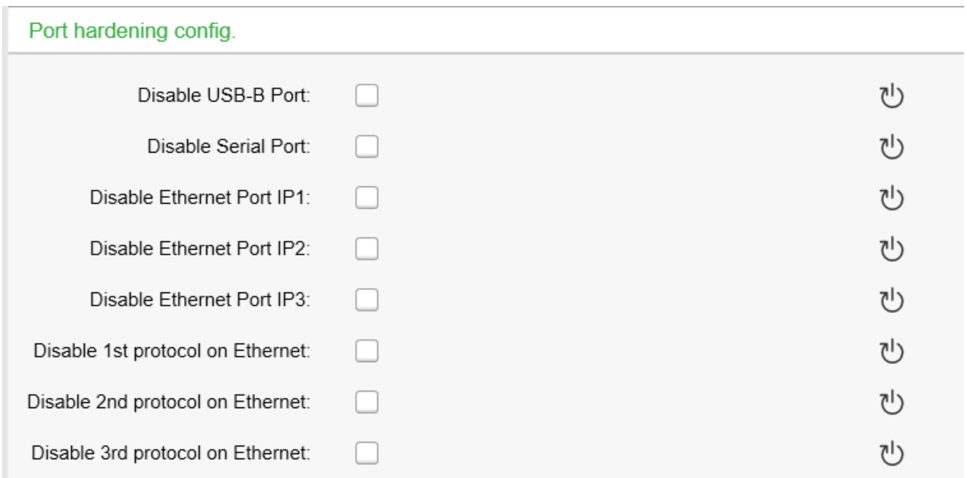
Table 4 - Serial port configuration parameters

Parameter	Value	Description	Note
Remote port protocol	None ModBusSlv IEC-103 MdbsMstr DNP3 IEC-101	Select the protocol of the serial port	Set

Port hardening configuration

It is possible to disable a communication port – either via the front panel or via protocol, using COMMUNICATION menu of eSetup Easergy Pro or Web HMI with the correct access rights.
This allows the user to take control of the physical ports limiting the exposure of ports to only those that are needed.

Figure 1 - Port hardening configuration parameters (depending on the communication modules used)



If the ports or the protocols on Ethernet module are disabled or enabled, then a reboot is needed.

Communication protocols

NOTICE

CYBER SECURITY HAZARD

- Except for the private GetSet protocol via secured communication (SSH), the device does not have the capability to transmit data encrypted using the following protocols: IEC 61850, DNP3 over Ethernet, Modbus slave over Ethernet, EtherNet/IP, Modbus slave serial, Modbus master serial, DNP3 serial, IEC 60870-5-103 serial, IEC 60870-5-101 serial, IEEE 1588 and SNTP.
- If other users gained access to your network, transmitted information can be disclosed or be subject to tampering.
- For transmitting data over an internal network, physically or logically segment the network. The access to the internal network needs to be restricted by using standard controls, such as firewalls, and other relevant features supported by your device, such as IPTable whitelisting.
- For transmitting data over an external network, encrypt protocol transmissions over all external connections using an encrypted tunnel, TLS wrapper or a similar solution.

Failure to follow these instructions can increase the risk of unauthorized access.

IEC 61850 communication

Presentation

IEC 61850 is a series of standards for communication networks and systems of power utility automation. Easergy P5 protection relays, used as a server, can be connected to an IEC 61850 station bus according to Edition 1 and Edition 2 of:

- IEC 61850-6
- IEC 61850-7-1 to 7-4
- IEC 61850-8-1

Based on the Ethernet protocol, the IEC 61850 communication standard helps to ensure:

- High communication speeds and versatile communication architectures
- Interoperability between manufacturers

Capability

Easergy P5 protection relays provide a built-in solution for demanding IEC 61850 applications:

- IEC 61850 logical nodes and configurable data sets to fit the needs of the Edge control system/SCADA system
- Peer-to-peer communication capabilities on Easergy P5 protection relays using GOOSE messages to enhance the protection and control system without the need of additional wiring
- Up to 8 simultaneous IEC 61850 client-server associations

The IEC 61850 protocol can be used to read/write static data from/to the Easergy P5 protection relays, to receive events, to send controls, and to receive/send GOOSE messages to other relays.

The IEC 61850 server interface is capable of:

- Configurable pre-defined data sets

- Dynamic data sets created by clients, which can be assigned to Buffered and Unbuffered Report Control Blocks
- Reporting function with Buffered and Unbuffered Report Control Blocks
- Supported control models:
  - Status-only
  - Direct control with normal security
  - Direct control with enhanced security
  - Select before operate with normal security
  - Select before operate with enhanced security
- Supported horizontal communication with GOOSE
  - Configurable GOOSE publisher data sets
  - Configurable filters for GOOSE subscriber inputs (i.e. MAC Address, APPID....)
- Sending and receiving analogue or binary values over GOOSE
- Setting modification
  - Editing a setting value in the setting group
  - Changing the active setting group

    Setting groups are selectable using the Setting Group Control Block class, (SGCB). The Active Setting Group can be selected using the Relay/LLN0.SP.SGCB.ActSG data attribute in Logical Device 'Relay'.
- File transfer
  - Extracting disturbance records from Easergy P5 relays by file transfer, as ASCII format COMTRADE files
  - All disturbance record files are accessible from the folder /COMTRADE/DR.
  - Deleting files in the /COMTRADE/DR folder is not supported.

Configuration of IEC 61850 communication

Configuration tools

The Easergy P5 protection relays IEC 61850 solution can be configured with:

- eSetup Easergy Pro used as a setting and operating software to help ensure straightforward configuration and to send IEC 61850 configuration to Easergy P5 protection relays
- CET850 software used as a configuration tool to adapt the communication profile of Easergy P5 protection relays to the precise needs of the system

Configuration files

The IEC 61850 configuration process uses and generates several types of System Configuration description Language (SCL) files; a selection is introduced here:

- ICD - IED (Intelligent Electronic Device) Capability Description

  An ICD file exists for each type of Easergy P5 protection relay. It describes the data model and communication services available in the referred-to Easergy P5 device model.

  ICD files are provided in a library together with the CET850 configuration tool, and are used as template models in the configuration process.

  The ICD files can be obtained from the ICD folder under eSetup EasergyPro or generated by the "Export ICD/SCL file" command by eSetup EasergyPro.
- IID - Instantiated IED Description

  The IID file describes the project-specific configuration of a single IED in a system.

It is used as an exchange file between the CET850 configuration tool and other IEC 61850 system configuration tools to exchange the configuration data of a single IED instantiated specifically for a project.

- CID - Configured IED Description

  For every configured Easergy P5 protection relays there is a CID file which describes the IEC 61850 configuration of the device.

  A CID file is created by the IED configuration tools. The CID file is then loaded into the device to configure it.

- SCD - System Configuration Description

  An SCD file contains the configuration data for the IEC 61850 system including the communication configuration settings for all related IEC 61850 devices.

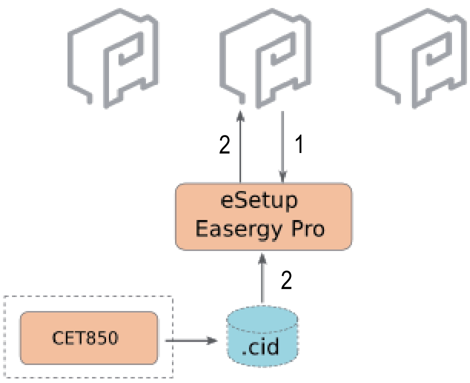
eSetup Easergy Pro for IEC 61850 configuration

The Easergy P5 protection relays setting and operating software, eSetup Easergy Pro, is used to create and to send IEC 61850 configuration to the Easergy P5 protection relay.

eSetup Easergy Pro is used to:

1. Get the information from Easergy P5 protection relays connected to the IEC 61850 network. This can be done automatically by the eSetup Easergy Pro polling the network to find connected devices (with IP address and port number).
2. Import a CID file to the Easergy P5 relay through eSetup Easergy Pro (see eSetup Easergy Pro user manual).

NOTE: The CID file name shall not include any whitespace or non-latin characters.



IEC 61850 main configuration

The IEC 61850 protocol is activated by setting it as the port protocol for an Ethernet port on the device. This setting can be found by navigating to the COMMUNICATION menu.

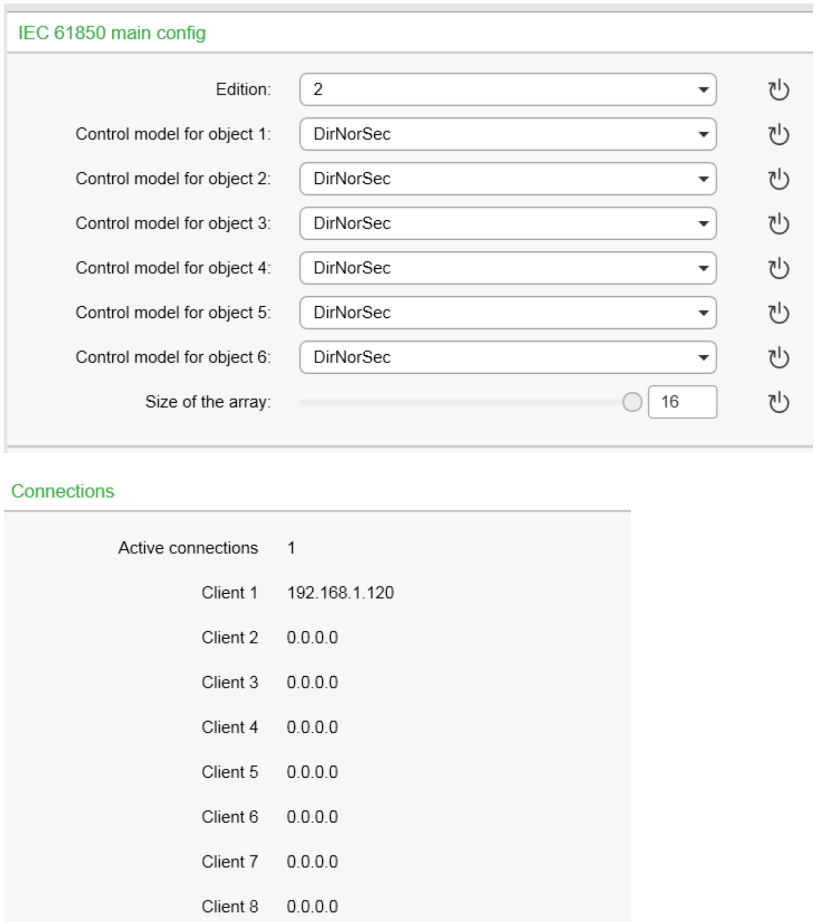
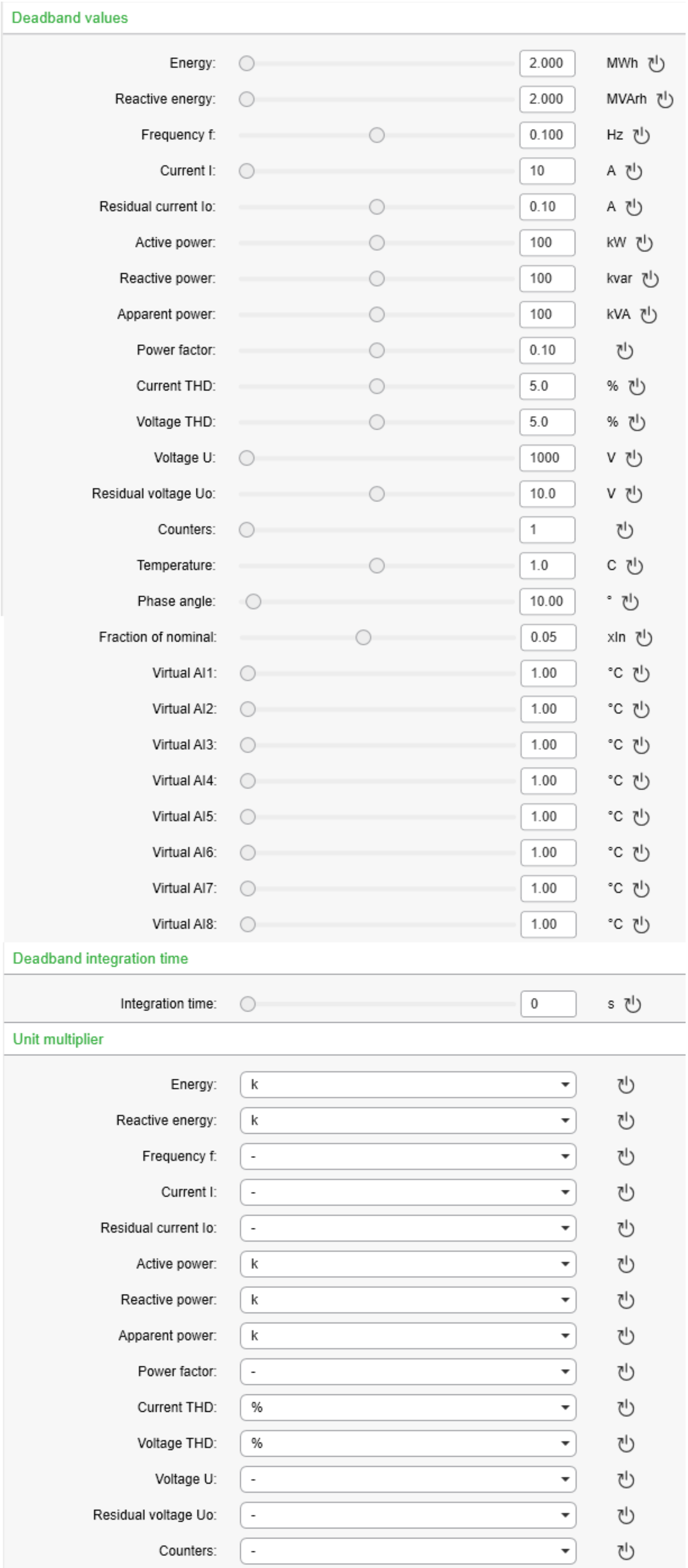


Table 5 - IEC 61850 main configuration parameters

Parameter	Description	Note
Edition	IEC 61850 standard edition to be used (1 or 2), Edition 2 is the default.	Set
Control model	Selects the control model to be used with the controllable Objects. • Status-only (StatusOnly) • Direct control with normal security (DirNorSec) • Select before operate with normal security (SBONorSec) • Direct control with enhanced security (DirEnhSec) • Select before operate with enhanced security (SBOEnhSec)	Set
Size of array	Number of elements in the arrays used to transfer the harmonics.	Set
Active connections	The number of active connections.	
Client x	The IP addresses of the clients.	

IEC 61850 measurement configuration

The IEC 61850 measurement configuration of deadband values (primary values) and unit multiplier settings can be found by navigating to the COMMUNICATION menu and IEC 61850 measurement configuration view in the eSetup Easergy Pro or Web HMI.


Deadband values
Energy: 2.000 MWh
Reactive energy: 2.000 MVArh
Frequency f: 0.100 Hz
Current I: 10 A
Residual current Io: 0.10 A
Active power: 100 kW
Reactive power: 100 kvar
Apparent power: 100 kVA
Power factor: 0.10
Current THD: 5.0 %
Voltage THD: 5.0 %
Voltage U: 1000 V
Residual voltage Uo: 10.0 V
Counters: 1
Temperature: 1.0 C
Phase angle: 10.00 °
Fraction of nominal: 0.05 xIn
Virtual AI1: 1.00 °C
Virtual AI2: 1.00 °C
Virtual AI3: 1.00 °C
Virtual AI4: 1.00 °C
Virtual AI5: 1.00 °C
Virtual AI6: 1.00 °C
Virtual AI7: 1.00 °C
Virtual AI8: 1.00 °C
Deadband integration time
Integration time: 0 s
Unit multiplier
Energy: k
Reactive energy: k
Frequency f: -
Current I: -
Residual current Io: -
Active power: k
Reactive power: k
Apparent power: k
Power factor: -
Current THD: %
Voltage THD: %
Voltage U: -
Residual voltage Uo: -
Counters: -

The table below shows the configuration parameters which can be defined for each individual measurement:

Table 6 - IEC 61850 measurement configuration parameters

Parameter [4]	Description	Note
Energy ... Virtual A18	Deadband of the measurements	Set
Integration time	Deadband integration time	Set
Unit multiplier	Set the unit multiplier of deadband values	Set

There are two variants of the deadband calculation: absolute deadband and integrated deadband. When absolute deadband is selected, set the integration time to zero.

> **NOTE:** Setting the values too low may result in unnecessary traffic or nuisance.

When integrated deadband is selected, the formula to check whether the value is changed is decided by the calculation method as follows:

abs (value2 – value1) × (t2 – t1) > Dead band value × Integration time

Here value2 means the current value, value1 means the last report value; t2 means the current time, t1 means the time of the last report value changed. The unit for t2, t1 and Integration time are all milliseconds.

A short example: If the Current I deadband value is set to 5 A, and the Integration time set to 0 (absolute deadband), the change condition will be satisfied when the value changes by more than 5 A from the previously reported value. If, on the other hand, the Integration time is set to 1, the change condition will be satisfied for instance, if the signal value changes by more than 5 A from the previously reported value and remains as such for one second.

In case there are several changes during the time period set (report buffer time > 0), the integration time is not considered and the analogue value of the pending previous event is overwritten. The behavior can be found in the “PIXIT Details” section in the Conformance Statement documents appended to the end of this manual. Mechanism on second internal data change notification of the same analogue data value within buffer period (see IEC 61850-7-2 Ed.1 §14.2.2.9 and IEC 61850-7-2 Ed.2 §17.2.2.9 respectively): Replace analogue value in pending report.

IEC 61850 generic events

Regardless from the modelling of information in IEC 61850-7-4, generic events can be configured via navigating to the COMMUNICATION menu and IEC 61850 generic events view in the eSetup Easergy Pro or Web HMI.
This provides means to map any events (i.e. protection trip, digital input change, port hardening change, ...) of the relay to maximum 8 indication data objects of the P5EVTGGIO1 logical node of the IEC 61850 interface. The status of the indication data object is determined by ON and OFF events set for the corresponding index.

4. These parameters can be set for each type of measurement.

IEC 61850 generic events

Index	ON event channel	ON event code	OFF event channel	OFF event code
1	69	1	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0

Table 7 - IEC 61850 generic events

Parameter	Description	Note
Ind idx	Index of the LN P5EVTGGIO1 indication	
ON event channel	Channel number of the ON event	Set
ON event code	Event code of state ON	Set
OFF event channel	Channel number of the OFF event	Set
OFF event code	Event code of state OFF	Set

The above screenshot features an example, where the status of Virtual Input 1 (event channel 69) is mapped to the generic events table. If the value of Virtual Input 1 is changed, then the value stored in the IEC 61850 address P5EVTGGIO1.Ind1.stVal indicates the current value of the Virtual Input 1.
If only an “ON event” is defined for an indication then the transition to OFF state is generated automatically after reporting the ON state (momentary ON state). And the same applies if only an “OFF event” is defined for an indication (momentary OFF state).

GOOSE configuration

The publisher configuration GoCB 1-4 and subscriber configuration can be found by navigating to the COMMUNICATION menu and GOOSE configuration view in eSetup Easergy Pro or Web HMI.

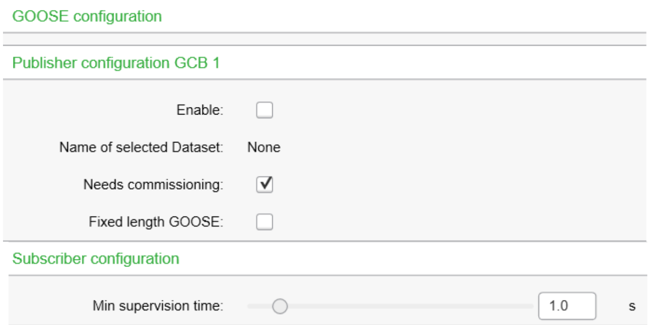


Table 8 - GOOSE configuration parameters

Parameter	Description	Note
Publisher configuration GCB x		
Enable	Enable/disable the publishing of data defined by GCB x.	Set
Name of selected dataset	Display the name of the dataset associated to the GCB x.	Set
Needs commissioning	A flag which can be used to indicate that some change has been done in the configuration and a new commissioning is needed.	Set

Table 8 - GOOSE configuration parameters (Continued)

Parameter	Description	Note
Fixed length GOOSE	Disable/enable sending the GOOSE messages in flexible or fixed format (fixed length is a feature defined by Edition 2).	Set
Subscriber configuration		
Min supervision time	Minimum timeout for indicating invalid status of GOOSE network inputs due to no incoming GOOSE messages (exceeded supervision time or time allowed to live from the last GOOSE message, whichever is greater).	Set

GOOSE subscriber: data points

The GOOSE subscriber 128 binary data and 8 analog data can be monitored by navigating to the COMMUNICATION menu and GOOSE Subscriber: data points view in eSetup Easergy Pro or Web HMI.

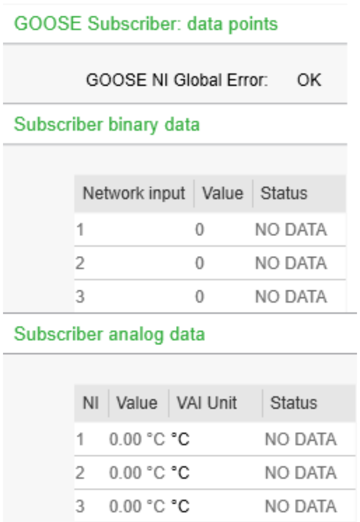


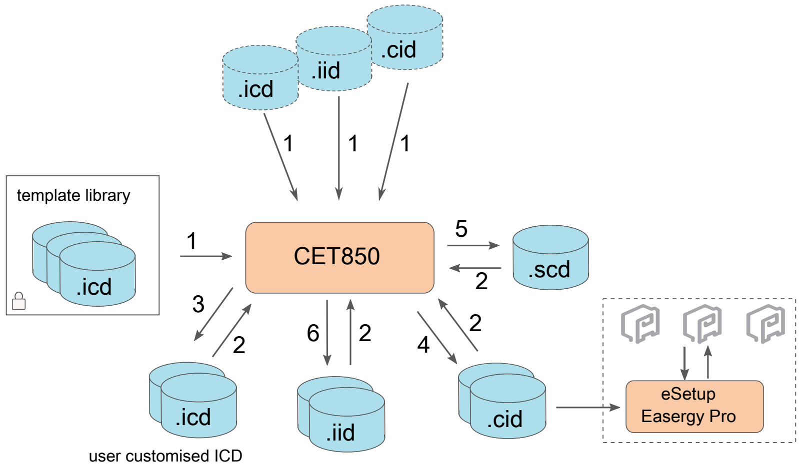
Table 9 - GOOSE subscriber: data points

Parameter	Description
GOOSE NI Global Error	Global error status of the GOOSE subscription
Network input	Index of the GOOSE data points. Input data can be binary or analogue. Binary NIs can be used as inputs for the user-defined logic blocks or as control inputs in the other functions of the relay (e.g. the output matrix).
Value	Data value received in the GOOSE data packet
Status	Status of the GOOSE data (NO DATA / OLD / OK)
VAI Unit	Unit of the incoming analogue data

NI = Network Input

CET850 for IEC 61850 configuration

IEC 61850 configuration software CET850 is used to create, display, modify or optimise an IEC 61850 configuration.

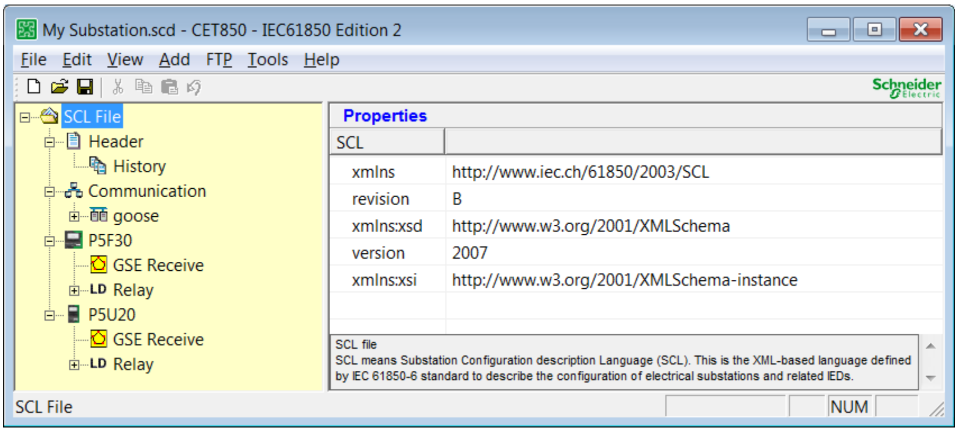


CET850 can be used to:

- Create an IEC 61850 configuration using an ICD, SCD, IID or CID file as an input.
- Edit an existing CID, SCD, IID or user-customised ICD file to modify its contents by :
  - Adding or removing Easergy P5 protection relays, in case of SCD
  - Displaying the configuration
  - Modifying communication parameter values
  - Optimising configuration by creating or modifying datasets and Report Control Blocks
  - Configuring or optimising the GOOSE communication by creating or modifying the GOOSE messages publication and subscription
- Generate a user-customised ICD file using an Easergy P5 protection relays IED template from the factory ICD library.
- Generate a CID file for storing the configuration of one device which can then be uploaded to the Easergy P5 protection relays using eSetup Easergy Pro.
- Generate SCD file for storing the configuration of an IEC 61850 system which can then be used by other IEC 61850 configuration tools.
- Generate an IID file for storing the specific configuration of an instantiated IED which can then be used by other IEC 61850 system configuration tools.

Graphical SCL editor

CET850 is a graphical tool that enables to browse an SCL file using a tree view that displays the content of the file in a hierarchical format.



Tree view

The following main sections are displayed in the tree view:

- Header and history

  The Header section identifies the SCL configuration file and its version.

- Communication

  This section contains the definition of all sub-networks defined in the IEC 61850 system, with the list of the connected IEDs. Both Client/Server and peer-to-peer communication access points are displayed.

- List of IEDs

  This section contains the definition of all IEDs defined in the IEC 61850 system. Each IED is displayed with all its contents:

  - Logical Devices (LD)
  - Logical Nodes (LN)
  - Datasets (DS)
  - Report Control Blocks (RCB)
  - GOOSE Control Blocks (GoCB)
  - GOOSE subscription

Property view

When an item is selected in the tree view, the property view displays details of the selected item. The user can activate editing operations from the tool bar and contextual menu. There are also specific dialogue interfaces to guide you.

Device configuration

Adding and removing a device in an IEC 61850 system consists of making the change in the associated SCD file.

Adding an IED

CET850 enables the addition of an IED to an IEC 61850 system using its ICD description file, or the addition of a device already defined by a CID file. A specific dialog interface requests a name for the IED and then its description. The description is provided from an ICD file, a CID file or from an IID file.

Procedure:

- Create a new SCL file for a substation system (e.g. My Substation.scd).
- From the tree view, select the SCL root element
- In the menu bar or in the contextual menu, click Add > IED
- Set the IED Identification and optionally the address parameters according to the following descriptions

- Click OK to validate the operation

IED identification:

- ICD/CID file

  Select the IEC 61850 description of the IED to add to an ICD or a CID. The user can select a device from a library or an other device with an external ICD file.

- IED name

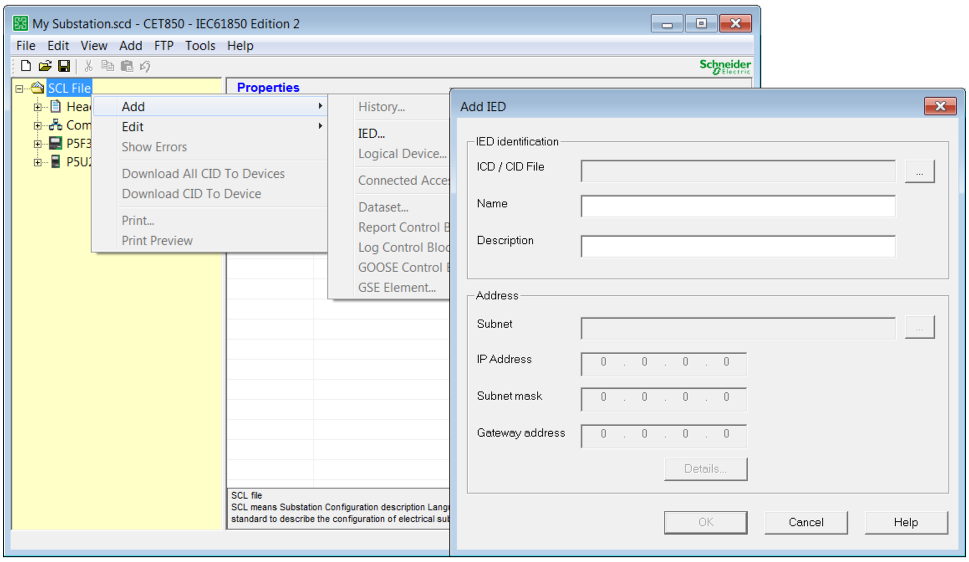
  Assign a name to the IED. The name of the IED must be unique in the IEC 61850 system. Its length is restricted to a maximum of 64 characters, and consists of alphanumeric and underscore (_) characters, beginning with a letter. It must not inclued a space character.

- IED description

  This is a free ASCII string where the user can write comments about the device.

Address:

Address parameters are set to connect to the IED in the communication network. Connecting the IED can be done at this stage or later using the Add > Connected Access Point menu.



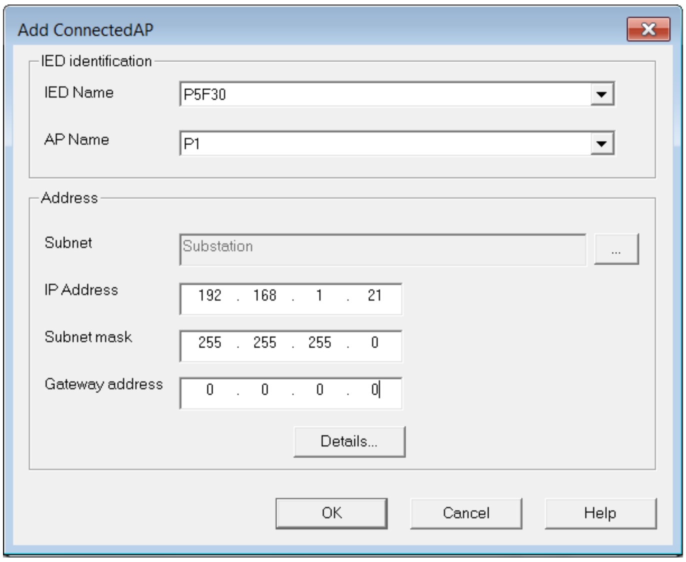
Removing an IED

An IED can be removed from an SCD file. This function is available when an IED is selected in the tree view. After confirming that the IED is to be deleted, the tree view and the content of the SCD file are updated.

Connecting a device in IEC 61850

An IEC 61850 IED uses an Access Point (AP) to communicate. This AP is connected to a subnetwork. CET850 provides the following set of functions to manage the communication architecture of an IEC 61850 System:

- Adding or removing a Subnet to the system
- Adding or removing an Access Point on a Subnet



IED configuration

The configuration of an IED described in an ICD, CID or SCD file can be modified so that its communication profile and behavior are adjusted to the needs of the system. Refer to the CET850 user manual for more information.

Create, modify or delete a dataset

With Easergy P5 protection relays, a dataset is a collection of references to Data Attributes (DA) grouped together to increase communication efficiency for reports and GOOSE messages.

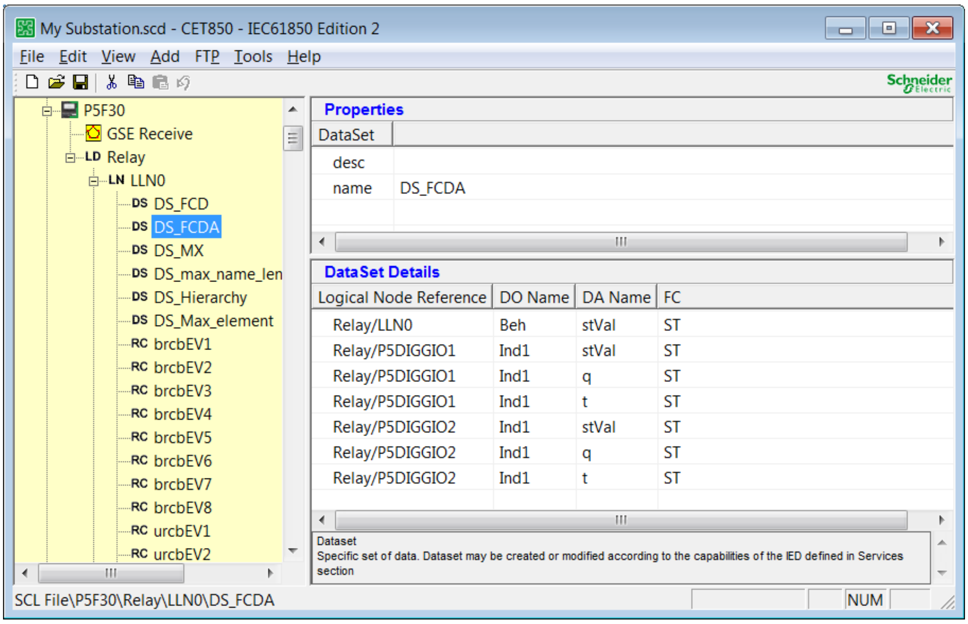
Datasets can be modified by the user and new dataset can be added, depending on the capabilities of the IED.

Any data produced by Easergy P5 protection relays may be referred-to in a dataset to be sent via a GOOSE message. Nevertheless, only data from the following types are applicable for GOOSE communication between Easergy P5 protection relays: Single Point Status (SPS), Double Point Status (DPS), Double Point Control (DPC), Complex Measured Value (CMV), and Measured Value (MV).

CET850 provides an easy way to create or edit a dataset inside LLN0. When creating a dataset, CET850 prompts the user for its name and description. A specific dialog interface allows the user to select which data is to be added to, or removed from the dataset.

The available data that can be selected is displayed in a hierarchical tree with collapse and expand facilities, from their host Logical Node down to the data attributes. Individual and multiple selections are possible.

After completing the definition of the dataset in the dialog interface, the changes to the dataset are reflected in the current SCL file and the CET850 display is updated: A newly created dataset is displayed in the tree view; a deleted dataset is removed from the tree view. The content of the dataset is updated in the property view.



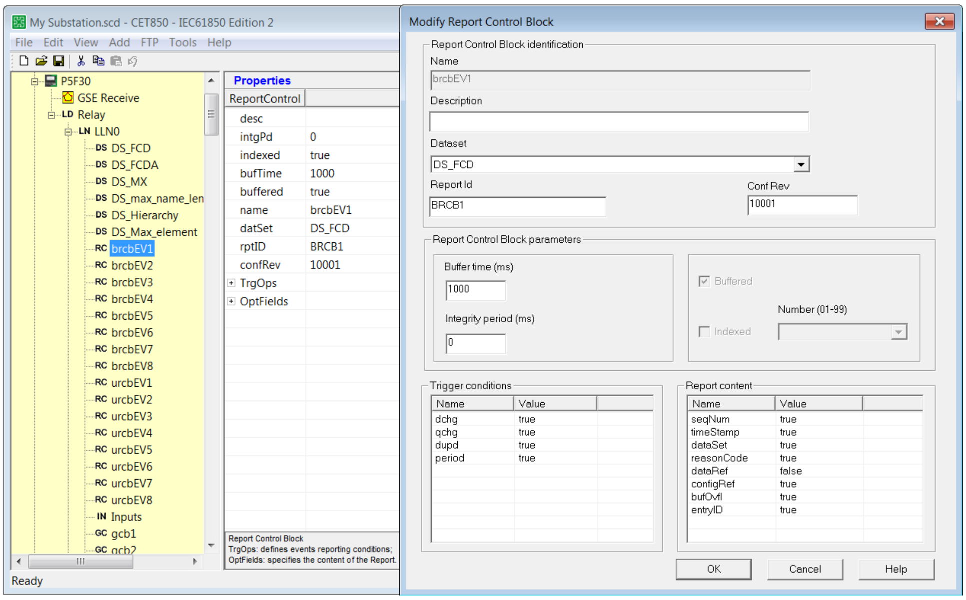
Modify Report Control Block (RCB)

Easergy P5 protection relays provide up to 16 buffered and 8 unbuffered RCBs inside LLN0.

CET850 provides a specific dialog interface for creating or modifying a Report Control Block. When creating an RCB, CET850 prompts the user for the name and description of the RCB. A specific dialog interface allows the user to select the dataset to be associated with the RCB and to define all settings concerning the report generation.

The most common trigger options for an RCB instance are:

- Data Change : the Report is triggered by changes to the value of the data which are referenced in the dataset
- Quality Change: the Report is triggered by changes to the quality of the data which are referenced in the dataset
- Integrity: the Report is triggered periodically, according to an Integrity period specified



Modify GOOSE Control Block (GoCB)

The GOOSE message service is an efficient real-time communication service for peer-to-peer exchanges between IEDs.

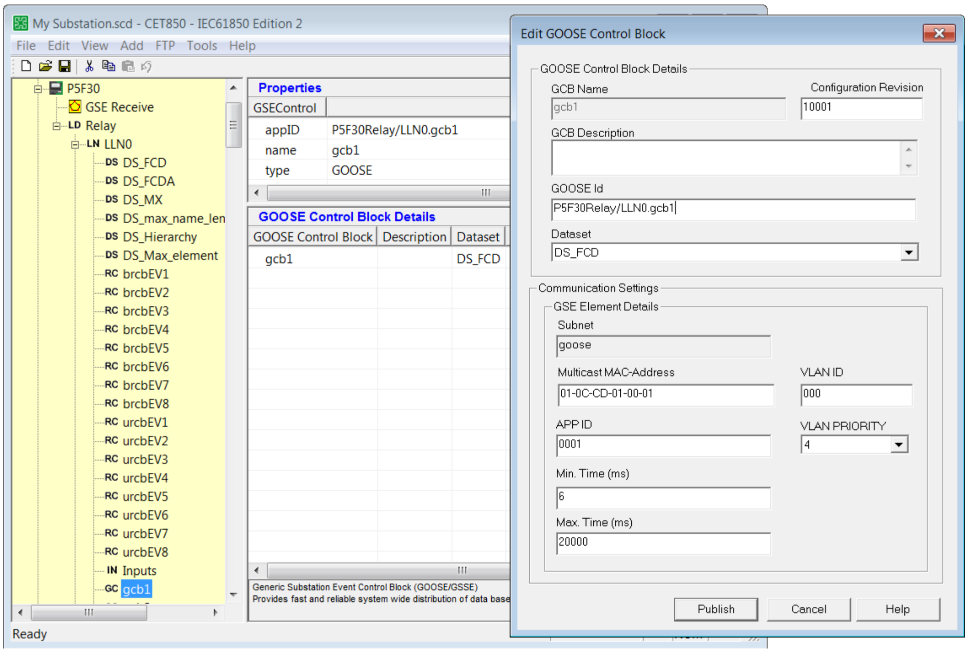
A GOOSE Control Block (GoCB) manages how information referenced in a dataset is transmitted in a GOOSE message. A GoCB can only be created inside the Logical Node 0 (LLN0). The Easergy P5 protection relay provides up to 4 GoCBs.

CET850 provides a specific dialog interface for modifying a GOOSE Control Block. A specific dialog interface allows the user to select the dataset whose referenced information shall be transmitted as a GOOSE message. Then, the user needs to enter the settings for publishing the GOOSE message.

This includes:

- Multicast MAC address to which the GOOSE message is transmitted to
- Time for the first retransmission of the GOOSE message (the fastest retransmission is after 4 ms)
- Maximum retransmission interval (heartbeat cycle time)

After completing the definition of the GoCB in the dialog interface, the changes to the GoCB are reflected in the current SCL file and the CET850 display is updated: A newly created GoCB is displayed in the tree view; a deleted GoCB is removed from the tree view. The GoCB settings are displayed in the property view.



Subscribe to GOOSE messages and assign GOOSE inputs

The capability of the Easergy P5 protection relay to receive GOOSE messages is defined in the ICD file. If GOOSE messages are to be subscribed to, a GOOSE Receive element is defined at the beginning of the IED section, in the tree view displayed by CET850.

Editing the GOOSE Receive element allows the user to:

- Select the GOOSE messages and the data to which the IED subscribes
- Assign the subscribed data to Easergy P5 protection relays GOOSE inputs

CET850 provides a specific dialog interface to edit the GOOSE Receive. The dialog is organized in two parts:

- GOOSE message and data subscription
- GOOSE Inputs assignment

Refer to Configuring the subscriber side, page 29 for a detailed description.

Generating, editing, validating of an SCL file

Generating CID files

When an SCD file is opened in the tool, CET850 can generate the CID file of a specific IED or all the CID files for all IEDs defined in the SCD file.

Generating a CID file is available when an IED is selected from the tree view and if this IED is connected to a subnet. A specific dialog interface box asks the user to enter the location and the name of the output CID file. By default, the name of the CID file is based on the name of the IED.

Generating all CID files is available if the SCD file includes at least one IED that is connected to a subnet. A specific dialog interface box asks the user to enter the location of the output CID files. The name of each CID file is based on the name of the IED.

Editing CID files

CET850 allows the editing of an existing CID file. This CID file is an advanced configuration file generated during a previous use of CET850, or a standard configuration file generated by eSetup Easergy Pro.

Validating SCL files

The validate function includes two kinds of verification:

- Verification of the structure and content of the SCL file

  The System Configuration description Language is based on Extensible Markup Language (XML). The structure and the content of an SCL file is fully specified by the IEC 61850 standard using an XML Schema (XSD files). CET850 is delivered with the set of XSD files defined by the IEC 61850 standard. Using the XercesTM parser, CET850 checks the validity of SCL files against the IEC 61850 XML Schema.
- Verification of the consistency of the GOOSE communication.

  The following checks are made:

  - The dataset defined for a GOOSE messages meets a specific size constraint.
  - The data sent by a publishing IED is consistent with the data expected and subscribed by the subscribing IED.

CET850 provides two ways to validate an SCL file:

- Schema validation
- Check XML syntax at file saving

Automatic validation is enabled or disabled using a specific option in the CET850 User Preferences.

Configuration of GOOSE communication

To configure the GOOSE communication, the following software are used:

- CET850 software to configure GOOSE communication in the IEC 61850 system
- eSetup Easergy Pro software to assign GOOSE Inputs to Easergy P5 protection relays control and monitoring functions for the precise needs of the system

Configuring GOOSE communication involves first configuring the publisher that sends the messages and then configuring the subscriber that receives the message. The GOOSE communication configuration is saved in an SCD file.

Configuring the GOOSE publisher side

To configure the GOOSE publisher side, the user needs to:

- Create a dataset (refer to IED configuration, page 25.)
- Configure a GOOSE Control Block to define the publishing of the data referenced in the dataset as a GOOSE message on the communication network

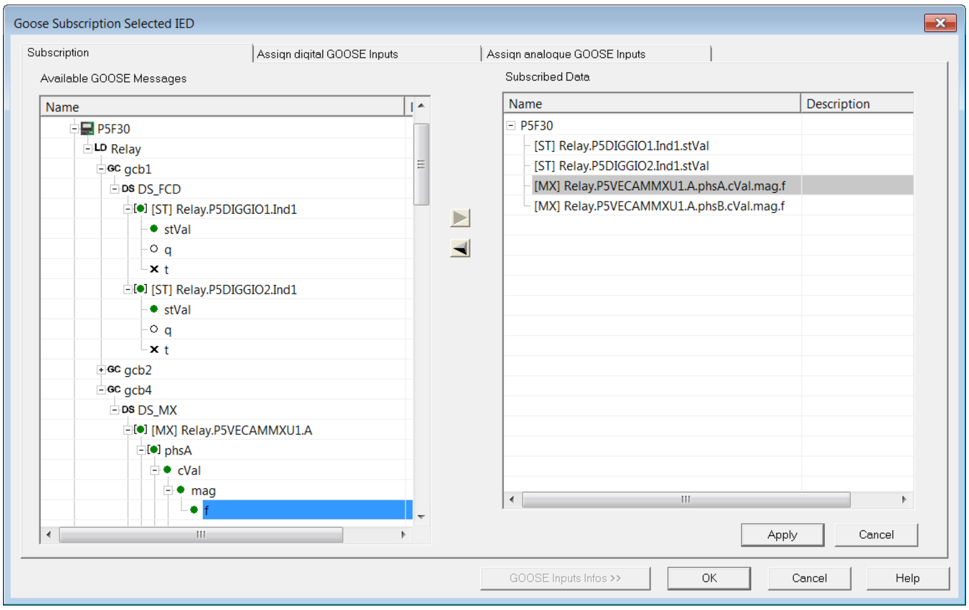
Any dataset may be attached to a GOOSE Control Block, provided its size is compatible with the size of one Ethernet frame. When creating a dataset, CET850 calculates the size of the dataset and informs the user if it is GOOSE compatible or not. When creating a GOOSE Control Block, CET850 allows the selection of GOOSE compatible datasets only.

Configuring the subscriber side

Procedure

1. Select from the published GOOSE messages which Data Attributes (DAs)/ Data Objects (DOs) the device shall subscribe to.
2. Assign subscribed DAs/DOs to GOOSE network inputs.

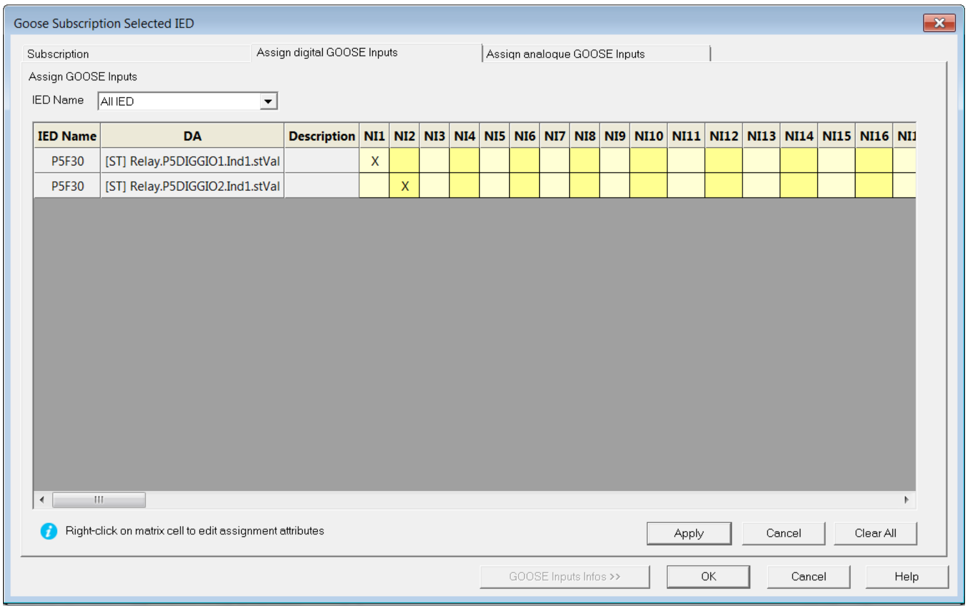
The Easergy P5 protection relay provides 128 digital GOOSE inputs and 8 analogue GOOSE inputs that can be used by control logic functions.



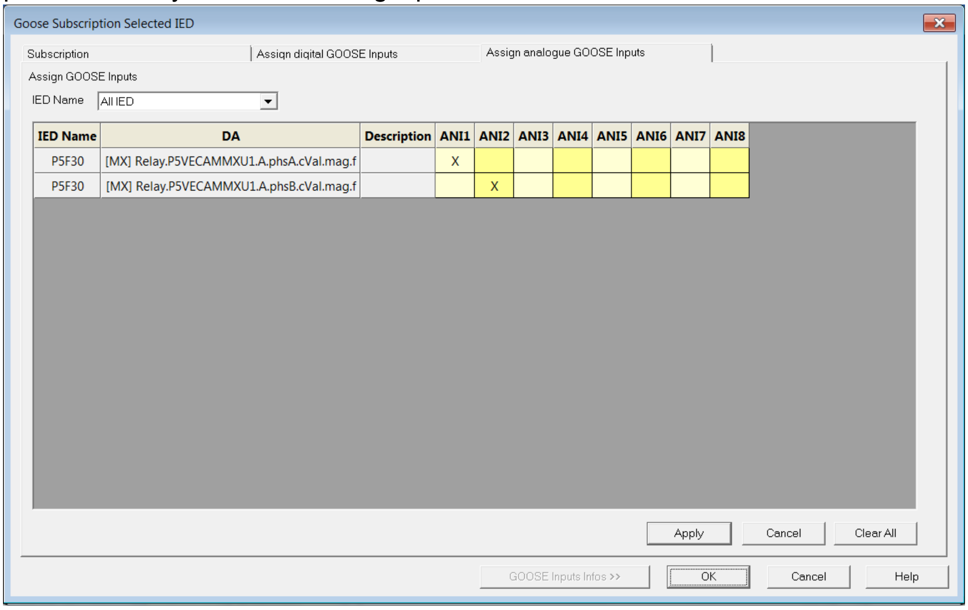
Assignment table

The subscribed DAs are assigned to Easergy P5 protection relays GOOSE network inputs in an assignment table. The assignment table gives in rows the list of all the subscribed DAs and in columns the list of the Easergy P5 protection relays GOOSE network inputs to which the DAs can be assigned/de-assigned. Assignment/de-assignment is done by selecting the appropriate cells in the table. Several DAs can be assigned to the same GOOSE network input. In this case, Easergy P5 protection relays apply a wired-OR logic operation to these DAs.

The below figure shows the assignment of subscribed DAs to Easergy P5 protection relays GOOSE digital network inputs.



The below figure shows the assignment of subscribed DAs to Easergy P5 protection relays GOOSE analog inputs.

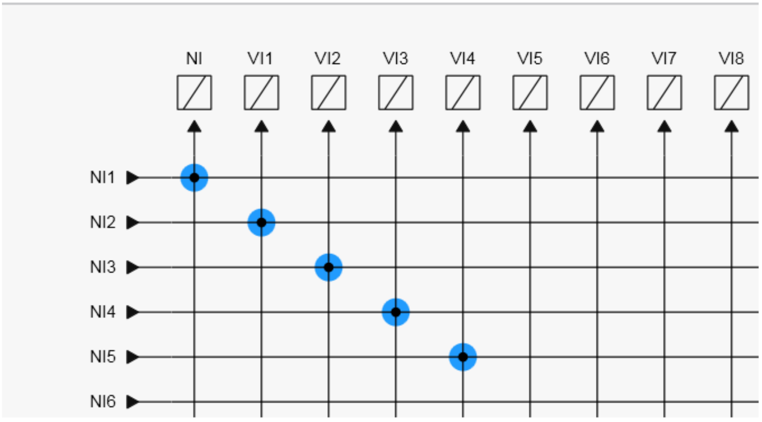


GOOSE matrix

All Easergy P5 protection relays GOOSE network inputs NI 1-128 can be mapped to NI or Vitual inputs VI 1-20 in COMMUNICATION menu and GOOSE matrix view in eSetup Easergy Pro or Web HMI.

Using the GOOSE matrix the user is able to map the GOOSE network inputs to Virtual inputs which can be processed by the relay applications. The same network input can be mapped to more than one Virtual input and it is also possible to map more than one GOOSE network input to the same Virtual input. Easergy Pro P5 protection relays apply a wired-OR logic operation on these mappings.

GOOSE matrix



GOOSE performance

According to IEC 61850-5 and IEC 61850-10 Edition 2, the GOOSE performance of Easergy P5 protection relays is compliant with Class P2 (< 10 ms). For more information, visit www.se.com.

Conformance statements

This manual includes, in its appendix, two conformance statement documents that describe the conformity to IEC 61850 edition 1 and IEC 61850 edition 2. They do not describe the standard itself, but indicate the choices that have been made when implementing the standard in the Easergy P5 protection relay, in terms of services, modeling, exceptions, extensions and adaptations.

The conformance statement documents are:

- Conformance Statement with IEC 61850 Edition 1 (Appendix 2)
- Conformance Statement with IEC 61850 Edition 2 (Appendix 3)

Each conformance statement document is made up of the following chapters:

- Protocol Implementation Conformance Statement (PICS):

  Describes choices made in protocol implementation.
- Model Implementation Conformance Statement (MICS):

  Describes how the information model is implemented.
- Protocol Implementation Extra Information for Testing (PIXIT):

  Gives any additional implementation specific information not found in the previous standardized documents. Despite the name, this information is useful for operation of the devices.
- Tissues Conformance Statement (TICS):

  Describes which Technical Issues (TISSUES) are considered in the device implementation.

DNP3

Presentation

DNP3 communication enables Easergy P5 protection relay units to be connected to a supervisor or other device featuring a DNP3 communication channel.

Communication is based on the master/slave principle:

- Easergy P5 protection relay is always a slave device.
- The master is the supervisor, which is another device.

The DNP3 protocol specifies the coding of data and the rules for exchanging this data between a slave device and a master device (supervision and control device or RTU). DNP3 is an open (non-proprietary) protocol, which can be implemented by any communicating device without any restrictions.

The DNP3 protocol was developed from the basic standards prepared by IEC Technical Committee 57 (Power systems management and associated communications).

DNP3 was chosen by IEEE Task Force C.2 as the IEEE Recommendation for communication between RTUs and IEDs.

For more information on the Intelligent Electronic Device protocol can be obtained from the DNP3 User Group (www.dnp.org).

The following data types from the DNP3 protocol are supported:

- Binary input
- Binary input change
- Double-bit input
- Binary output
- Analog input
- Counter

Easergy P5 protection relays also support the division of data into classes.

Function description

Transmission mode

Easergy P5 protection relays can communicate using DNP, in two transmission modes:

- Serial port mode
- TCP/IP mode

The maximum number of clients for DNP3 is 8. The client and master can be connected by either:

- a serial port connection
- a TCP connection via an Ethernet port

The Easergy P5 protection relays can be configured to support the serial port mode and TCP/IP mode together at the same time and work at maximum 3 IP addresses.

Status polling

Easergy P5 protection relays allow the polling of current status values on master request with class 0.

The contents of binary input for polling, group number and variation number are configurable.

The function code for polling is 1 [READ].

Status reporting

Easergy P5 protection relays allow the reporting of data change events which are derived from:

- Polled value status change
- Control command status change

The status to be reported is configurable.

The event class can be configured as class 1, class 2 or class 3.

Status report entries are stored in a circular buffer with access provided to the most recent ones.

It is possible for a master to query the availability of status reports, in order that the master can determine whether it is necessary to read the available status reports from the slave.

Easergy P5 protection relays may be configured to support unsolicited responses.

Measurement polling

Easergy P5 protection relays support the polling of static measurement values on master request with class 0.

The list of measurement values for polling, group number and variation number are configurable.

The function code for polling is 1[READ].

The data type of each measurement value is configurable.

Measurement event polling (Reporting)

Easergy P5 protection relays support the polling of measurements event values on master request.

The list of measurement event values for polling is configurable.

The function code for polling is 1[READ].

The data type of each measurement event value is configurable.

The deadband values for managing measurement events reported by Easergy P5 protection relays are configurable.

Remote control

Easergy P5 protection relays support both remote control command requests and polling command status requests from a master.

Remote control command requests can be used with data types: binary output.

The remote control commands supported are listed below:

- Select
- Operate
- Direct operate
- Direct operate with no ACK

Both DC (Direct Control) and SBO (Select Before Operate) control models are supported. The DNP3 checks whether the point to be controlled has been configured only. DNP3 doesn't check whether the value is correct or not.

Easergy P5 protections relays implement an SBO timeout of 60s.

Easergy P5 protection relays send response frame to client according to the real control command response.

Counter management

Easergy P5 protection relays support the polling of counter values on master request.

The list of the counter values for polling is configurable.

The function code for polling is 1[READ].

General interrogation

The general interrogation functions for Easergy P5 protection relays mean to poll class 0 data for DNP3 master.
When Easergy P5 protection relays receive the general interrogation command from DNP3 master, the Easergy P5 protection relays report all the point’s static data values (except for the point’s class is not assigned to one of the four classes) in one frame or multi-frame.
Generally, the group number 60 and variation number 1 is used for general interrogation for all profiles.

Time synchronisation

The time of Easergy P5 protection relays corresponds to Universal Coordinated Time (UTC).

Easergy P5 protection relays support time synchronization command requests and the polling of current date and time information from a DNP3 master.

It's possible for master to verify the correctness of system time.

The function code for actioning the time synchronization command is 2 [WRITE].

The function code for polling the current date and time information is 1 [READ].

The time synchronization procedure for TCP and serial is different.

Easergy P5 protection relays do not retry time synchronization messages at either the Application or Data Link layers for these application layer function codes.

- DELAY_MEASURE request from master and corresponding response (RESPONSE function code) from outstation
- WRITE requests from master with an Absolute Time object, group 50, variation 1
- WRITE requests from master with a Last Recorded Time object, group 50, variation 3

When Easergy P5 protection relays detect that the time synchronization request has not been received within the configured timeout, the IIN1.4 [NEED_TIME] bit is set in the response message. The master must send the time synchronization request after receiving a response with this bit set.

Application identifier

The application identifier uses the function code 16[INITIALIZE_APPL], 17 [START_APPL], 18[STOP_APPL].
When Easergy P5 protection relays receive a request related with application identifier, nothing internally is performed.

Cold restart and warm restart

When an Easergy P5 relay receives a cold or warm restart request, it immediately triggers the cold/warm restart sequence. A response frame containing the Delay Time DNP3 object, with a value of 10 seconds is generated. The response indicates the time when the relay will be available again. Hence during this period the Easergy P5 relay does not respond to requests from the DNP3 client.

IED file extraction

The Easergy P5 protection relay supports IED file extraction, which can be used to transfer the disturbance record file to clients. The file operations of the Easergy P5 protection relay include:

- Open file
- Close file
- Get file/folder information
- Read file
- Abort file
- Delete file

File authentication is not supported. The Easergy P5 can only have one file open at a time.

The file operations above can act on the folder '/COMTRADE' and all its sub-folders.

Device profile document

<table>
<tr><td colspan="2">DNP 3.0
Device Profile Document</td></tr>
<tr><td colspan="2">Vendor Name: Schneider Electric
Device Name: Easergy P5 Protection Relay</td></tr>
<tr><td>Highest DNP Level Supported:
For Requests: Level 2
For Responses: Level 2</td><td>Device Function:
Master
✓ Slave</td></tr>
<tr><td colspan="2">Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the DNP Implementation table):</td></tr>
<tr><td>Maximum Data Link Frame Size (octets):
Transmitted: 292
Received: 292</td><td>Maximum Application Fragment Size (octets):
Transmitted: 2048
Received: 2048</td></tr>
<tr><td>Maximum Data Link Re-tries:
None
Fixed
✓ Configurable from 0 to 255</td><td>Maximum Application Layer Re-tries:
None
✓ Configurable</td></tr>
<tr><td colspan="2">Requires Data Link Layer Confirmation:
Never
Always
Sometimes
✓ Configurable with confirmation type selector, default NO ACK</td></tr>
<tr><td colspan="2">Requires Application Layer Confirmation:
Never
Always
Sometimes
✓ When reporting Event Data (Slave devices only)
✓ When sending multi-fragment responses (Slave devices only)
Sometimes
✓ Configurable as: “Only when reporting event data”, or “When reporting event data or multi-fragment messages.”</td></tr>
<tr><td colspan="2">Timeouts while waiting for:
<table>
<tr><td>Data Link Confirm:</td><td>None</td><td>Fixed at</td><td>Variable</td><td>✓ Configurable</td></tr>
<tr><td>Complete Appl. Fragment:</td><td>✓ None</td><td>Fixed at</td><td>Variable</td><td>Configurable</td></tr>
<tr><td>Application Confirm:</td><td>None</td><td>Fixed at</td><td>Variable</td><td>✓ Configurable</td></tr>
<tr><td>Complete Appl. Response:</td><td>✓ None</td><td>Fixed at</td><td>Variable</td><td>Configurable</td></tr>
</table></td></tr>
</table>

DNP 3.0

Device Profile Document

Vendor Name: **Schneider Electric**

Device Name: Easergy P5 Protection Relay

Sends/Executes Control Operations:

WRITE Binary Outputs	✓ **Never**	Always	Sometimes	Configurable
SELECT/OPERATE	Never	✓ **Always**	Sometimes	Configurable
DIRECT OPERATE	Never	✓ **Always**	Sometimes	Configurable
DIRECT OPERATE – NO ACK	Never	✓ **Always**	Sometimes	Configurable
Count > 1	✓ **Never**	Always	Sometimes	Configurable
Pulse On	Never	✓ **Always**	Sometimes	Configurable
Pulse Off	Never	✓ **Always**	Sometimes	Configurable
Latch On	Never	✓ **Always**	Sometimes	Configurable
Latch Off	Never	✓ **Always**	Sometimes	Configurable
Queue	✓ **Never**	Never	Sometimes	Configurable
Clear Queue	✓ **Never**	Never	Sometimes	Configurable

Reports Binary Input Change Events when no specific variation requested:

- Never
- Only time-tagged
- Only non-time-tagged
- ✓ **Configurable to send one or the other**

Reports time-tagged Binary Input Change Events when no specific variation requested:

- Never
- ✓ **Binary Input Change With Time**
- Binary Input Change With Relative Time
- Configurable

Sends Unsolicited Responses:

- Never
- ✓ **Configuration**
- Only certain Objects
- Sometimes
- ✓ **ENABLE/DISABLE UNSOLICITED Function codes supported**

Sends Static Data in Unsolicited Responses:

- ✓ **Never**
- When Device Restarts
- When Status Flags Change

No other options are permitted.

Default Counter Object/Variation:

- No Counters Reported
- Configurable
- ✓ **Default Object: 20**
- ✓ **Default Variation: 1**
- Point-by-point list attached

Counters Roll Over at:

- No Counters Reported
- Configurable
- ✓ **16 Bits, but roll-over bits not used**
- 32 Bits
- Other Value:____
- Point-by-point list attached

Sends Multi-Fragment Responses:

- ✓ **Yes**
- No
- Configuration

Sequential File Transfer Support:

Append File Mode	Yes	✓ **No**
Custom Status Code Strings	Yes	✓ **No**
Permissions Field	✓ **Yes**	No
File Events Assigned to Class	Yes	✓ **No**
File Events Send Immediately	✓ **Yes**	No
Multiple Blocks in a Fragment	Yes	✓ **No**
Max Number of Files Open	1	

Implementation table

DNP Object Group and Variation			Request (Master may issue Outstation parses)		Response (Master parses Outstation may issue)	
Group Num	**Var Num**	**Description**	**Function Codes (dec)**	**Qualifier Codes (hex)**	**Function Codes (dec)**	**Qualifier Codes (dec)**
1	0	Binary Input – Any Variation	1 (read)	00, 01 (start-stop) 06 (no range, or all)		
1	1	Binary Input – Packed format	1 (read)	00, 01 (start-stop) 06 (no range, or all)	129 (response)	00, 01, 17,28
1	2	Binary Input – With flags	1 (read)	00, 01 (start-stop) 06 (no range, or all)	129 (response)	00, 01, 17,28
2	0	Binary Input Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
2	1	Binary Input Event – Without time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
2	2	Binary Input Event – With absolute time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
3	0	Double-bit Binary Input – Any Variation	1 (read)	00, 01, 06		
3	1	Double-bit Binary Input – Packed format	1 (read)	00, 01, 06	129 (response)	00, 01, 17, 28
3	2	Double-bit Binary Input – With flags	1 (read)	00, 01, 06	129 (response)	00, 01, 17, 28
4	0	Double-bit Binary Input – Any Variation	1 (read)	00, 01, 06		
4	1	Double-bit Binary Input Event – Without time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
4	2	Double-bit Binary Input Event – With absolute time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
10	0	Binary Output – Any Variation	1 (read)	00, 01, 06		
10	2	Binary Output – Output status with flags		00, 01, 06	129 (response)	00, 01, 17, 28
12	1	Binary Command – Control relay output block (CROB)	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, no ack)	00, 01, 17, 28	129 (response)	00, 01, 17, 28
20	0	Counter – Any Variation	1 (read)	00, 01, 06		
20	1	Counter – 32-bit with flag	1 (read)	00, 01, 06	129 (response)	00, 01, 17, 28
20	2	Counter – 16-bit with flag	1 (read)	00, 01, 06	129 (response)	00, 01, 17, 28
20	5	Counter – 32-bit without flag	1 (read)	00, 01, 06	129 (response)	00, 01, 17, 28
20	6	Counter – 16-bit without flag	1 (read)	00, 01, 06	129 (response)	00, 01, 17, 28

DNP Object Group and Variation			Request (Master may issue Outstation parses)		Response (Master parses Outstation may issue)	
Group Num	**Var Num**	**Description**	**Function Codes (dec)**	**Qualifier Codes (hex)**	**Function Codes (dec)**	**Qualifier Codes (dec)**
30	0	Analog Input – Any Variation	1 (read)	06 (no range,or all)		
30	1	Analog Input – 32-bit with flag	1 (read)	00, 01, 06	129 (response)	00, 01, 17, 28
30	2	Analog Input – 16-bit with flag	1 (read)	00, 01, 06	129 (response)	00, 01, 17, 28
30	3	Analog Input – 32-bit without flag	1 (read)	00, 01, 06	129 (response)	00, 01, 17, 28
30	4	Analog Input – 16-bit without flag	1 (read)	00, 01, 06	129 (response)	00, 01, 17, 28
30	5	Analog Input – Short float	1 (read)	00, 01, 06	129 (response)	00, 01, 17, 28
32	0	Analog Input Event – Any Variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
32	1	Analog Input Event – 32-bit without time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	2	Analog Input Event – 16-bit without time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	3	Analog Input Event – 32-bit with time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	4	Analog Input Event – 16-bit with time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	5	Short Float Ana. Change Ev. without Time	1	6, 7, 8	129 (response) 130 (unsol. resp)	17, 28 (index)
50	0	Time and Date	1 (read)	06, 07, 08	129 (response)	17, 28
50	1	Time and Date – Absolute time	1 (read) 2 (write)	06, 07, 08 07, 08	129 (response) 129 (response)	17, 28
52	2	Time Delay – Fine	23	07	129 (response)	07 (limited qty) (qty = 1)
60	0	Class Objects – Class 0, 1, 2, 3	1 (read)	06		
60	1	Class Objects – Class 0 data	1 (read)	06 (no range,or all)		
60	2	Class Objects – Class 1 data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
60	3	Class Objects – Class 2 data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
60	4	Class Objects – Class 3 data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
70	3	File Command Object -initiate Open or Delete operations	25, 27	5b		
70	4	File Command Status Objectt	26, 30	5b	129, 130	5b
70	5	File Transport Object	1	5b	129, 130	5b
70	6	File Transport Status Object			129, 130	5b
70	7	File Description Object	28	5b	129, 130	5b
80	1	Internal Indications – Packed format	2 (write)	00 (start-stop) index=7	129	
90	1	Application Identifier	16, 17, 18	0	129	
		No Object (function code only)	13 (cold restart)			
		No Object (function code only)	14 (warm restart)			

Supported function codes

The table below is the application layer function codes that DNP3 slave supported.

Code	Function	Description	Supported
Transfer function codes			
0	Confirm	Message fragment confirmation No response	Yes
1	Read	Request objects from outstation Response with requested objects	Yes
2	Write	Store specified objects to outstation Respond with status of operation	Yes
Control function codes			
3	Select	Select output point of outstation Respond with status of control point	Yes
4	Operate	Set output that has previously selected Respond with status of control point	Yes
5	Direct operate	Set output directly Respond with status of control point	Yes
6	Direct operate	Set output directly No response	Yes
Freeze function codes			
7	Immediate freeze	Copy specified objects to freeze buffer Respond with status of operation	No
8	Immediate freeze	Copy specified objects to freeze buffer No respond	No
9	Freeze and clear	Copy specified objects to freeze buffer and clear objects Respond with status of operation	No
10	Freeze and clear -NO ACK	Copy specified objects to freeze buffer and clear objects No respond	No
11	Freeze with time	Copy specified objects to freeze buffer at specified time Respond with status of operation	No
12	Freeze with time -NO ACK	Copy specified objects to freeze buffer at specified time No respond	No

Code	Function	Description	Supported
Application control function codes			
13	Cold restart	Perform desired reset sequence Respond with a time object	Yes
14	Warm restart	Perform desired partial reset operation Respond with a time object	Yes
16	Initialize application	Ready the specified application to run Respond with status of operation	No
17	Start application	Start the specified application to run Respond with status of operation	Yes
18	Stop application	Stop the specified application to run Respond with status of operation	Yes
Configuration function codes			
19	Save configuration	Save configuration Respond with status of operation	No
20	Enable unsolicited messages	Enable unsolicited messages Respond with status of operation	Yes
21	Disable unsolicited messages	Disable unsolicited messages Respond with status of operation	Yes
22	Assign class	Assign specified objects to a class Respond with status of operation	No
Time synchronization function codes			
23	Delay measurement	Perform propagation delay measurement	Yes
24	Record current time	For LAN networks only	No
File transfer			
25	Open file		Yes
26	Close file		Yes
27	Delete file		Yes
28	get file information		Yes
29	Authenticate file		No
30	Abort file		Yes
31	Activate configuration		No
Response function codes			
0	Confirm	Message fragment confirmation	Yes
129	Response	Response to request message	Yes
130	Unsolicited message	Spontaneous message without request	Yes

Configuration parameters

Parameter	Value	Description
Bit rate	1200, 4800, 9600, 19200, 38400, 57600, 115200 bps	The communication speed, bits per second.
Parity	None, Even, Odd	The type of parity bit used.
Wire number	2, 4	The wires number for serial port.
Poll line	False, True	Polarized line.
Frame Gap	10…500	Specifies the amount of time (calculated by bits) to determine that a frame has been completed.
Slave unit	1…65519	The address of the device (slave address).
Master unit	1…65534	The address of the master.
Linklayer Confirmation Timeout	0 ms 1…65535 ms	Link layer confirmation disabled. Timeout for link layer confirmation.
Linklayer Retry Count	1…255	Link layer retries if Link layer confirmation is enabled.
Appl.layer Confirmation Timeout	0…65535 ms	Timeout for application layer confirmation.
Appl.layer Confirmation Mode	EvOnly All	Confirmation requested for application layer messages containing event information only. Confirmation requested for all application layer messages.
Double-Bit Input Support	No Yes	Double-Bit input is not supported. Double-Bit input is supported.
ClockSync Mode	0 1…64000 s	Clock synchronisation is requested only at startup. Interval for clock synchronisation request.
Float precision enable flag	No Yes	Integer variation carries values with same precision as float variation. (i.e. voltage 230.4 V as integer: 2304, as float: 2304.0) Float variation has bigger precision than integer variation. (i.e. voltage 230.4V as integer: 230, as float: 230.4)
Deadband calculation method	Disabled Fixed Integrated	No deadband, no AI events generated. An Event is generated when the AI value change exceeds given deadband. Integrating deadband used.
Deadband integrating time	1…200 s	Integrating time setting used when the Deadband calculation method is Integrated.
Unsolicited resp. mode	Disabled +Empty&Ena +Empty Enabled	Unsolicited responses not in use. Unsolicited response enabled, empty UR sent first, waiting for Enable UR from master. Unsolicited response enabled, empty UR sent first, not waiting for master Enable UR before proceeding. Unsolicited response enabled, starts sending UR’s directly.

Parameter	Value	Description
Unsolicited resp. event delay	0…200 s	Unsolicited responses are delayed by this amount of seconds from first event.
Unsolocited resp. event count	1…10	Unsolicited responses are delayed until this many events are available. Used together with previous parameter.
Unsolicited resp. max event cnt	1…100	Maximum number of events in one unsolicited response.
Collision avoidance enable flag	No, Yes	Collision avoidance off/on.
Collision avoidance fixed delay	1…200 s	Delay setting used in next parameter.
Collision avoidance slots number	1…255	Number of bus access slots available for random bus access. If the line is busy, the slave waits for: fixed delay + random (slots), after the bus becomes idle before accessing the bus.
File Handle timeout	Range: 1 to 3600 second	Timeout for no activity references a file handle to close the file and send a File Transport Status Object (group 70 var 6) using a status code value of file handle expired (0x02). Range: 1 to 3600 second. Default 60 s.
Default Variation BI	1, 2	1: Single-bit packed. 2: Single-bit with flag.
Default Variation BI event	1, 2	1: Without time. 2: With absolute time.
Default Variation BO	2	2: Binary output status.
Default Variation DBI	1, 2	1: Without flag. 2: With flag.
Default Variation DBI event	1, 2	1: Without time. 2: With absolute time.
Default Variation Counter	1…6	1: 32-bit with flag. 2: 16-bit with flag. 3: Not supported. 4: Not supported. 5. 32-bit without flag. 6: 16-bit without flag.
Default Variation AI	1…5	1: 32-bit with flag. 2: 16-bit with flag. 3. 32-bit without flag. 4: 16-bit without flag. 5: Single precision, floating point without time.
Default Variation AI event	1…5	1: 32-bit without time. 2: 16-bit without time. 3: 32-bit with time. 4: 16-bit with time. 5: Single precision, floating point without time.

Data configuration

In Easergy P5 protection relays, data is mapped to five different categories:

- Binary inputs (BI)
- Double-bit inputs (DBI)
- Analog inputs (AI)
- Counters (CNTRS)
- Binary outputs (BO)

The configuration of these is described in the following subsections.

Binary inputs

Binary inputs are found in the DNP3: data points – BI view of COMMUNICATION menu in eSetup Easergy Pro or Web HMI.

DNP3: data points - BI

Binary inputs

Index	Class	UR	Item
0	1	☐	DI1(B)
1	1	☐	DI2(B)
2	1	☐	DI3(B)
3	1	☐	DI4(B)
4	1	☐	SGrp1
5	1	☐	SGrp2
6	1	☐	SGrp3
7	1	☐	SGrp4
8	1	☐	TCS alarm
9	1	☐	Logic2
10	1	☐	Logic3
11	1	☐	Logic4
12	1	☐	Logic5
13	1	☐	Logic6
14	1	☐	VI1
15	1	☐	VI2
16	1	☐	VI3

Table 10 - DNP3 data points – BI

Parameter	Description
Index	The index of the data item in the list.
Class	Which class the data point belongs to. (Class 1, 2 or 3).
UR	Controls whether changes in the value of the data point generates unsolicited responses or not.
Item	The data point.

Double-bit inputs

DNP3: data points – DBI view of COMMUNICATION menu contains the configuration of Double-bit Inputs.

DNP3: data points - DBI

Double-bit Inputs

Index	Class	UR	Item
0	1	☐	Object1
1	1	☐	Object2
2	1	☐	Object3
3	1	☐	Object4
4	1	☐	Object5
5	1	☐	Object6
6	1	☐	Object7
7	1	☐	Object8

The configuration of these points is analogous to that of Binary Inputs, see DNP3 data points – BI, page 43.

Analog inputs

Analog inputs are configured in the DNP3: data points – AI view of COMMUNICATION menu.

DNP3: data points - AI

Analog inputs

Index	Class	UR	Deadband	Item
0	2	☐	1	PS1 value
1	2	☐	1	PS2 value
2	2	☐	1	PS3 value
3	2	☐	1	PS4 value
4	2	☐	1	PS5 value
5	2	☐	1	PS6 value
6	2	☐	1	PS7 value
7	2	☐	1	PS8 value

Table 11 - DNP3 data points – AI

Parameter	Description
Index	The index of the data item in the list.
Class	Which class the data point belongs to. (Class 1, 2 or 3).
UR	Controls whether changes in the value of the data point generates unsolicited responses or not.
Deadband	The amount of change in value needed before a change is registered. The range of this setting is 1…4200000000.
Item	The data point.

Counters

The configuration of counters is found in the DNP3: data points – CNTRS view of COMMUNICATION menu.

DNP3: data points - CNTRS

Counters

Index	Item
0	DI1(B)
1	DI2(B)
2	DI3(B)
3	DI4(B)
4	None
5	None

Binary outputs

Binary outputs are found in the DNP3: data points – BO view of COMMUNICATION menu.

DNP3: data points - BO

Binary outputs

Index	Item
0	Object1
1	Object2
2	Object3
3	Object4
4	Object5
5	Object6

The structure of this configuration table is simple: only an index for the data items (data points) and an Item field, which determines which data point if found at the corresponding index. The data points are edited by clicking on an element in the Item column and selecting the desired output.

Data model of DNP3

The default Binary Inputs, Double-bit Inputs, Analog Inputs, Counts and Binary Outputs of Easergy P5 protection relays pre-configured in DNP3 can be found in following tables.

Binary inputs

Default Index	Default Class	Item
0	1	DI1
1	1	DI2
2	1	DI3
3	1	DI4
4	1	Setting group 1
5	1	Setting group 2
6	1	Setting group 3
7	1	Setting group 4
8	1	Logic1
9	1	Logic2
10	1	Logic3
11	1	Logic4
12	1	Logic5
13	1	Logic6
14	1	VI1
15	1	VI2
16	1	VI3
17	1	VI4
18	1	VI5
19	1	VI6

Double-bit inputs

Default Index	Default Class	Item
0	1	Object1
1	1	Object2
2	1	Object3
3	1	Object4
4	1	Object5
5	1	Object6
6	1	Object7
7	1	Object8

Analog inputs

Default Index	Default Class	Item
0	2	PS1 value
1	2	PS2 value
2	2	PS3 value
3	2	PS4 value
4	2	PS5 value
5	2	PS6 value
6	2	PS7 value
7	2	PS8 value

Counters

Default Index	Item
0	DI1
1	DI2
2	DI3
3	DI4

Binary outputs

Default Index	Item
0	Object1
1	Object2
2	Object3
3	Object4
4	Object5
5	Object6

IEC 60870-5-101

Presentation

IEC 60870-5-101 is an accompanying standard for the standards in the IEC 60870-5 series. It defines communication between protection devices and the various devices in a control system (supervisor or RTU) in a substation.

Easergy P5 protection relays using IEC 60870-5-101 work as controlled outstation (slave) units in unbalanced mode. Supported application functions include:

- Process data transmission
- Event transmission
- Command transmission
- General interrogation
- Clock synchronization
- Transmission of integrated totals
- Acquisition of transmission delay

The IEC 60870-5-101 communication in Easergy P5 protection relays is only command and event driven. Therefore only Class 1 data is reported. Class 2 is not be used.

Class 1 data is handled in the following priority order:

- Command responses
- Events (binary events, analog events, counter value change events)

  The event buffer size of IEC 60870-5-101 is 250.
- General Interrogation data

Chronology between events and requested data are always maintained. For lists of default data mappings in Easergy P5 protection relays, refer to Data model of IEC 60870-5-101, page 55.

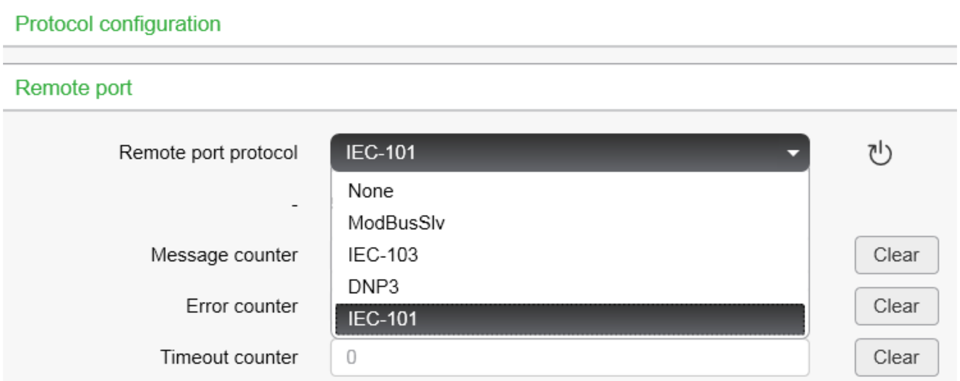
IEC 60870-5-101 configuration

This section explains how to configure Easergy P5 protection relays to use the IEC 60870-5-101 protocol.

General configuration

The IEC 60870-5-101 protocol is activated by setting it as the port protocol for a serial port on the device. This setting can be found by navigating to the COMMUNICATION menu and Protocol configuration view in the eSetup Easergy Pro or Web HMI.

The IEC 60870-5-101 protocol is activated on the Remote port as follows:



NOTE: Setting a protocol to any port requires a reboot of the device for the changes to take effect. eSetup Easergy Pro will prompt for a reboot.

Once the protocol has been activated, it can be configured. This is done with eSetup Easergy Pro in the IEC 60870-5-101 main config view. All values shown are defaults.

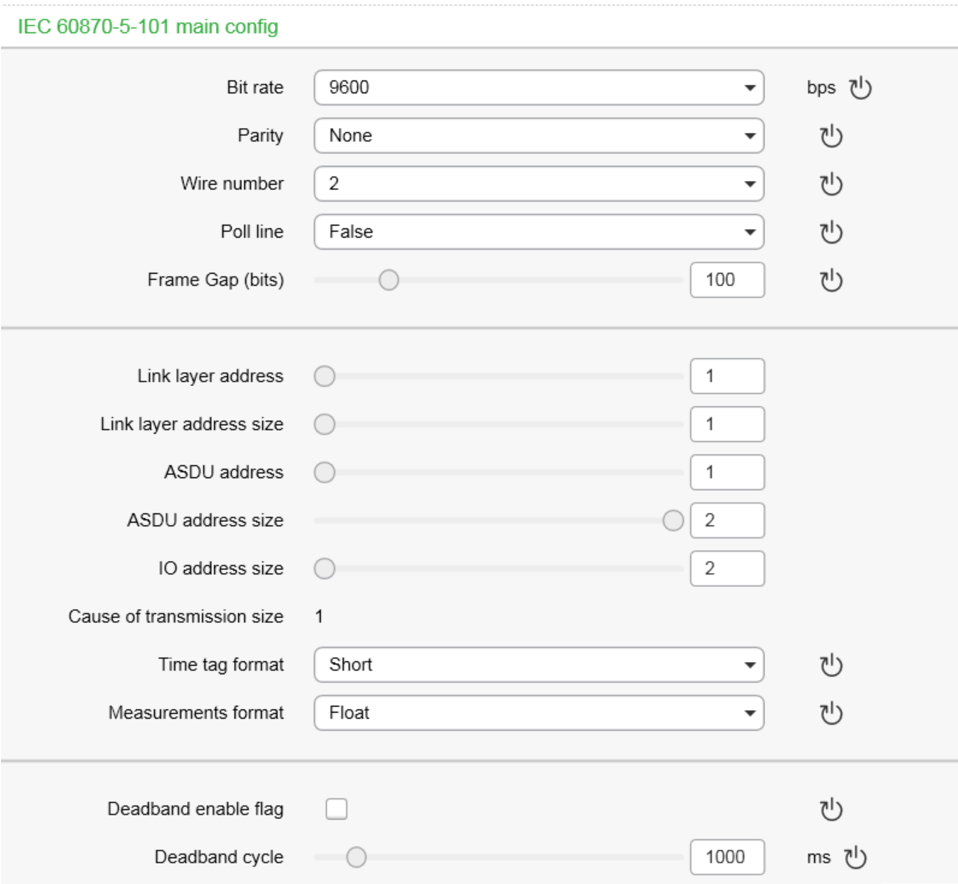


Table 12 - IEC 60870-5-101 main configuration parameters

Parameter	Value	Description
Bit rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps	Communication speed
Parity	None, Even, Odd	Parity used for serial communication
WireNum	2, 4	Number of wire connection
PolLine	False, True	Polarity of the wire connection
FrameGap	10...500	Specifies the amount of time (calculated by bits) to use to determine that a frame has been completed
Link layer address	1 byte: 1…254 2 bytes: 1…65534	Device address
Link layer address size	1 or 2 bytes	Size of the device address
ASDU address	1 byte: 1…254 2 bytes: 1…65534	Address of data segment on the same device address
ASDU address size	1 or 2 bytes	Size of the ASDU
IO address size	2 or 3 bytes	Size of Information Object address
Cause of transmission size	1 byte	Size of the code for the reason why a message is sent
Time tag format	Short, Full	Determines the time tag format: 3-octet time tag of 7- octet time tag
Measurements format	Scaled, Normalised, Float	Determines the data format for measurements, float, normalised or scaled values
Deadband enable flag	On, Off	Enabling of deadband measurements and event generation
Deadband cycle	100...10000 ms	The interval of deadband calculations

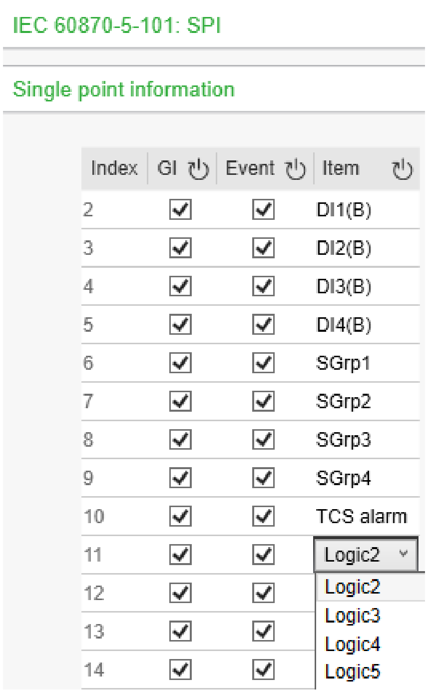
Data configuration

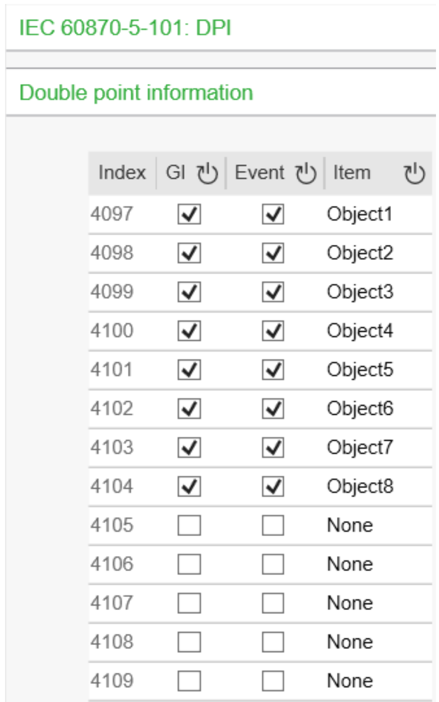
Data and commands are mapped to six different tables: Single point information (SPI), Double point information (DPI), Analog inputs (AI), Analog events (AE), Integrated totals (IT) and Commands (CMD). The settings for these categories are described in the following subsections.

Single and double point information

Single point information (SPI) objects are one-bit data items (range 0…1). Double point information objects are two-bit data items (range 0…3). Default SPI and DPI mapping are shown in figures below.

A description of the column elements for SPI and DPI objects is given in the table.





NOTE: Information object address (Index) 1 is reserved for an SPI object: Class 1 buffer overflow indication (BOV1).

Table 13 - SPI and DPI mapping table

Parameter	Description
Index	Information object address
GI	Determines whether the object is included in response to General Interrogation request message (Enabled/Disabled)
Event	Determines whether change events for the object are put into Class 1 buffer (Enabled/Disabled)
Item	The data item which is configured on the row (for instance, DI1)

Analog inputs

Analog inputs are measurement values that are float, scaled or normalised. Scaling is done according to the scaling settings found under the list item Modbus and IEC 60870-5-101 specific scalings in eSetup Easergy Pro or Web HMI (it applies to IEC 60870-5-101 if the protocol is configured to use scaled values). When using float for measurement values, no scalling is needed.

IEC 60870-5-101: AI

Analog inputs

Index	GI	Event	Deadband	Max	Item
16385	☑	☑	1.000	1000	PS1 value
16386	☑	☑	1.000	1000	PS2 value
16387	☑	☑	1.000	1000	PS3 value
16388	☑	☑	1.000	1000	PS4 value
16389	☑	☑	1.000	1000	PS5 value
16390	☑	☑	1.000	1000	PS6 value
16391	☑	☑	1.000	1000	PS7 value
16392	☑	☑	1.000	1000	PS8 value

NOTE: Measurement values have no time tags when read upon request. Change events (based on deadband supervision) are sent with time tags with cause of transmission spontaneous in Class 1. The time tag format is determined by the interface configuration (general time tag format selection parameter).

Table 14 - AI mapping table

Parameter	Description
Index	Information object address
GI	Determines whether the object is included in response to General Interrogation request message (Enabled/Disabled)
Event	Determines whether change events for the object are put into Class 1 buffer (Enabled/Disabled)
Deadband	Deadband value for change supervision and change event generation (valid only if Event is Enabled).
Max	Maximum value for defining the value range as –Max…+Max. This range is transformed to the range -1…+1 if the protocol measurement format is set to “Normalised”
Item	The data item which is configured on the row

Analog events

These analog values are fault event and are sent with time tags. The values are float, normalised or scaled measured values. A part of the default data mapping is shown in following figure.

IEC 60870-5-101: AE

Analog events

Index	Event	Item
18433	☐	PS1 value
18434	☐	PS2 value
18435	☐	PS3 value
18436	☐	PS4 value
18437	☐	PS5 value
18438	☐	PS6 value
18439	☐	PS7 value
18440	☐	PS8 value

Table 15 - AE mapping table

Parameter	Description
Index	Information object address
Event	Determines whether change events for the object are put into Class 1 buffer (Enabled/Disabled)
Item	The data item which is configured on the row

Integrated totals

Integrated totals are energy and pulse counter values. the following figure is a part of the mapping table in eSetup Easergy Pro.

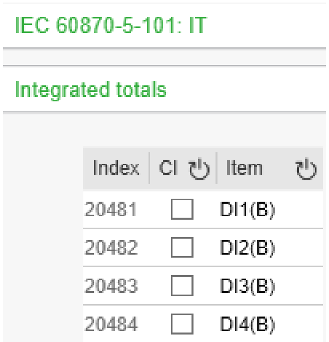
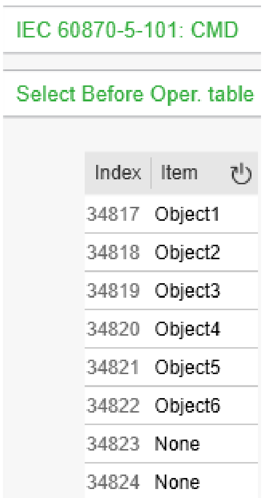


Table 16 - Integrated totals mapping table

Parameter	Description
Index	Information object address
CI Counter Interrogation	Determines whether the object is included in responses to Counter Interrogation messages (Enabled/Disabled)
Item	The data item which is configured on the row

Command items

The commands are divided into two categories: Select Before Operate and Direct Operate.



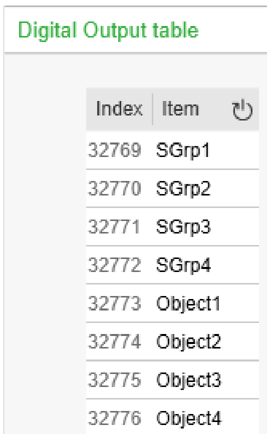


Table 17 - Description of command items

Parameter	Description
Index	Information object address
Item	The data item which is configured on the row

Scaling

Measured values that transferred as signed integers of 16 bits are in the range: – $2^{15} \cdots 2^{15} - 1 = -32768 \cdots 32767$. Thus values that exceed this range are scaled in order to be successfully sent over an IEC 101 data link.

The scaling is determined by the float value of corresponding specific scalings. It is common to use scaling factors with base ten (0.100,1.000,10.000, 100.000…). In such cases, only the decimals are removed from the original measurements and such values are easy to read and rescale to actual values on the client side after transmission. Different settings for scaling can be used for the power-, power factor-, tan phi-, voltage- and frequency scaling. These settings for scaling can be set by navigating to the Modbus and IEC 60870-5-101 specific scalings view in the COMMUNICATION menu in eSetup Easergy Pro or Web HMI.

A short example: The frequency is internally (in the Easergy P5 protection relays) stored as an integer value which also holds three decimal places, that is, 50.000 Hz is represented as 50000. This is a value too large to be represented with 16 bits (signed integer). However, frequency is multipled by default scaled value 0.1, enabling it to be sent over the data line.

Thus, the value on the receiving side (the scaled value) is:

valueScaled = k · valueInternal = 0.1 · 50000 = 5000

> **NOTE:** It is highly recommended to scale values so that they are kept in the interval 0 –32768 to avoid overflow.

Normalisation

When using normalisation for measured values, the normalised value is calculated using the Max parameter, which determines the range for the data (- Max … + Max).

An example:

The frequency is internally (in the Easergy P5 protection relays) stored as an integer value which also holds three decimal places, that is, 50.000 Hz is represented as 50000. If normalisation is activated and the Max value set to 100000, the value sent over the data link is (in the ideal case):

value Normalised = *valueInternal/Max* = 50000/100000 = 0.5

Currently, however, the scaling is also performed before normalisation. This means that the scaling is always active.

The equation is therefore:

value Normalised = *valueScaled/Max* = 0.1 x 50000/100000 = 0.05

Float

When using Float for measured values, no scaling will be used. An example: 50.000 Hz is represented as 50, just use the raw value to transfer.

Event buffer size

The event buffer size is defined as 250. That means IEC 60870-5-101 can store maximum 250 events internally.

Data model of IEC 60870-5-101

The default Single Point Information, Double Point Information, Analog Inputs, Analog Events, Intergrated Totals and Command of Easergy P5 protection relays pre-configured in IEC 60870-5-101 can be found in following tables.

Default single and double point information

Table 18 - Single point information

Default Index	Item
2	DI1
3	DI2
4	DI3
5	DI4
6	Setting group 1
7	Setting group 2
8	Setting group 3
9	Setting group 4
10	Logic1
11	Logic2
12	Logic3
13	Logic4
14	Logic5
15	Logic6

Table 19 - Double point information

Default Index	Item
4097	Object1
4098	Object2
4099	Object3
4100	Object4
4101	Object5
4102	Object6
4103	Object7
4104	Object8

Analog inputs

Default Index	Deadband	Max	Item
16385	1.000	1000	PS1 value
16386	1.000	1000	PS2 value
16387	1.000	1000	PS3 value
16388	1.000	1000	PS4 value
16389	1.000	1000	PS5 value
16390	1.000	1000	PS6 value
16391	1.000	1000	PS7 value
16392	1.000	1000	PS8 value

Analog events

Default Index	Item
18433	PS1 value
18434	PS2 value
18435	PS3 value
18436	PS4 value
18437	PS5 value
18438	PS6 value
18439	PS7 value
18440	PS8 value

Integrated totals

Default Index	Item
20481	DI1
20482	DI2
20483	DI3
20484	DI4

Default command

Table 20 - Select Before Operate table

Default	Item
34817	Object1
34818	Object2
34819	Object3
34820	Object4
34821	Object5
34822	Object6

Table 21 - Digital Output table

Default Index	Item
32769	Setting group 1
32770	Setting group 2
32771	Setting group 3
32772	Setting group 4
32773	Object1
32774	Object2
32775	Object3
32776	Object4
32777	Object5
32778	Object6

IEC 60870-5-103

Presentation

IEC 60870-5-103 is an accompanying standard for the standards in the IEC 60870-5 series. It defines communication between protection devices and the various devices in a control system (supervisor or RTU) in a substation.

The unbalanced transmission mode of the protocol is used, and the device functions as a secondary station (slave) in the communication. Data is transferred to the primary system using the "data acquisition by polling" principle.

The Easergy P5 protection relay supports the following IEC 61870-5-103 application functions:

- Data acquisition by polling
- General initialization
- Station initialization
- General interrogation
- Clock synchronization
- Command transmission
- Transmission of disturbance data
- Read and write setting data

The following functions are not supported:

- Generic services
- Test mode
- Blocking in monitoring direction

The following ASDU (Application Service Data Unit) types are used in communication from the Easergy P5 protection relays:

- ASDU 1: Time tagged message
- ASDU 3: Measurands I
- ASDU 4: Time-tagged measurands with relative time
- ASDU 5: Identification message
- ASDU 6: Time synchronization
- ASDU 8: Termination of general interrogation
- ASDU 9: Measurands II

Easergy P5 protection relays accept:

- ASDU 6: Time synchronization
- ASDU 7: Initiation of general interrogation
- ASDU 20: General command

The ASDUs from 23 to 31 are used for disturbance data transmission.

The ASDU 140, ASDU 144, ASDU 17, ASDU 201, ASDU 169, ASDU 49 are used to write and read setting data.

The ASDU 135, which is related with SPA-bus, is not supported.

The data in a message frame is identified by:

- Type identification
- Function type (TYP)
- Information number (INF)

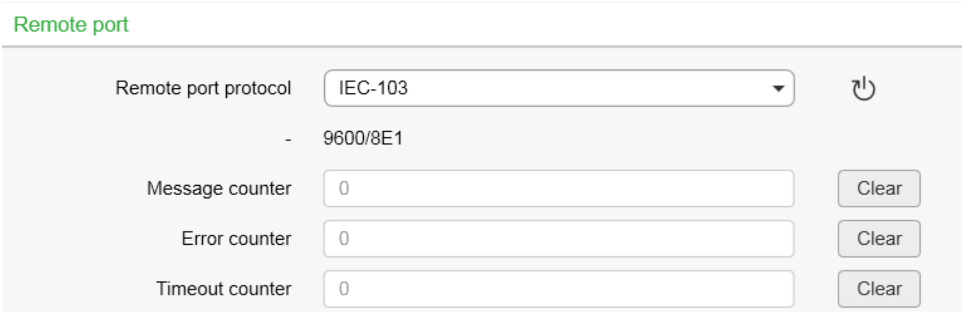
For more information on the IEC 60870-5-103 protocol, visit www.iec.ch.

IEC 60870-5-103 configuration

This section explains how to configure Easergy P5 protection relays to use the IEC 60870-5-103 protocol.

General configuration

The IEC 60870-5-103 protocol is activated by setting it as the port protocol for a serial port on the device. This setting can be found by navigating to the COMMUNICATION menu and Protocol configuration view in the eSetup Easergy Pro or Web HMI. IEC 60870-5-103 protocol is activated on the Remote port.



NOTE: Setting a protocol to any port will require a reboot of the device for the changes to take effect. eSetup Easergy Pro will prompt for a reboot.

Once the protocol has been activated, it can be configured. This is done with eSetup Easergy Pro in the IEC 60870-5-103 main config view. All values shown are defaults.

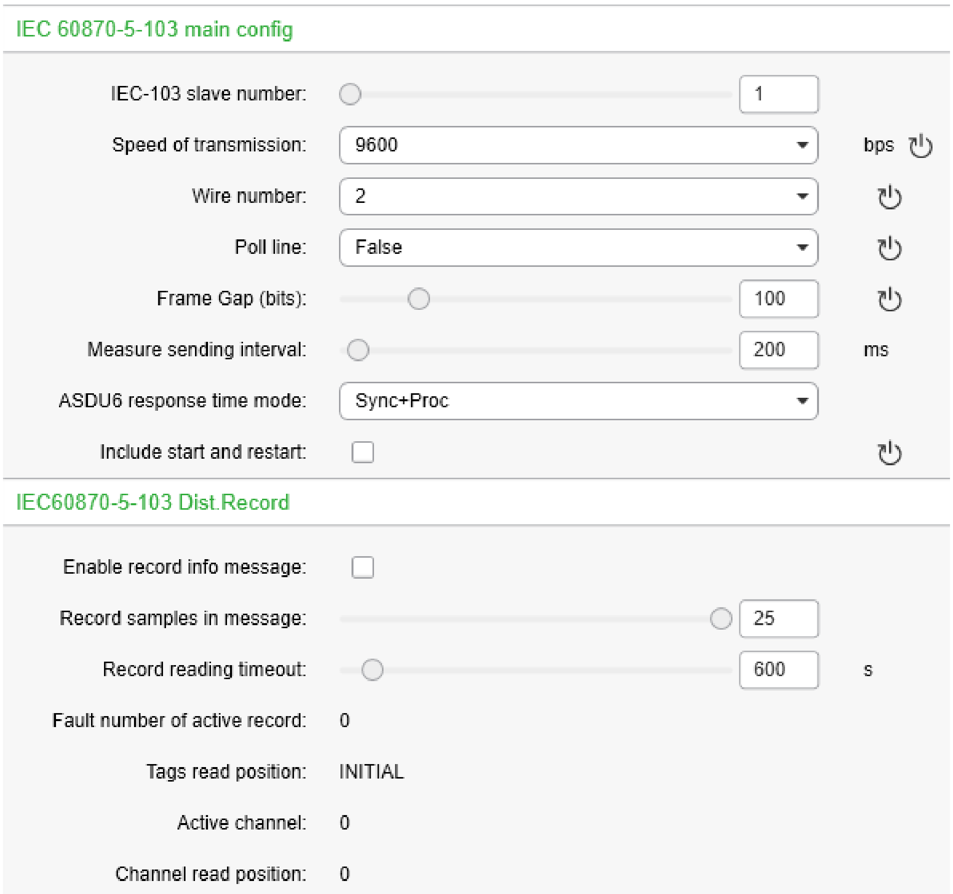


Table 22 - IEC 60870-5-103 main configuration parameters

Parameter	Value	Description
IEC-103 slave number	1 ... 254	A unique address within the system setup
Speed of transmission	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps	Communication speed
Wire number	2, 4	Number of wire connection
Poll line	False, True	Polarity of the wire connection
Frame Gap (bits)	10 ... 500	Specifies the amount of time (calculated by bits) to use to determine that a frame has been completed
Measure sending interval	200 … 10000 ms	Minimum measurement response interval
ASDU6 response time mode	Sync;	The time in the slave’s response = the master’s time.
	Sync + Proc;	The time in the slave’s response = the master’s time + internal processing time (standard).
	Msg;	The time in the slave’s response = the slave’s time at the moment when the clock sync message arrived.
	Msg + Proc	The time in the slave’s response = the slave’s time at the moment when the clock sync message arrived + internal processing time.
Include start and restart	On, Off	

Table 23 - IEC 60870-5-103 disturbance recorder parameter

Parameter	Value	Description
Enable record info message	On, Off	Enable record information messages
Record samples in message	1 ... 25	Record samples in one message
Record reading timeout	10 … 10000 s	Record reading timeout
Fault number of active record	(not editable)	The fault number of the current record. This is a number which is given by Easergy P5 protection relays, incrementally and is what identifies faults.
Tags read position	(not editable)	Tags are indications of change in the value of digital data. The current tag read position shows which such item is being read.
Active channel	(not editable)	“Channel” refers to the channels in Easergy P5 protection relays Disturbance recorder, which can be found in the DISTURBANCE RECORDER view in eSetup Easergy Pro. The active channel indicates which channel is being read.
Channel read position	(not editable)	A channel contains sampled analog values. The current read position indicates which of these entries in the active channel is being read.

Data configuration

The data points available through the IEC 60870-5-103 protocol interface in Easergy P5 protection relays can be configured in the IEC 60870-5-103: Data config view. It is divided into two categories, Digital data points (1-bit values) and Analog data points.

Digital data

The parameters, by which digital data points are defined, are explained below. In order to change the value of an existing data item, click on the row. This brings up an item configuration window, in which the parameters can be set. Pressing Save in the window will save the item set, pressing Remove will remove the item from the list and pressing Cancel will close the popup window without making any changes to the digital item configuration.

In order to add new items to the list, press the ADD Item row furthest down in the list. Doing so will add a new item at the end of the list. New items will be set to Digital Input 1 by default. The new item is configured as explained in the previous paragraph.

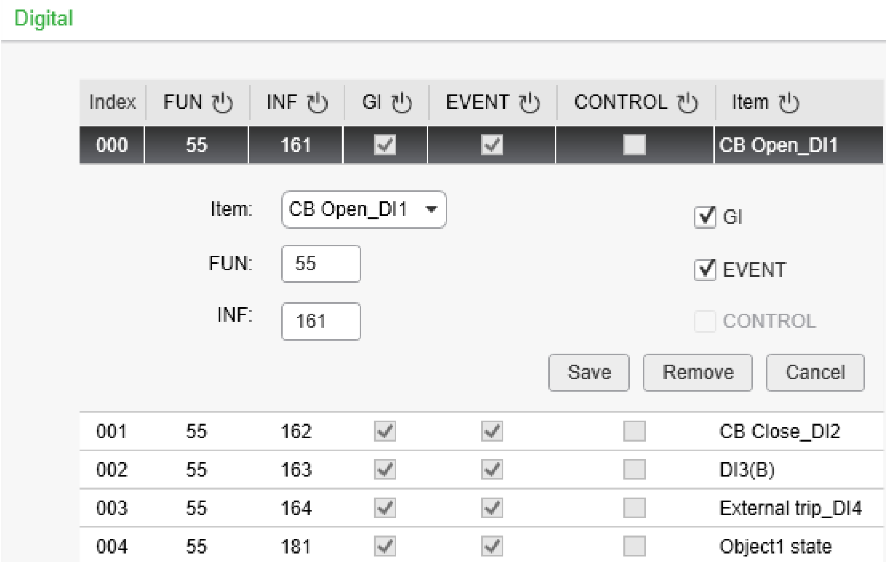


Table 24 - Description of digital data configuration parameters

Parameter	Description
Index	Index of the data item in the list
FUN	Function type
INF	Information number
GI	Item included in General Interrogation (Enabled/Disabled) and data acquisition by polling
EVENT	Events enabled for change of item value (Enabled/Disabled)
CONTROL	Item value can be set by command (Enabled/Disabled)
Item	The data item which is configured on the row (for instance, Digital Input 1)

NOTE: Changes will not take effect if they are not explicitly written to the device using the Write changes to device button in eSetup Easergy Pro. This will require a reboot.

NOTE: The read command for digital data according to FUN and INF is not supported. If the GI parameter is disabled, the item value will not be included in response message by GI command. The value changing event is reported only by polling command.

Analog data

The parameters, by which analog data points are defined, are explained below. In order to change the value of an existing data item, click on the row. This brings up an item configuration window, in which the parameters can be set. Pressing Save in the window will save the item set, pressing Remove will remove the item from the list and pressing Cancel will close the popup window without making any changes to the analog item configuration.

In order to add new items to the list, press the ADD Item row furthest down in the list. Doing so will add a new item at the end of the list. The new item is configured as explained in the previous paragraph.

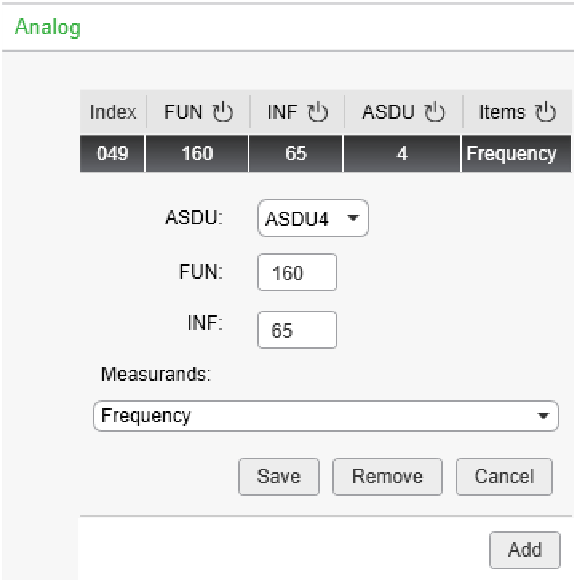


Table 25 - Description of analog data configuration parameters

Parameter	Description
Index	Index of the data item in the list
FUN	Function type
INF	Information number
ASDU	Application service data unit to be used to send the data item: ASDU 3.1: analog data 1 value ASDU 3.2: analog data 2 values ASDU 3.3: analog data 4 values ASDU 3.4: analog data 2 values ASDU 4: analog data floating point value ASDU 9: analog data 9 values
Items	The data item which is configured on the row

NOTE: Changes will not take effect if they are not explicitly written to the device using the Write changes to device button in eSetup Easergy Pro. This will require a reboot.

Measurement data

Analog measurements are transferred in two different formats, as integers and as floating point values. The value format depends on the application message type, ASDU. The following ASDU types are available for measurement values:

Table 26 - ASDU types for measurement values

ASDU	Number of measurements in one message	Format
3.1	1	Integer
3.2	2	
3.3	4	
3.4	2	
9	9	
4	1	Float

Integer value scaling

Integer scaled values in ASDU 3.x and 9 are transferred in 12 bit + sign integer format. The raw 12 bit values (-4096 … +4095) are relative to 2.4 x nominal values. The following table shows the scaling for different measurements. The values of scaling settings can be found in the SCALING view in eSetup Easergy Pro.

NOTE: Integer RTD value is specially relative to 0.24 x nominal values (32768).

Table 27 - Integer scaled values

Type	Measurement	Scaling
Current	IL1 ... IL3 IoCalc	2.4 × IN
Residual current	Ir	2.4 × IrN
	Irvs	2.4 × IrvsN
Voltage	VL1...VL3 U12...U13	2.4 × UN
Residual voltage	Ur	2.4 × UrN
Power	P, Q, S	2.4 × IN × UN × √3
Other	DI counters	1:1
	PF, Cos Phi	2.4:1

An example:

The device transfers phase 1 current, IL1, with ASDU 3.1.

The scaling setting is as follows: CT primary = 500 A.

The measured value M = 321 A.

Thus, the value sent, $B = M \times (4096/(2.4 \times 500)) = 321 \times (4096/(2.4 \times 500)) = 1095$

The protocol master receives the value: $B = 1095$

OVF (Overflow bit in frame): No

Valid: Yes

This value is converted back to the measured value:

$M = B \times ((2.4 \times 500)/4096) = 1095 \times ((2.4 \times 500)/4096) = 320.8 \approx 321$ A

An example:

The device transfers phase 1 current, IL1, with ASDU 3.1.

The scaling setting is as follows: CT primary = 500 A.

The measured value M = 1321 A.

Thus, the value sent, $B = M \times (4096/(2.4 \times 500))$= 1321 × (4096/(2.4 × 500)) = 4509, is too large a value to fit into twelve bits. Thus, the value is sent as B = 4095 (the largest value that can be sent with twelve bits) and the OVF (Overflow flag) set.

The protocol master receives the value: B = 4095

OVF (Overflow bit in frame): Yes

Valid: Yes

This value is converted back to the measured value: $M \geq 2.4 \times 500\ A$, so $M \geq$ 1200 A

Floating point values

Values transferred in ASDU 4 need not be scaled. Most of the measurements are sent as primary scaled values, but some values can be sent as per unit (PU) values. This setting can be changed via the local panel on the Easergy P5 protection relays.

Measurement	Format
Fault current I>	PU or A
Fault current I>>	PU or A
Fault current I>>>	PU or A
Fault reactance	Ω
Exported energy	MWh
Exported reactive energy	Mvarh

Write and read setting data

ASDU types description

These are the ASDU types available:

- ASDU 140 in the control direction – setting read request
- ASDU 143 in the control direction – setting write request (8 bits)
- ASDU 144 in the control direction – setting write request (16 bits)
- ASDU 201 in the control direction – setting write request (32 bits)
- ASDU 49 in the monitor direction – reject setting read/write request (8 bits)
- ASDU 168 in the monitor direction – answer to setting read/write request (8 bits)
- ASDU 17 in the monitor direction – answer to setting read/write request (16 bits)
- ASDU 169 in the monitor direction – answer to setting read/write request (32 bits)

ASDU **140** (8CH): **Control Direction**

Table 28 - ASDU 140 for IEC 60870-5-103 setting

Type identification	**8CH** (Read protection parameter)
Variable Struct. Qualifier	81H
Cause of Transmission	14H
Device address	Common address of ASDU
Function byte (**FUN**)	Parameter y-Value
Information number (**INF**)	Parameter x-Value

ASDU **143** (8FH): **Control Direction**

Table 29 - ASDU 143 for IEC 60870-5-103 setting

Type identification	**8FH** (Write analog protection parameter)
Variable Struct. Qualifier	81H
Cause of transmission	14H
Device address	Common address of ASDU
Function byte (**FUN**)	Parameter y-Value
Information number (**INF**)	Parameter x-Value
Value byte	byte

ASDU **144** (90H): **Control Direction**

Table 30 - ASDU 144 for IEC 60870-5-103 setting

Type identification	**90H** (Write analog protection parameter)
Variable Struct. Qualifier	81H
Cause of transmission	14H
Device address	Common address of ASDU
Function byte (**FUN**)	Parameter y-Value
Information number (**INF**)	Parameter x-Value
Value low-byte	word (low)
Value high-byte	word (high)

ASDU **201** (C9H): **Control Direction**

Table 31 - ASDU 201 for IEC 60870-5-103 setting

Type identification	**C9H** (Write analog protection parameter)
Variable Struct. Qualifier	81H
Cause of transmission	14H
Device address	Common address of ASDU
Function byte (**FUN**)	Parameter y-Value
Information number (**INF**)	Parameter x-Value
Byte 1	Low word (low)
Byte 2	Low word (high)
Byte 3	High word (low)
Byte 4	High word (high)

Type identification 49 (31H): Monitor direction

Table 32 - ASDU 49 for IEC 60870-5-103 setting

Type identification	**31H** (Analog protection signal)
Variable Struct. Qualifier	81H
Cause of transmission	15H
Device address	Common address of ASDU
Function byte (**FUN**)	Parameter y-Value
Information number (**INF**)	Parameter x-Value
Value low-byte	MW (low)
Value high-byte	MW (high)
TT (Time tag)	ms low
	ms high
	IV 0 m m m m m m
	SU 0 h h h h h

Reject the read request or write request with special Fun and INF values as below.

Special values **Function byte** (**FUN**) = 7FH and **Information number** (**INF**) = FFH shall be used as a negative response on a command message ("Rejection telegram"): in this case MW contains the error code, so the cause of rejection.

The list of causes of rejection possibly used is as follows:

Cause of rejection	Meaning
80H 00H	OK
80H 07H	Unknown parameter address
80H 08H	Wrong data
80H 09H	Wrong frame data length
80H 30H	Wrong data in message

ASDU 168 (A8H): Monitor direction

Table 33 - ASDU 168 for IEC 60870-5-103 setting

Type identification	**A8H** (Analog protection parameter)
Variable Struct. Qualifier	81H
Cause of transmission (COT)	**14H**
Device address	Common address of ASDU
Function byte (**FUN**)	Parameter y-Value
Information number (**INF**)	Parameter x-Value
Byte 1	byte
TT (Time tag)	ms low
	ms high
	IV 0 m m m m m m
	SU 0 h h h h h

ASDU **17** (11H): **Monitor direction**

Table 34 - ASDU 17 for IEC 60870-5-103 setting

Type identification	**11H** (Analog protection parameter)
Variable Struct. Qualifier	81H
Cause of Transmission	**14H**
Device address	Common address of ASDU
Function byte (**FUN**)	Parameter y-Value
Information number (**INF**)	Parameter x-Value
Value low-byte	word (low)
Value high-byte	word (high)
TT (Time tag)	ms low
	ms high
	IV 0 m m m m m m
	SU 0 h h h h h

ASDU 169 (A9H): Monitor direction

Table 35 - ASDU 169 for IEC 60870-5-103 setting

Type identification	**A9H** (Analog protection parameter)
Variable Struct. Qualifier	81H
Cause of transmission (COT)	**14H**
Device address	Common address of ASDU
Function byte (**FUN**)	Parameter y-Value
Information number (**INF**)	Parameter x-Value
Byte 1	Low word (low)
Byte 2	Low word (high)
Byte 3	High word (low)
Byte 4	High word (high)
TT (Time tag)	ms low
	ms high
	IV 0 m m m m m m
	SU 0 h h h h h

COT Meaning **(Cause of Transmission):**

In a response to a write command only:

= 14H - Positive acknowledge to a read/write command.

= 15H - Negative acknowledge to a write command.

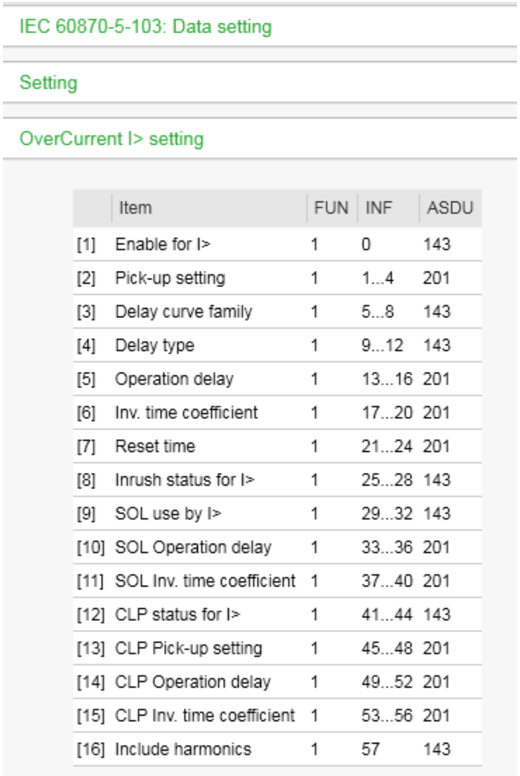
(All the frame structure may be changed according to last design.)

Setting data addressing

All setting data are addressed by y-Value (FUN) / x-Value (INF) corresponding to each protection and item.

The list of setting parameters displayed on eSetup Easergy Pro for each function are not editable. The user can select setting items by using the parameters FUN, INF and ASDU (for writing different types). Each item's FUN and INF can't been changed. The Master uses ASDU140 for all value types' reading requests.

Figure 2 - IEC 60870-5-103 setting data points



IEC 60870-5-103: Data setting

Setting

OverCurrent I> setting

	Item	FUN	INF	ASDU
[1]	Enable for I>	1	0	143
[2]	Pick-up setting	1	1...4	201
[3]	Delay curve family	1	5...8	143
[4]	Delay type	1	9...12	143
[5]	Operation delay	1	13...16	201
[6]	Inv. time coefficient	1	17...20	201
[7]	Reset time	1	21...24	201
[8]	Inrush status for I>	1	25...28	143
[9]	SOL use by I>	1	29...32	143
[10]	SOL Operation delay	1	33...36	201
[11]	SOL Inv. time coefficient	1	37...40	201
[12]	CLP status for I>	1	41...44	143
[13]	CLP Pick-up setting	1	45...48	201
[14]	CLP Operation delay	1	49...52	201
[15]	CLP Inv. time coefficient	1	53...56	201
[16]	Include harmonics	1	57	143

Table 36 - IEC 60870-5-103 setting parameters

Parameter	Description
Item	Db item
FUN	Function type(y-Value)
INF	Information number(x-Value)
ASDU	Application service data unit to be used to send the data item: ASDU 140: read request for master ASDU 143: write 8 bits type request for master ASDU 144: write 16 bits type request for master ASDU 201: write 32 bits type request for master

Data model of IEC 60870-5-103

The default digital and analog data of Easergy P5 protection relays preconfigured in IEC 60870-5-103 can be found in following tables.

Default digital configuration

Defaut Index	FUN	INF	Item
000	55	161	CB Open_DI1
001	55	162	CB Close_DI2
002	55	163	Digital input 3
003	55	164	External trip_DI4
004	55	181	Object1 state
005	55	182	Object2 state
006	55	183	Object3 state
007	55	184	Object4 state
008	55	185	Object5 state

Defaut Index	FUN	INF	Item
009	55	186	Object6 state
010	55	187	Object7 state
011	55	188	Object8 state
012	160	20	Logic output 1 on
013	160	21	Logic output 2 on
014	160	22	Logic output 3 on
015	160	23	Logic output 4 on
016	160	24	Logic output 5 on
017	160	25	Logic output 6 on
018	160	26	Logic output 7 on
019	160	27	Logic output 8 on
020	160	28	Logic output 9 on
021	160	29	Logic output 10 on
022	160	130	Virtual input 1
023	160	131	Virtual input 2
024	160	132	Virtual input 3
025	160	133	Virtual input 4
026	160	134	Virtual input 5
027	160	135	Virtual input 6
028	160	136	Virtual input 7
029	160	137	Virtual input 8
030	160	138	Virtual input 9
031	160	139	Virtual input 10
032	160	140	CB Fail 1 Trip On
033	160	141	CB Fail 2 Trip On
034	55	23	Setting group 1
035	55	24	Setting group 2
036	55	25	Setting group 3
037	55	26	Setting group 4
038	160	103	Prg1 start
039	160	105	Prg1 trip
040	160	98	Prg2 start
041	160	100	Prg2 trip
042	160	99	Prg3 start
043	160	101	Prg3 trip
044	160	180	Prg4 start
045	160	181	Prg4 trip
046	160	69	Prg5 start
047	160	70	Prg5 trip
048	160	71	Prg6 start
049	160	19	Prg6 trip

Default analog configuration parameters

Default Index	FUN	INF	ASDU	Item
050	160	65	4	Frequency

Setting data

The setting values that can be configured in IEC 60870-5-103 on the Easergy P5 protection relay is listed in the table below:

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
ARC setting items									
I>int. pick-up value	1	0	201	1.00 xIn = 100				■	■
Io>int. pick-up value	1	1	201	1.00 xIn = 100				■	■
Arc stage 1 enabled	1	2	143	Off=0;On=1				■	■
Arc stage 2 enabled	1	3	143	Off=0;On=1				■	■
Arc stage 3 enabled	1	4	143	Off=0;On=1				■	■
Arc stage 4 enabled	1	5	143	Off=0;On=1				■	■
Arc stage 5 enabled	1	6	143	Off=0;On=1				■	■
Arc stage 6 enabled	1	7	143	Off=0;On=1				■	■
Arc stage 7 enabled	1	8	143	Off=0;On=1				■	■
Arc stage 8 enabled	1	9	143	Off=0;On=1				■	■
Stage 1 Mode	1	10	143	Light=0;Light&Current=1				■	■
Stage 2 Mode	1	11	143	Light=0;Light&Current=1				■	■
Stage 3 Mode	1	12	143	Light=0;Light&Current=1				■	■
Stage 4 Mode	1	13	143	Light=0;Light&Current=1				■	■
Stage 5 Mode	1	14	143	Light=0;Light&Current=1				■	■
Stage 6 Mode	1	15	143	Light=0;Light&Current=1				■	■
Stage 7 Mode	1	16	143	Light=0;Light&Current=1				■	■
Stage 8 Mode	1	17	143	Light=0;Light&Current=1				■	■
Trip 1 delay [x1ms]	1	18	143	1 = 1				■	■
Trip 2 delay [x1ms]	1	19	143	1 = 1				■	■
Trip 3 delay [x1ms]	1	20	143	1 = 1				■	■
Trip 4 delay [x1ms]	1	21	143	1 = 1				■	■
Trip 5 delay [x1ms]	1	22	143	1 = 1				■	■
Trip 6 delay [x1ms]	1	23	143	1 = 1				■	■
Trip 7 delay [x1ms]	1	24	143	1 = 1				■	■
Trip 8 delay [x1ms]	1	25	143	1 = 1				■	■
Min. hold time [x1ms]	1	26	201	1 = 1				■	■
Min. hold time2 [x1ms]	1	27	201	1 = 1				■	■
Min. hold time3 [x1ms]	1	28	201	1 = 1				■	■
Min. hold time4 [x1ms]	1	29	201	1 = 1				■	■
Min. hold time5 [x1ms]	1	30	201	1 = 1				■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
Min. hold time6 [x1ms]	1	31	201	1 = 1				■	■
Min. hold time7 [x1ms]	1	32	201	1 = 1				■	■
Min. hold time8 [x1ms]	1	33	201	1 = 1				■	■
Inrush setting									
Enable for Inrush	2	0	143	Off=0;On=1	■	■		■	■
Max inrush current	2	1	201	1.00 xIn = 100	■	■		■	■
Pickup for 2nd harmonic	2	2	201	1 % = 1	■	■		■	■
OverCurrent I> setting									
Enable for I>	3	0	143	Off=0;On=1	■	■		■	■
Pick-up value	3	1...4	201	1.00 xIn = 100	■	■		■	■
Delay curve family	3	5...8	143	DT=0;IEC=1;IEEE=2; IEEE2=3;Others=4; Prg1=5;Prg2=6;Prg3=7	■	■		■	■
Delay type	3	9...12	143	DT=0;NI=1;VI=2;EI=3; LTI=4;LTEI=5;LTVI=6; MI=7;STI=8;STEI=9; CO8=10;RI=11;RXIDG= 12	■	■		■	■
Operation delay	3	13...16	201	1.00 s = 100	■	■		■	■
Inv. time coefficient	3	17...20	201	1.000 = 1000	■	■		■	■
Reset time	3	21...24	201	1.00 s = 100	■	■		■	■
Inrush status for I>	3	25...28	143	Off=0;On=1	■	■		■	■
SOL use by I>	3	29...32	143	Off=0;On=1	■	■		■	■
SOL Operation delay	3	33...36	201	1.00 s = 100	■	■		■	■
SOL Inv. time coefficient	3	37...40	201	1.000 = 1000	■	■		■	■
CLPU status for I>	3	41...44	143	Off=0;On=1	■	■		■	■
CLPU Pick-up value	3	45...48	201	1.00 xIn = 100	■	■		■	■
CLPU Operation delay	3	49...52	201	1.00 s = 100	■	■		■	■
CLPU Inv. time coefficient	3	53...56	201	1.000 = 1000	■	■		■	■
Include harmonics	3	57	143	Off=0;On=1	■	■		■	■
Reset type	3	58...61	143	DT=0;IDMT=1	■	■		■	■
OverCurrent I>> setting									
Enable for I>>	4	0	143	Off=0;On=1	■	■		■	■
Pick-up value	4	1...4	201	1.00 xIn = 100	■	■		■	■
Delay curve family	4	5...8	143	DT=0;IEC=1;IEEE=2; IEEE2=3;Others=4; Prg1=5;Prg2=6;Prg3=7	■	■		■	■
Delay type	4	9...12	143	DT=0;NI=1;VI=2;EI=3; LTI=4;LTEI=5;LTVI=6; MI=7;STI=8;STEI=9; CO8=10;RI=11;RXIDG= 12	■	■		■	■
Operation delay	4	13...16	201	1.00 s = 100	■	■		■	■
Inv. time coefficient	4	17...20	201	1.000 = 1000	■	■		■	■
Inrush status for I>>	4	21...24	143	Off=0;On=1	■	■		■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
SOL use by I>>	4	25...28	143	Off=0;On=1	■	■		■	■
SOL Operation delay	4	29...32	201	1.00 s = 100	■	■		■	■
SOL Inv. time coefficient	4	33...36	201	1.000 = 1000	■	■		■	■
CLPU status for I>>	4	37...40	143	Off=0;On=1	■	■		■	■
CLPU Pick-up value	4	41...44	201	1.00 xIn = 100	■	■		■	■
CLPU Operation delay	4	45...48	201	1.00 s = 100	■	■		■	■
CLPU Inv. time coefficient	4	49...52	201	1.000 = 1000	■	■		■	■
Include harmonics	4	53	143	Off=0;On=1	■	■		■	■
Reset type	4	54...57	143	DT=0;IDMT=1	■	■		■	■
Reset time	4	58...61	201	1.00 s = 100	■	■		■	■
OverCurrent I>>> setting									
Enable for I>>>	5	0	143	Off=0;On=1	■	■		■	■
Pick-up value	5	1...4	201	1.00 xIn = 100	■	■		■	■
Operation delay	5	5...8	201	1.00 s = 100	■	■		■	■
Inrush status for I>>>	5	9...12	143	Off=0;On=1	■	■		■	■
SOL use by I>>>	5	13...16	143	Off=0;On=1	■	■		■	■
SOL Operation delay	5	17...20	201	1.00 s = 100	■	■		■	■
CLPU status for I>>>	5	21...24	143	Off=0;On=1	■	■		■	■
CLPU Pick-up value	5	25...28	201	1.00 xIn = 100	■	■		■	■
CLPU Operation delay	5	29...32	201	1.00 s = 100	■	■		■	■
SOTF setting									
Enable for SOTF	6	0	143	Off=0;On=1	■	■		■	■
Pick-up value	6	1	201	1.00 xIn = 100	■	■		■	■
Dead line detection delay	6	2	201	1.00 s = 100	■	■		■	■
SOTF active Timer	6	3	201	1.00 s = 100	■	■		■	■
Dead line detection input	6	4	144	Value [5]	■	■		■	■
Iφ> setting									
Enable for Iφ>	7	0	143	Off=0;On=1	■			■	■
Pick-up value	7	1...4	201	1.00 xIn = 100	■			■	■
Direction mode	7	5...8	143	Dir+Backup=0;Undir=1; Dir=2	■			■	■
Angle offset	7	9...12	144	1 ° = 1	■			■	■
Delay curve family	7	13...16	143	DT=0;IEC=1;IEEE=2; IEEE2=3;Others=4; Prg1=5;Prg2=6;Prg3=7	■			■	■
Delay type	7	17...20	143	DT=0;NI=1;VI=2;EI=3; LTI=4;LTEI=5;LTVI=6; MI=7;STI=8;STEI=9;	■			■	■

5. DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DO1(B)=33;DO2(B)=34;DO3(B)=35; Watchdog=36;SF=37;SF=38;...;SF=40;SF=41;BO=42;DO1(C)=43;DO2(C)=44;DO3(C)=45;DO4(C)=46;LedAl=49;LedTr=50;LedA=51; LedB=52;LedC=53;LedDR=54;VO1=55;VO2=56;...;DI39=83;DI40=84;F1=85;F2=86;...;F6=90;F7=91;DO1(D)=97;DO2(D)=98;DO3(D) =99;SF=100;DO1(E)=101;DO2(E)=102;NI1=129;NI2=130;...;NI63=191;NI64=192;POC1=193;POC2=194;...;POC15=207;POC16=208; VI5=225;VI6=226;...;VI19=239;VI20=240;VO7=257;VO8=258;...;VO19=269;VO20=270;NI65=289;NI66=290;...;NI127=351;NI128=352

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
				CO8=10;RI=11;RXIDG=12					
Operation delay	7	21...24	201	1.00 s = 100	■			■	■
Inv. time coefficient	7	25...28	201	1.000 = 1000	■			■	■
Reset time	7	29...32	201	1.00 s = 100	■			■	■
Inrush status for Iφ>	7	33...36	143	Off=0;On=1	■			■	■
SOL status for Iφ>	7	37...40	143	Off=0;On=1	■			■	■
SOL Operation delay	7	41...44	201	1.00 s = 100	■			■	■
SOL Inv. time coefficient	7	45...48	201	1.000 = 1000	■			■	■
CLPU status for Iφ>	7	49...52	143	Off=0;On=1	■			■	■
CLPU Pick-up value	7	53...56	201	1.00 xIn = 100	■			■	■
CLPU Operation delay	7	57...60	201	1.00 s = 100	■			■	■
CLPU Inv. time coefficient	7	61...64	201	1.000 = 1000	■			■	■
Reset type	7	65...68	143	DT=0;IDMT=1	■			■	■
Iφ>> setting									
Enable for Iφ>>	8	0	143	Off=0;On=1	■			■	■
Pick-up value	8	1...4	201	1.00 xIn = 100	■			■	■
Direction mode	8	5...8	143	Dir+Backup=0;Undir=1;Dir=2	■			■	■
Angle offset	8	9...12	144	1 ° = 1	■			■	■
Delay curve family	8	13...16	143	DT=0;IEC=1;IEEE=2;IEEE2=3;Others=4;Prg1=5;Prg2=6;Prg3=7	■			■	■
Delay type	8	17...20	143	DT=0;NI=1;VI=2;EI=3;LTI=4;LTEI=5;LTVI=6;MI=7;STI=8;STEI=9;CO8=10;RI=11;RXIDG=12	■			■	■
Operation delay	8	21...24	201	1.00 s = 100	■			■	■
Inv. time coefficient	8	25...28	201	1.000 = 1000	■			■	■
Reset time	8	29...32	201	1.00 s = 100	■			■	■
Inrush status for Iφ>>	8	33...36	143	Off=0;On=1	■			■	■
SOL status for Iφ>>	8	37...40	143	Off=0;On=1	■			■	■
SOL Operation delay	8	41...44	201	1.00 s = 100	■			■	■
SOL Inv. time coefficient	8	45...48	201	1.000 = 1000	■			■	■
CLPU status for Iφ>>	8	49...52	143	Off=0;On=1	■			■	■
CLPU Pick-up value	8	53...56	201	1.00 xIn = 100	■			■	■
CLPU Operation delay	8	57...60	201	1.00 s = 100	■			■	■
CLPU Inv. time coefficient	8	61...64	201	1.000 = 1000	■			■	■
Reset type	8	65...68	143	DT=0;IDMT=1	■			■	■
Iφ>>> setting									
Enable for Iφ>>>	9	0	143	Off=0;On=1	■			■	■
Pick-up value	9	1...4	201	1.00 xIn = 100	■			■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
Direction mode	9	5...8	143	Dir+Backup=0;Undir=1; Dir=2	■			■	■
Angle offset	9	9...12	144	1 ° = 1	■			■	■
Operation delay	9	13...16	201	1.00 s = 100	■			■	■
Inrush status for Iφ>>>	9	17...20	143	Off=0;On=1	■			■	■
SOL status for Iφ>>>	9	21...24	143	Off=0;On=1	■			■	■
SOL Operation delay	9	25...28	201	1.00 s = 100	■			■	■
CLPU status for Iφ>>>	9	29...32	143	Off=0;On=1	■			■	■
CLPU Pick-up value	9	33...36	201	1.00 xIn = 100	■			■	■
CLPU Operation delay	9	37...40	201	1.00 s = 100	■			■	■
Iφ>>>> setting									
Enable for Iφ>>>>	10	0	143	Off=0;On=1	■			■	■
Pick-up value	10	1...4	201	1.00 xIn = 100	■			■	■
Direction mode	10	5...8	143	Dir+Backup=0;Undir=1; Dir=2	■			■	■
Angle offset	10	9...12	144	1 ° = 1	■			■	■
Operation delay	10	13...16	201	1.00 s = 100	■			■	■
Inrush status for Iφ>>>>	10	17...20	143	Off=0;On=1	■			■	■
SOL status for Iφ>>>>	10	21...24	143	Off=0;On=1	■			■	■
SOL Operation delay	10	25...28	201	1.00 s = 100	■			■	■
CLPU status for Iφ>>>>	10	29...32	143	Off=0;On=1	■			■	■
CLPU Pick-up value	10	33...36	201	1.00 xIn = 100	■			■	■
CLPU Operation delay	10	37...40	201	1.00 s = 100	■			■	■
P< setting									
Enable for P<	11	0	143	Off=0;On=1	■			■	■
Pick-up value	11	1...4	201	1 %Sn = 1	■			■	■
Operation delay	11	5...8	201	1.0 s = 10	■			■	■
P<< setting									
Enable for P<<	12	0	143	Off=0;On=1	■			■	■
Pick-up value	12	1...4	201	1 %Sn = 1	■			■	■
Operation delay	12	5...8	201	1.0 s = 10	■			■	■
I< setting									
Enable for I<	13	0	143	Off=0;On=1	■	■			■
Pick-up value	13	1...4	201	1.00 %In = 100	■	■			■
Operation delay	13	5...8	201	1.0 s = 10	■	■			■
I2>I1 setting									
Enable for I2/I1>	14	0	143	Off=0;On=1	■	■		■	■
Pick-up value	14	1...4	201	1 % = 1	■	■		■	■
Operation delay	14	5...8	201	1.00 s = 100	■	■		■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
I2> setting									
Enable for I2>	16	0	143	Off=0;On=1	■	■		■	■
Pick-up value	16	1...4	201	1.00 xIn = 100	■	■		■	■
Delay curve family	16	5...8	143	DT=0;IEC=1;IEEE=2; IEEE2=3;Others=4; Prg1=5;Prg2=6;Prg3=7	■	■		■	■
Delay type	16	9...12	143	DT=0;NI=1;VI=2;EI=3; LTI=4;LTEI=5;LTVI=6; MI=7;STI=8;STEI=9; CO8=10;RI=11;RXIDG= 12	■	■		■	■
Operation delay	16	13...16	201	1.00 s = 100	■	■		■	■
Inv. time coefficient	16	17...20	201	1.000 = 1000	■	■		■	■
Reset type	16	21...24	143	DT=0;IDMT=1	■	■		■	■
Reset time	16	25...28	201	1.00 s = 100	■	■		■	■
Ist> setting									
Enable for Ist>	17	0	143	Off=0;On=1	■	■			■
Delay type	17	1	143	DT=0;INV=1	■	■			■
Motor start time	17	2	201	1.0 s = 10	■	■			■
Ilr> setting									
Enable for Ilr>	18	0	143	Off=0;On=1	■	■			■
Pick-up value	18	1	201	1.0 % = 10	■	■			■
Delay type	18	2	143	DT=0;INV=1	■	■			■
Operation delay	18	3	201	1.0 s = 10	■	■			■
N> setting									
Enable for N>	19	0	143	Off=0;On=1	■	■			■
Max motor Hot starts	19	1	201	1 = 1	■	■			■
Max motor cold starts	19	2	201	1 = 1	■	■			■
Min time between motor starts	19	3	201	1.0 min = 10	■	■			■
Reference period	19	4	201	1.0 min = 10	■	■			■
Hot Status Limit	19	5	201	1.0 % = 10	■	■			■
Motor T> setting									
Enable for Motor T>	20	0	143	Off=0;On=1	■	■			■
Basic current setting	20	1...4	201	1.00 xIn = 100	■	■			■
Max permissive I factor	20	5...8	201	1.00 = 100	■	■			■
Heating time constant	20	9...12	201	1.0 min = 10	■	■			■
Time constant for motor starting	20	13...16	201	1.0 min = 10	■	■			■
Cooling time constant	20	17...20	201	1.0 min = 10	■	■			■
Unbalance factor	20	21...24	201	1.0 = 10	■	■			■
Thermal alarm value	20	25...28	201	1 % = 1	■	■			■
Reserve time thermal alarm	20	29...32	201	1.0 min = 10	■	■			■
Temperature based mode	20	33...36	143	Current=0;Ambient=1	■	■			■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
Nominal ambient temp	20	37...40	144	1 °C = 1 / 1 °F = 1	■	■			■
Max object temperature	20	41...44	144	1 °C = 1 / 1 °F = 1	■	■			■
Alarm temperature	20	45...48	144	1 °C = 1 / 1 °F = 1	■	■			■
Min ambient temperature	20	49...52	144	1 °C = 1 / 1 °F = 1	■	■			■
Default ambient temperature	20	53...56	144	1 °C = 1 / 1 °F = 1	■	■			■
Feeder T> setting									
Enable for feeder T>	21	0	143	Off=0;On=1	■	■		■	
Basic current setting	21	1...4	201	1.00 xIn = 100	■	■		■	
Max permissive I factor	21	5...8	201	1.00 = 100	■	■		■	
Heating time constant	21	9...12	201	1.0 min = 10	■	■		■	
Thermal alarm value	21	13...16	201	1 % = 1	■	■		■	
Reserve time thermal alarm	21	17...20	201	1.0 min = 10	■	■		■	
Temperature based mode	21	21...24	143	Current=0;Ambient=1	■	■		■	
Nominal ambient temp	21	25...28	144	1 °C = 1 / 1 °F = 1	■	■		■	
Max object temperature	21	29...32	144	1 °C = 1 / 1 °F = 1	■	■		■	
Alarm temperature	21	33...36	144	1 °C = 1 / 1 °F = 1	■	■		■	
Min ambient temperature	21	37...40	144	1 °C = 1 / 1 °F = 1	■	■		■	
Default ambient temperature	21	41...44	144	1 °C = 1 / 1 °F = 1	■	■		■	
Io> setting									
Enable for Io>	22	0	143	Off=0;On=1	■	■		■	■
Pick-up value	22	1...4	201	1.000 pu = 1000	■	■		■	■
Delay curve family	22	5...8	143	DT=0;IEC=1;IEEE=2; IEEE2=3;Others=4; Prg1=5;Prg2=6;Prg3=7	■	■		■	■
Delay type	22	9...12	143	DT=0;NI=1;VI=2;EI=3; LTI=4;LTEI=5;LTVI=6; MI=7;STI=8;STEI=9; CO8=10;RI=11;RXIDG=12	■	■		■	■
Operation delay	22	13...16	201	1.00 s = 100	■	■		■	■
Inv. time coefficient	22	17...20	201	1.000 = 1000	■	■		■	■
Network earthing	22	21...24	143	Res=0;Cap=1	■	■		■	■
Reset time	22	25...28	201	1.00 s = 100	■	■		■	■
Inrush status for Io>	22	29...32	143	Off=0;On=1	■	■		■	■
SOL use for Io>	22	33...36	143	Off=0;On=1	■	■		■	■
SOL Operation delay	22	37...40	201	1.00 s = 100	■	■		■	■
SOL Inv. time coefficient	22	41...44	201	1.000 = 1000	■	■		■	■
CLPU status for Io>	22	45...48	143	Off=0;On=1	■	■		■	■
CLPU Pick-up value	22	49...52	201	1.00 xIn = 100	■	■		■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
CLPU Operation delay	22	53...56	201	1.00 s = 100	■	■		■	■
CLPU Inv. time coefficient	22	57...60	201	1.000 = 1000	■	■		■	■
Reset type	22	61...64	143	DT=0;IDMT=1	■	■		■	■
Enable faulty phase detection	22	65	143	Off=0;On=1	■	■		■	■
Phase currents change limit	22	66	143	1 % = 1	■	■		■	■
Io>> setting									
Enable for Io>>	23	0	143	Off=0;On=1	■	■		■	■
Pick-up value	23	1...4	201	1.00 pu = 100	■	■		■	■
Delay curve family	23	5...8	143	DT=0;IEC=1;IEEE=2; IEEE2=3;Others=4; Prg1=5;Prg2=6;Prg3=7	■	■		■	■
Delay type	23	9...12	143	DT=0;NI=1;VI=2;EI=3; LTI=4;LTEI=5;LTVI=6; MI=7;STI=8;STEI=9; CO8=10;RI=11;RXIDG= 12	■	■		■	■
Operation delay	23	13...16	201	1.00 s = 100	■	■		■	■
Inv. time coefficient	23	17...20	201	1.000 = 1000	■	■		■	■
Network earthing	23	21...24	143	Res=0;Cap=1	■	■		■	■
Inrush status for Io>>	23	25...28	143	Off=0;On=1	■	■		■	■
SOL use for Io>>	23	29...32	143	Off=0;On=1	■	■		■	■
SOL Operation delay	23	33...36	201	1.00 s = 100	■	■		■	■
SOL Inv. time coefficient	23	37...40	201	1.000 = 1000	■	■		■	■
CLPU status for Io>>	23	41...44	143	Off=0;On=1	■	■		■	■
CLPU Pick-up value	23	45...48	201	1.00 xIn = 100	■	■		■	■
CLPU Operation delay	23	49...52	201	1.00 s = 100	■	■		■	■
CLPU Inv. time coefficient	23	53...56	201	1.000 = 1000	■	■		■	■
Reset type	23	57...60	143	DT=0;IDMT=1	■	■		■	■
Reset time	23	61...64	201	1.00 s = 100	■	■		■	■
Enable faulty phase detection	23	65	143	Off=0;On=1	■	■		■	■
Phase currents change limit	23	66	143	1 % = 1	■	■		■	■
Io>>> setting									
Enable for Io>>>	24	0	143	Off=0;On=1	■	■		■	■
Pick-up value	24	1...4	201	1.00 pu = 100	■	■		■	■
Operation delay	24	5...8	201	1.00 s = 100	■	■		■	■
Network earthing	24	9...12	143	Res=0;Cap=1		■		■	■
Inrush status for Io>>>	24	13...16	143	Off=0;On=1		■		■	■
SOL use for Io>>>	24	17...20	143	Off=0;On=1		■		■	■
SOL Operation delay	24	21...24	201	1.00 s = 100		■		■	■
CLPU status for Io>>>	24	25...28	143	Off=0;On=1		■		■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
CLPU Pick-up value	24	29...32	201	1.00 xIn = 100		■		■	■
CLPU Operation delay	24	33...36	201	1.00 s = 100		■		■	■
Enable faulty phase detection	24	37	143	Off=0;On=1		■		■	■
Phase currents change limit	24	38	143	1 % = 1		■		■	■
Io>>>> setting									
Enable for Io>>>>	25	0	143	Off=0;On=1		■		■	■
Pick-up value	25	1...4	201	1.00 pu = 100		■		■	■
Operation delay	25	5...8	201	1.00 s = 100		■		■	■
Network earthing	25	9...12	143	Res=0;Cap=1		■		■	■
Inrush status for Io>>>>	25	13...16	143	Off=0;On=1		■		■	■
SOL use for Io>>>>	25	17...20	143	Off=0;On=1		■		■	■
SOL Operation delay	25	21...24	201	1.00 s = 100		■		■	■
CLPU status for Io>>>>	25	25...28	143	Off=0;On=1		■		■	■
CLPU Pick-up value	25	29...32	201	1.00 xIn = 100		■		■	■
CLPU Operation delay	25	33...36	201	1.00 s = 100		■		■	■
Enable faulty phase detection	25	37	143	Off=0;On=1		■		■	■
Phase currents change limit	25	38	143	1 % = 1		■		■	■
Io>>>>> setting									
Enable for Io>>>>>	26	0	143	Off=0;On=1		■		■	■
Pick-up value	26	1...4	201	1.00 pu = 100		■		■	■
Operation delay	26	5...8	201	1.00 s = 100		■		■	■
Ioφ> setting									
Enable for Ioφ>	27	0	143	Off=0;On=1	■			■	■
Direction mode	27	1...4	143	ResCap=0;Sector=1; Undir=2	■			■	■
Char ctrl. in ResCap mode	27	5...8	143	Res=0;Cap=1;DI1=2; DI2=3;...;DI19=20;DI20= 21;Arc1=26;Arc2=27;BI= 28;VI1=30;VI2=31;VI3= 32;VI4=33;DI21=66; DI22=67;...;DI31=76; DI32=77	■			■	■
Pick-up value	27	9...12	201	1.000 pu = 1000	■			■	■
Uo setting for Ioφ> stage	27	13...16	201	1.0 % = 10	■			■	■
Angle offset	27	17...20	144	1 ° = 1	■			■	■
Pick up sector size	27	21...24	144	1 ±° = 1	■			■	■
Delay curve family	27	25...28	143	DT=0;IEC=1;IEEE=2; IEEE2=3;Others=4; Prg1=5;Prg2=6;Prg3=7	■			■	■
Delay type	27	29...32	143	DT=0;NI=1;VI=2;EI=3; LTI=4;LTEI=5;LTVI=6; MI=7;STI=8;STEI=9; CO8=10;RI=11;RXIDG= 12	■			■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
Operation delay	27	33...36	201	1.00 s = 100	■			■	■
Inv. time coefficient	27	37...40	201	1.000 = 1000	■			■	■
Reset type	27	41...44	143	DT=0;IDMT=1	■			■	■
Reset time	27	45...48	201	1.00 s = 100	■			■	■
Ioφ>> setting									
Enable for Ioφ>>	28	0	143	Off=0;On=1	■			■	■
Direction mode	28	1...4	143	ResCap=0;Sector=1; Undir=2	■			■	■
Char ctrl. in ResCap mode	28	5...8	143	Res=0;Cap=1;DI1=2; DI2=3;...;DI19=20;DI20= 21;Arc1=26;Arc2=27;BI= 28;VI1=30;VI2=31;VI3= 32;VI4=33;DI21=66; DI22=67;...;DI31=76; DI32=77	■			■	■
Pick-up value	28	9...12	201	1.000 pu = 1000	■			■	■
Uo setting for Ioφ>> stage	28	13...16	201	1.0 % = 10	■			■	■
Angle offset	28	17...20	144	1 ° = 1	■			■	■
Pick up sector size	28	21...24	144	1 ±° = 1	■			■	■
Delay curve family	28	25...28	143	DT=0;IEC=1;IEEE=2; IEEE2=3;Others=4; Prg1=5;Prg2=6;Prg3=7	■			■	■
Delay type	28	29...32	143	DT=0;NI=1;VI=2;EI=3; LTI=4;LTEI=5;LTVI=6; MI=7;STI=8;STEI=9; CO8=10;RI=11;RXIDG= 12	■			■	■
Operation delay	28	33...36	201	1.00 s = 100	■			■	■
Inv. time coefficient	28	37...40	201	1.000 = 1000	■			■	■
Reset type	28	41...44	143	DT=0;IDMT=1	■			■	■
Reset time	28	45...48	201	1.00 s = 100	■			■	■
Ioφ>>>setting									
Enable for Ioφ>>>	29	0	143	Off=0;On=1	■			■	■
Direction mode	29	1...4	143	ResCap=0;Sector=1; Undir=2	■			■	■
Char ctrl. in ResCap mode	29	5...8	143	Res=0;Cap=1;DI1=2; DI2=3;...;DI19=20;DI20= 21;Arc1=26;Arc2=27;BI= 28;VI1=30;VI2=31;VI3= 32;VI4=33;DI21=66; DI22=67;...;DI31=76; DI32=77	■			■	■
Pick-up value	29	9...12	201	1.000 pu = 1000	■			■	■
Uo setting for Ioφ>>> stage	29	13...16	201	1.0 % = 10	■			■	■
Angle offset	29	17...20	144	1 ° = 1	■			■	■
Pick up sector size	29	21...24	144	1 ±° = 1	■			■	■
Delay curve family	29	25...28	143	DT=0;IEC=1;IEEE=2; IEEE2=3;Others=4; Prg1=5;Prg2=6;Prg3=7	■			■	■
Delay type	29	29...32	143	DT=0;NI=1;VI=2;EI=3; LTI=4;LTEI=5;LTVI=6; MI=7;STI=8;STEI=9; CO8=10;RI=11;RXIDG= 12	■			■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
Operation delay	29	33...36	201	1.00 s = 100	■			■	■
Inv. time coefficient	29	37...40	201	1.000 = 1000	■			■	■
Reset type	29	41...44	143	DT=0;IDMT=1	■			■	■
Reset time	29	45...48	201	1.00 s = 100	■			■	■
IoUo> setting									
Enable for IoUo>	30	0	143	Off=0;On=1				■	■
Direction mode	30	1...4	143	Forward=0;Reverse=1				■	■
Inhibit ctrl.	30	5...8	143	DI1=1;DI2=2;...;DI19=19; DI20=20;Arc1=25;Arc2= 26;BI=27;VI1=29;VI2= 30;VI3=31;VI4=32;DI21= 65;DI22=66;...;DI39=83; DI40=84;VI5=225;VI6= 226;...;VI19=239;VI20= 240				■	■
Timer instant delay ctrl.	30	9...12	143	DI1=1;DI2=2;...;DI19=19; DI20=20;Arc1=25;Arc2= 26;BI=27;VI1=29;VI2= 30;VI3=31;VI4=32;DI21= 65;DI22=66;...;DI31=75; DI32=76					■
Pick-up value	30	13...16	201	1.00 %Pno = 100				■	■
Uo pick-up value	30	17...20	201	1.0 % = 10				■	■
Pick-up sector size	30	21...24	144	1 ±° = 1				■	■
Operation delay	30	25...28	201	1.00 s = 100				■	■
SOL Mode	30	29...32	143	Off=0;On=1					■
SOL Operation delay	30	33...36	201	1.00 s = 100					■
Memory Mode	30	37...40	143	None=0;Voltage=1; Time=2;Both=3				■	■
Uo pick-up value	30	41...44	201	1.0 % = 10				■	■
Memory time	30	45...48	201	1.00 s = 100				■	■
Reset time	30	49	201	1.00 s = 100				■	■
IoUo>> setting									
Enable for IoUo>>	31	0	143	Off=0;On=1				■	■
Direction mode	31	1...4	143	Forward=0;Reverse=1				■	■
Input for inhibit control	31	5...8	143	DI1=1;DI2=2;...;DI19=19; DI20=20;Arc1=25;Arc2= 26;BI=27;VI1=29;VI2= 30;VI3=31;VI4=32;DI21= 65;DI22=66;...;DI39=83; DI40=84;VI5=225;VI6= 226;...;VI19=239;VI20= 240				■	■
Timer instant delay ctrl.	31	9...12	143	DI1=1;DI2=2;...;DI19=19; DI20=20;Arc1=25;Arc2= 26;BI=27;VI1=29;VI2= 30;VI3=31;VI4=32;DI21= 65;DI22=66;...;DI39=83; DI40=84;VI5=225;VI6= 226;...;VI19=239;VI20= 240				■	■
Pick-up value	31	13...16	201	1.00 %Pno = 100				■	■
Uo pick-up value	31	17...20	201	1.0 % = 10				■	■
Pick up sector size	31	21...24	144	1 ±° = 1				■	■
Operation delay	31	25...28	201	1.00 s = 100				■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
SOL Mode	31	29...32	143	Off=0;On=1				■	■
SOL Operation delay	31	33...36	201	1.00 s = 100				■	■
Memory Mode	31	37...40	143	None=0;Voltage=1; Time=2;Both=3				■	■
Uo memory value	31	41...44	201	1.0 % = 10				■	■
Memory time	31	45...48	201	1.00 s = 100				■	■
Reset time	31	49	201	1.00 s = 100				■	■
U> setting									
Enable for U>	32	0	143	Off=0;On=1	■		■	■	■
Pick-up value	32	1...4	201	1.0 %Un = 10	■		■	■	■
Operation delay	32	5...8	201	1.00 s = 100	■		■	■	■
Reset time	32	9	201	1.00 s = 100	■		■	■	■
Hysteresis	32	10	201	1.0 % = 10	■		■	■	■
U>> setting									
Enable for U>>	33	0	143	Off=0;On=1	■		■	■	■
Pick-up value	33	1...4	201	1.0 %Un = 10	■		■	■	■
Operation delay	33	5...8	201	1.00 s = 100	■		■	■	■
Hysteresis	33	9	201	1.0 % = 10	■		■	■	■
U>>> setting									
Enable for U>>>	34	0	143	Off=0;On=1	■		■	■	■
Pick-up value	34	1...4	201	1.0 %Un = 10	■		■	■	■
Operation delay	34	5...8	201	1.00 s = 100	■		■	■	■
Hysteresis	34	9	201	1.0 % = 10	■		■	■	■
U< setting									
Enable for U<	35	0	143	Off=0;On=1	■		■	■	■
Pick-up value	35	1...4	201	1.0 %Un = 10	■		■	■	■
Operation delay	35	5...8	201	1.00 s = 100	■		■	■	■
Reset time	35	9	201	1.00 s = 100	■		■	■	■
Hysteresis	35	10	201	1.0 % = 10	■		■	■	■
U<< setting									
Enable for U<<	36	0	143	Off=0;On=1	■		■	■	■
Pick-up value	36	1...4	201	1.0 %Un = 10	■		■	■	■
Operation delay	36	5...8	201	1.00 s = 100	■		■	■	■
Hysteresis	36	9	201	1.0 % = 10	■		■	■	■
U<<< setting									
Enable for U<<<	37	0	143	Off=0;On=1	■		■	■	■
Pick-up value	37	1...4	201	1.0 %Un = 10	■		■	■	■
Operation delay	37	5...8	201	1.00 s = 100	■		■	■	■
Hysteresis	37	9	201	1.0 % = 10	■		■	■	■
U1< setting									
Enable for U1<	38	0	143	Off=0;On=1			■		■
Pick-up value	38	1...4	201	1 %Vn = 1			■		■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
Operation delay	38	5...8	201	1.00 s = 100			■		■
Low voltage blocking	38	9	201	1.0 %Un = 10			■		■
U1<< setting									
Enable for U1<<	39	0	143	Off=0;On=1			■		■
Pick-up value	39	1...4	201	1 %Vn = 1			■		■
Operation delay	39	5...8	201	1.00 s = 100			■		■
Low voltage blocking	39	9	201	1.0 %Un = 10			■		■
Uo> setting									
Enable for Uo>	40	0	143	Off=0;On=1	■		■	■	■
Pick-up value	40	1...4	201	1 % = 1	■		■	■	■
Operation delay	40	5...8	201	1.00 s = 100	■		■	■	■
Reset time	40	9...12	201	1.00 s = 100	■		■	■	■
Uo>> setting									
Enable for Uo>>	41	0	143	Off=0;On=1	■		■	■	■
Pick-up value	41	1...4	201	1 % = 1	■		■	■	■
Operation delay	41	5...8	201	1.00 s = 100	■		■	■	■
Reset time	41	9...12	201	1.00 s = 100	■		■	■	■
Uo>>> setting									
Enable for Uo>>>	42	0	143	Off=0;On=1	■		■	■	■
Pick-up value	42	1...4	201	1 % = 1	■		■	■	■
Operation delay	42	5...8	201	1.00 s = 100	■		■	■	■
Reset time	42	9...12	201	1.00 s = 100	■		■	■	■
fX setting									
Enable for fX	43	0	143	Off=0;On=1	■		■	■	■
Pick-up value	43	1...4	201	50.00 Hz = 5000	■		■	■	■
Operation delay	43	5...8	201	1.00 s = 100	■		■	■	■
Low voltage blocking	43	9	201	1.0 %Un = 10	■		■	■	■
fXX setting									
Enable for fXX	44	0	143	Off=0;On=1	■		■	■	■
Pick-up value	44	1...4	201	50.00 Hz = 5000	■		■	■	■
Operation delay	44	5...8	201	1.00 s = 100	■		■	■	■
Low voltage blocking	44	9	201	1.0 %Un = 10	■		■	■	■
f< setting									
Enable for f<	45	0	143	Off=0;On=1	■		■	■	■
Pick-up value	45	1...4	201	50.00 Hz = 5000	■		■	■	■
Operation delay	45	5...8	201	1.00 s = 100	■		■	■	■
Low voltage blocking	45	9	201	1.0 %Un = 10	■		■	■	■
f<< setting									
Enable for f<<	46	0	143	Off=0;On=1	■		■	■	■
Pick-up value	46	1...4	201	50.00 Hz = 5000	■		■	■	■
Operation delay	46	5...8	201	1.00 s = 100	■		■	■	■
Low voltage blocking	46	9	201	1.0 %Un = 10	■		■	■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
CBFail setting									
Enable for CB fail	47	0	143	Off=0;On=1	■	■	■	■	■
Enable CBF timer1	47	1	143	Off=0;On=1	■	■	■	■	■
Timer1 Operation Delay	47	2	201	1.00 s = 100	■	■	■	■	■
Enable CBF timer2	47	3	143	Off=0;On=1	■	■	■	■	■
Timer2 Operation Delay	47	4	201	1.00 s = 100	■	■	■	■	■
Noncurrent CBF reset mode	47	5	143	I<Only=0;PoleDead=1; ProtRst=2	■	■	■	■	■
Ext. CBF reset mode	47	6	143	I<Only=0;PoleDead=1; ProtRst=2	■	■	■	■	■
I< current set	47	7	201	1.00 xIn = 100	■	■		■	■
Io< current set	47	8	201	1.000 pu = 1000	■	■		■	■
Io'< current set	47	9	201	1.000 pu = 1000		■		■	■
Ih5> setting									
Enable for Ih5>	49	0	143	Off=0;On=1	■	■		■	■
Pick-up value	49	1	201	1 % = 1	■	■		■	■
Operation delay	49	2	201	1.00 s = 100	■	■		■	■
CT setting									
Enable for CT supervision	50	0	143	Off=0;On=1	■	■		■	■
CTS Operate mode	50	1	143	3I only=0;I0&U0=1;Both=2	■	■		■	■
CTS reset input	50	2	144	Value [6]	■	■		■	■
Operation delay	50	3	201	1.00 s = 100	■	■		■	■
Residual current >	50	4	201	1.00 xIn = 100	■			■	■
Residual voltage <	50	5	201	1.0 %Un = 10	■			■	■
VT setting									
Enable for VTS	51	0	143	Off=0;On=1	■		■	■	■
U2> setting	51	1	201	1.0 %Vn = 10	■			■	■
I2< setting	51	2	201	1.00 xIn = 100	■			■	■
Operation delay	51	3	201	1.00 s = 100	■			■	■
VTS output reset	51	4	144	Value [7]	■			■	■
DI for MCB position	51	5	144	DI1=1;DI2=2;...;DI39=39; DI40=40	■		■	■	■
Io'> setting									
Enable for Io'>	52	0	143	Off=0;On=1		■		■	■

6. DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DO1(B)=33;DO2(B)=34;DO3(B)=35; Watchdog=36;SF=37;SF=38;SF=39;SF=40;SF=41;BO=42;DO1(C)=43;DO2(C)=44;DO3(C)=45;DO4(C)=46;LedAl=49;LedTr=50;LedA=51;LedB=52;LedC=53;LedDR=54;VO1=55;VO2=56;...;VO5=59;VO6=60;DI21=65;DI22=66;...;DI39=83;DI40=84;F1=85;F2=86;...;F6=90;F7=91;DO1(D)=97;DO2(D)=98;DO3(D)=99;SF=100;DO1(E)=101;DO2(E)=102;NI1=129;NI2=130;...;NI63=191;NI64=192;POC1=193;POC2=194;...;POC15=207;POC16=208;VI5=225;VI6=226;...;VI19=239;VI20=240;VO7=257;VO8=258;...;VO19=269;VO20=270;NI65=289;NI66=290;...;NI127=351;NI128=352
7. DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DO1(B)=33;DO2(B)=34;DO3(B)=35; Watchdog=36;SF=37;SF=38;SF=39;SF=40;SF=41;BO=42;DO1(C)=43;DO2(C)=44;DO3(C)=45;DO4(C)=46;LedAl=49;LedTr=50;LedA=51;LedB=52;LedC=53;LedDR=54;VO1=55;VO2=56;...;VO5=59;VO6=60;DI21=65;DI22=66;...;DI39=83;DI40=84;F1=85;F2=86;...;F7=91;DO1(D)=97;DO2(D)=98;DO3(D)=99;SF=100;DO1(E)=101;DO2(E)=102;NI1=129;NI2=130;...;NI63=191;NI64=192;POC1=193;POC2=194;...;POC15=207;POC16=208;VI5=225;VI6=226;...;VI19=239;VI20=240;VO7=257;VO8=258;...;VO19=269;VO20=270;NI65=289;NI66=290;...;NI127=351;NI128=352

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
Pick-up value	52	1...4	201	1.000 pu = 1000		■		■	■
Delay curve family	52	5...8	143	DT=0;IEC=1;IEEE=2; IEEE2=3;Others=4; Prg1=5;Prg2=6;Prg3=7		■		■	■
Delay type	52	9...12	143	DT=0;NI=1;VI=2;EI=3; LTI=4;LTEI=5;LTVI=6; MI=7;STI=8;STEI=9; CO8=10;RI=11;RXIDG= 12		■		■	■
Operation delay	52	13...16	201	1.00 s = 100		■		■	■
Inv. time coefficient	52	17...20	201	1.000 = 1000		■		■	■
Network grounding	52	21...24	143	Res=0;Cap=1		■		■	■
Reset time	52	25...28	201	1.00 s = 100		■		■	■
Inrush status for Io'>	52	29...32	143	Off=0;On=1		■		■	■
SOL status for Io'>	52	33...36	143	Off=0;On=1		■		■	■
SOL Operation delay	52	37...40	201	1.00 s = 100		■		■	■
SOL Inv. time coefficient	52	41...44	201	1.000 = 1000		■		■	■
CLPU status for Io'>	52	45...48	143	Off=0;On=1		■		■	■
CLPU Pick-up value	52	49...52	201	1.00 xIn = 100		■		■	■
CLPU Operation delay	52	53...56	201	1.00 s = 100		■		■	■
CLPU Inv. time coefficient	52	57...60	201	1.000 = 1000		■		■	■
Reset type	52	61...64	143	DT=0;IDMT=1		■		■	■
Enable faulty phase detection	52	65	143	Off=0;On=1		■		■	■
Phase currents change limit	52	66	143	1 % = 1		■		■	■
Io'>> setting									
Enable for Io'>>	53	0	143	Off=0;On=1		■		■	■
Pick-up value	53	1...4	201	1.000 pu = 1000		■		■	■
Delay curve family	53	5...8	143	DT=0;IEC=1;IEEE=2; IEEE2=3;Others=4; Prg1=5;Prg2=6;Prg3=7		■		■	■
Delay type	53	9...12	143	DT=0;NI=1;VI=2;EI=3; LTI=4;LTEI=5;LTVI=6; MI=7;STI=8;STEI=9; CO8=10;RI=11;RXIDG= 12		■		■	■
Operation delay	53	13...16	201	1.00 s = 100		■		■	■
Inv. time coefficient	53	17...20	201	1.000 = 1000		■		■	■
Network earthing	53	21...24	143	Res=0;Cap=1		■		■	■
Inrush status for Io'>>	53	25...28	143	Off=0;On=1		■		■	■
SOL status for Io'>>	53	29...32	143	Off=0;On=1		■		■	■
SOL Operation delay	53	33...36	201	1.00 s = 100		■		■	■
SOL Inv. time coefficient	53	37...40	201	1.000 = 1000		■		■	■
CLPU status for Io'>>	53	41...44	143	Off=0;On=1		■		■	■
CLPU Pick-up value	53	45...48	201	1.00 xIn = 100		■		■	■
CLPU Operation delay	53	49...52	201	1.00 s = 100		■		■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
CLPU Inv. time coefficient	53	53...56	201	1.000 = 1000		■		■	■
Reset type	53	57...60	143	DT=0;IDMT=1		■		■	■
Reset time	53	61...64	201	1.00 s = 100		■		■	■
Enable faulty phase detection	53	65	143	Off=0;On=1		■		■	■
Phase currents change limit	53	66	143	1 % = 1		■		■	■
Io'>>> setting									
Enable for Io'>>>	54	0	143	Off=0;On=1		■		■	■
Pick-up value	54	1...4	201	1.000 pu = 1000		■		■	■
Operation delay	54	5...8	201	1.00 s = 100		■		■	■
Network grounding	54	9...12	143	Res=0;Cap=1		■		■	■
Inrush status for Io'>>>	54	13...16	143	Off=0;On=1		■		■	■
SOL status for Io'>>>	54	17...20	143	Off=0;On=1		■		■	■
SOL Operation delay	54	21...24	201	1.00 s = 100		■		■	■
CLPU status for Io'>>>	54	25...28	143	Off=0;On=1		■		■	■
CLPU Pick-up value	54	29...32	201	1.00 xIn = 100		■		■	■
CLPU Operation delay	54	33...36	201	1.00 s = 100		■		■	■
Enable faulty phase detection	54	37	143	Off=0;On=1		■		■	■
Phase currents change limit	54	38	143	1 % = 1		■		■	■
Uc> setting									
Enable for Uc>	55	0	143	Off=0;On=1		■		■	
Pick-up value	55	1...4	201	1.00 xUcLN = 100		■		■	
Operation delay	55	5...8	201	1.0 s = 10		■		■	
df/dt> setting									
Enable for df/dt>	56	0	143	Off=0;On=1	■		■	■	
Direction of change	56	1...4	143	Negative=0;Positive=1; Either=2	■		■	■	
Pick-up value	56	5...8	201	1.0 Hz/s = 10	■		■	■	
Operation delay	56	9...12	201	1.00 s = 100	■		■	■	
Low voltage blocking	56	13	201	1.0 %Un = 10	■		■	■	
df/dt>> setting									
Enable for df/dt>>	57	0	143	Off=0;On=1	■		■	■	
Direction of change	57	1...4	143	Negative=0;Positive=1; Either=2	■		■	■	
Pick-up value	57	5...8	201	1.0 Hz/s = 10	■		■	■	
Operation delay	57	9...12	201	1.00 s = 100	■		■	■	
Low voltage blocking	57	13	201	1.0 %Un = 10	■		■	■	
IoInt> setting									
Enable for IoInt>	58	0	143	Off=0;On=1				■	
Direction mode	58	1...4	143	Forward=0;Reverse=1				■	

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
Uo pick-up value	58	5...8	201	1 % = 1				■	
Operation delay	58	9...12	201	1.00 s = 100				■	
Min number of peaks	58	13...16	143	1 = 1				■	
Reset delay	58	17...20	201	1.00 s = 100				■	
Intermittent time	58	21	201	1.00 s = 100				■	
Feeder Fault Locator setting									
Pick-up value	59	0	201	1.00 xIn = 100				■	
Triggering digital input	59	1	144	Value [8]				■	
Line reactance/unit	59	2	201	1.000 ohm = 1000				■	
Earth factor	59	3	201	1.000 = 1000				■	
Earth factor angle	59	4	144	1 ° = 1				■	
Event enabling	59	5	143	Off=0;On=1				■	
Average voltage limit	59	6	201	1.0 %Un = 10				■	
Io limit	59	7	201	1.00 xIn = 100				■	
DI timeout	59	8	201	1.00 s = 100				■	
Release timeout	59	9	201	1.00 s = 100				■	
Synchro-check 1 setting									
Enable for Synchro check 1	60	0	143	Off=0;On=1	■		■	■	■
CB object 1	60	1	143	Object 1=1;Object 2=2; Object 3=3;Object 4=4; Object 5=5;Object 6=6	■		■	■	■
CB object 2	60	2	143	Object 1=1;Object 2=2; Object 3=3;Object 4=4; Object 5=5;Object 6=6	■		■	■	■
Input for selecting Object2	60	3	144	Value [8]	■		■	■	■
Inhibit closing unselected CB	60	4	143	Off=0;On=1	■		■	■	■
Synchronization mode	60	5	143	Off=0;Async=1;Sync=2	■		■	■	■
Voltage check mode	60	6	143	DD=1;DL=2;LD=3;DD/DL=4;DD/LD=5;DL/LD=6;DD/DL/LD=7	■		■	■	■
CB closing time	60	7	201	1.00 s = 100	■		■	■	■
Bypass DI	60	8	144	Value [9]	■		■	■	■
Bypass	60	9	143	1 = 1	■		■	■	■
Ok pulse length	60	10	144	1 ms = 1	■		■	■	■
Udead limit setting	60	11...14	201	1.0 %Un = 10	■		■	■	■
Ulive limit setting	60	15...18	201	1.0 %Un = 10	■		■	■	■

8. DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DO1(B)=33;DO2(B)=34;DO3(B)=35;Watchdog=36;SF=37;SF=38;SF=39;SF=40;SF=41;BO=42;DO1(C)=43;DO2(C)=44;DO3(C)=45;DO4(C)=46;LedAl=49;LedTr=50;LedA=51;LedB=52;LedC=53;LedDR=54;VO1=55;VO2=56;...;VO5=59;VO6=60;DI21=65;DI22=66;...;DI39=83;DI40=84;F1=85;F2=86;...;F6=90;F7=91;DO1(D)=97;DO2(D)=98;DO3(D)=99;SF=100;DO1(E)=101;DO2(E)=102;NI1=129;NI2=130;...;NI63=191;NI64=192;POC1=193;POC2=194;...;POC15=207;POC16=208;VI5=225;VI6=226;...;VI19=239;VI20=240;VO7=257;VO8=258;...;VO19=269;VO20=270;NI65=289;NI66=290;...;NI127=351;NI128=352
9. DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DO1(B)=33;DO2(B)=34;DO3(B)=35;Watchdog=36;SF=37;SF=38;SF=39;SF=40;SF=41;BO=42;DO1(C)=43;DO2(C)=44;DO3(C)=45;DO4(C)=46;LedAl=49;LedTr=50;LedA=51;LedB=52;LedC=53;LedDR=54;VO1=55;VO2=56;VO3=57;VO4=58;VO5=59;VO6=60;DI21=65;DI22=66;...;DI39=83;DI40=84;F1=85;F2=86;...;F6=90;F7=91;DO1(D)=97;DO2(D)=98;DO3(D)=99;SF=100;DO1(E)=101;DO2(E)=102;NI1=129;NI2=130;...;NI63=191;NI64=192;POC1=193;POC2=194;...;POC15=207;POC16=208;VI5=225;VI6=226;...;VI19=239;VI20=240;VO7=257;VO8=258;...;VO19=269;VO20=270;NI65=289;NI66=290;...;NI127=351;NI128=352

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
Frequency difference	60	19...22	201	50.00 Hz = 5000	■		■	■	■
Voltage difference	60	23...26	201	1.0 %Un = 10	■		■	■	■
Phase angle difference	60	27...30	144	1 ° = 1	■		■	■	■
Request timeout	60	31...34	201	1.0 s = 10	■		■	■	■
CB Monitoring setting									
Enable for CB monitoring	61	0	143	Off=0;On=1	■	■		■	■
Alarm level	61	1...2	201	1.00 kA = 100	■	■		■	■
Limit for operation left	61	3...4	201	1000 = 1000	■	■		■	■
High limit (primary value)	61	5...8	201	1.0 kA = 10	■	■		■	■
Motor status									
Motor status	62	0	143	Off=0;On=1	■	■			■
Nom motor start current	62	1	201	1.00 xIn = 100	■	■			■
Motor start detection current	62	2	201	1.00 xIn = 100	■	■			■
Motor start detection mode	62	3	143	CBPos=0;Current=1; CBPos&Cur=2	■	■			■
Enable motor speed detection	62	4	143	Off=0;On=1	■	■			■
Motor speed input DI	62	5	144	Slot C DI1=0;Slot D DI1= 1;Slot E DI1=2	■	■			■
Rated motor speed Ωn	62	6	201	1 rpm = 1	■	■			■
Pulse per rotation	62	7	201	1 = 1	■	■			■
Zero speed confirm time	62	8	201	1 s = 1	■	■			■
SOL setting									
Enable for SOL	63	0	143	Off=0;On=1	■	■		■	■
SOL signal number	63	1	143	1=0;2=1	■	■		■	■
CB Trip Clearing time	63	2	201	1.00 s = 100	■	■		■	■
Admittance E/F Io/Uo> setting									
Enable for Io/Uo>	64	0	143	Off=0;On=1				■	■
Io input	64	1	143	Io=0;Io CSH=1;Iocalc=2; Io'=3					■
Uo pick-up value	64	2...5	201	1.0 % = 10				■	■
Correction angle	64	6...9	144	1 ° = 1				■	■
Admittance E/F Io/Uo> YN>									
Enable for YN>	65	0	143	Off=0;On=1				■	■
Pick-up value	65	1...4	201	1.0 Yn% = 10				■	■
Input for inhibit control	65	5...8	143	DI1=1;DI2=2;...;DI19=19; DI20=20;Arc1=25;Arc2= 26;BI=27;VI1=29;VI2= 30;VI3=31;VI4=32;DI21= 65;DI22=66;...;DI39=83; DI40=84;VI5=225;VI6= 226;...;VI19=239;VI20= 240				■	■
Operation delay	65	9...12	201	1.00 s = 100				■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
Reset time	65	13...16	201	1.00 s = 100				■	■
SOL Mode	65	17...20	143	Off=0;On=1				■	■
SOL Operation delay	65	21...24	201	1.00 s = 100				■	■
Admittance E/F Io/Uo> GN>									
Enable for GN>	66	0	143	Off=0;On=1				■	■
Pick-up value	66	1...4	201	1.0 Gn% = 10				■	■
Input for inhibit control	66	5...8	143	DI1=1;DI2=2;...;DI19=19; DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DI21=65;DI22=66;...;DI39=83; DI40=84;VI5=225;VI6=226;...;VI19=239;VI20=240				■	■
Direction mode	66	9...12	143	Undir=0;Forward=1; Reverse=2				■	■
Operation delay	66	13...16	201	1.00 s = 100				■	■
Reset time	66	17...20	201	1.00 s = 100				■	■
SOL Mode	66	21...24	143	Off=0;On=1				■	■
SOL Operation delay	66	25...28	201	1.00 s = 100				■	■
Admittance E/F Io/Uo> BN>									
Enable for BN>	67	0	143	Off=0;On=1				■	■
Pick-up value	67	1...4	201	1.0 Bn% = 10				■	■
Input for inhibit control	67	5...8	143	DI1=1;DI2=2;...;DI19=19; DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DI21=65;DI22=66;...;DI39=83; DI40=84;VI5=225;VI6=226;...;VI19=239;VI20=240				■	■
Direction mode	67	9...12	143	Undir=0;Forward=1; Reverse=2				■	■
Operation delay	67	13...16	201	1.00 s = 100				■	■
Reset time	67	17...20	201	1.00 s = 100				■	■
SOL Mode	67	21...24	143	Off=0;On=1				■	■
SOL Operation delay	67	25...28	201	1.00 s = 100				■	■
Admittance E/F Io/Uo>> setting									
Enable for Io/Uo>>	68	0	143	Off=0;On=1				■	■
Io input	68	1	143	Io=0;Io CSH=1;Iocalc=2; Io'=3					■
Uo pick-up value	68	2...5	201	1.0 % = 10				■	■
Angle correction	68	6...9	144	1 ° = 1				■	■
Admittance E/F Io/Uo> YN>>									
Enable for YN>>	69	0	143	Off=0;On=1				■	■
Pick-up value	69	1...4	201	1.0 Yn% = 10				■	■
Input for inhibit control	69	5...8	143	DI1=1;DI2=2;...;DI19=19; DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DI21=65;DI22=66;...;DI39=83; DI40=84;VI5=225;VI6=226;...;VI19=239;VI20=240				■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
Operation delay	69	9...12	201	1.00 s = 100				■	■
Reset time	69	13...16	201	1.00 s = 100				■	■
SOL Mode	69	17...20	143	Off=0;On=1				■	■
SOL Operation delay	69	21...24	201	1.00 s = 100				■	■
Admittance E/F Io/Uo>> GN>									
Enable for GN>>	70	0	143	Off=0;On=1				■	■
Pick-up value	70	1...4	201	1.0 Gn% = 10				■	■
Input for inhibit control	70	5...8	143	DI1=1;DI2=2;...;DI19=19; DI20=20;Arc1=25;Arc2= 26;BI=27;VI1=29;VI2= 30;VI3=31;VI4=32;DI21= 65;DI22=66;...;DI39=83; DI40=84;VI5=225;VI6= 226;...;VI19=239;VI20= 240				■	■
Direction mode	70	9...12	143	Undir=0;Forward=1; Reverse=2				■	■
Operation delay	70	13...16	201	1.00 s = 100				■	■
Reset time	70	17...20	201	1.00 s = 100				■	■
SOL Mode	70	21...24	143	Off=0;On=1				■	■
SOL Operation delay	70	25...28	201	1.00 s = 100				■	■
Admittance E/F Io/Uo>> BN>									
Enable for BN>>	71	0	143	Off=0;On=1				■	■
Pick-up value	71	1...4	201	1.0 Bn% = 10				■	■
Input for inhibit control	71	5...8	143	DI1=1;DI2=2;...;DI19=19; DI20=20;Arc1=25;Arc2= 26;BI=27;VI1=29;VI2= 30;VI3=31;VI4=32;DI21= 65;DI22=66;...;DI39=83; DI40=84;VI5=225;VI6= 226;...;VI19=239;VI20= 240				■	■
Direction mode	71	9...12	143	Undir=0;Forward=1; Reverse=2				■	■
Operation delay	71	13...16	201	1.00 s = 100				■	■
Reset time	71	17...20	201	1.00 s = 100				■	■
SOL Mode	71	21...24	143	Off=0;On=1				■	■
SOL Operation delay	71	25...28	201	1.00 s = 100				■	■
U2> setting									
Enable for U2>	72	0	143	Off=0;On=1	■		■	■	■
VTS Operating Mode	72	1...4	143	NO ACTION=0; BLOCKING=1	■		■	■	■
Pick-up value	72	5...8	201	1.0 %Un = 10	■		■	■	■
Delay type	72	9...12	143	DT=0;INV=1	■		■	■	■
Operation delay	72	13...16	201	1.00 s = 100	■		■	■	■
Reset time	72	17...20	201	1.00 s = 100	■		■	■	■
U2>> setting									
Enable for U2>>	73	0	143	Off=0;On=1	■		■	■	■
VTS Operating Mode	73	1...4	143	NO ACTION=0; BLOCKING=1	■		■	■	■
Pick-up value	73	5...8	201	1.0 %Un = 10	■		■	■	■

Name	FUN	INF	ASDU	Scaling	P5U20 LPCT/LPVT	P5U20	P5V20	P5F30	P5M30
Delay type	73	9...12	143	DT=0;INV=1	■		■	■	■
Operation delay	73	13...16	201	1.00 s = 100	■		■	■	■
Reset time	73	17...20	201	1.00 s = 100	■		■	■	■
Motor overspeed Ω>									
Enable for Ω>	74	0	143	Off=0;On=1	■	■			■
Pick-up value	74	1	201	1 %Ωn = 1	■	■			■
Operation delay	74	2	201	1 s = 1	■	■			■
Motor overspeed Ω>>									
Enable for Ω>	75	0	143	Off=0;On=1	■	■			■
Pick-up value	75	1	201	1 %Ωn = 1	■	■			■
Operation delay	75	2	201	1 s = 1	■	■			■
Motor underspeed Ω									
Enable for Ω<<	76	0	143	Off=0;On=1	■	■			■
Pick-up value	76	1	201	1 %Ωn = 1	■	■			■
Operation delay	76	2	201	1 s = 1	■	■			■
Motor underspeed Ω<									
Enable for Ω<<	77	0	143	Off=0;On=1	■	■			■
Pick-up value	77	1	201	1 %Ωn = 1	■	■			■
Operation delay	77	2	201	1 s = 1	■	■			■
Motor Anti-backspin ABS									
Enable motor anti-backspin	78	0	143	Off=0;On=1	■	■			■
Measured Zero Speed Mode	78	1	143	Off=0;On=1	■	■			■
Zero speed external mode	78	2	143	Off=0;On=1	■	■			■
Zero speed input DI	78	3	144	Value [10]	■	■			■
Anti-backspin Time	78	4	201	1 s = 1	■	■			■
Cold load pick-up CLPU									
Enable for CLPU	79	0	143	Off=0;On=1	■	■			■
Idle current	79	1	201	1.00 xIn = 100	■	■			■
Pickup current	79	2	201	1.00 xIn = 100	■	■			■
CLPU dead time	79	3	201	1.00 s = 100	■	■			■
CLPU time delay	79	4	201	1.00 s = 100	■	■			■

10. DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DO1(B)=33;DO2(B)=34;DO3(B)=35; Watchdog=36;SF=37;SF=38;SF=39;SF=40;SF=41;BO=42;DO1(C)=43;DO2(C)=44;DO3(C)=45;DO4(C)=46;LedAl=49;LedTr=50;LedA=51;LedB=52;LedC=53;LedDR=54;VO1=55;VO2=56;VO3=57;VO4=58;VO5=59;VO6=60;DI21=65;DI22=66;...;DI39=83;DI40=84;F1=85; F2=86;...;F6=90;F7=91;DO1(D)=97;DO2(D)=98;DO3(D)=99;SF=100;DO1(E)=101;DO2(E)=102;NI1=129;NI2=130;...;NI63=191;NI64=192;POC1=193;POC2=194;...;POC16=208;VI5=225;VI6=226;...;VI19=239;VI20=240;VO7=257;VO8=258;...;VO19=269;VO20=270; NI65=289;NI66=290;...;NI127=351;NI128=352

Modbus slave

Presentation

The Modbus interface is a master/slave protocol defined by the Modbus organization.

For more information on the Modbus protocol, visit www.modbus.org.

It is used to exchange information between a master and one or more slave units, identified by a number. It implements request-reply dialog, where requests are always initiated by the master. Modbus exists in ASCII and binary (RTU mode) formats. Data is exchanged in the form of 16-bit words (also called registers) or simply bits. Each piece of information (bit or register) has a 16-bit address. Modbus is a data-transmission protocol in charge of communication using serial link or Ethernet links.

Modbus TCP/IP offers the same functionality as Modbus over a serial link, as well as compatibility with multi-master architectures.

The Easergy P5 protection relay is considered in Modbus communication as a slave only. The maximum number of Modbus slaves in the device is 2.

Function description

The Modbus slave can communicate with masters using either of two transmission modes:

- Serial RTU mode
- TCP/IP mode

The Modbus slave can communicate with the master through the serial port and Ethernet port at the same time.

The Modbus slave can be configured to work at max. 3 IP addresses.

The maximal number of clients for Modbus slave is 8. The client and master can be connected by either:

- a serial port connection
- a TCP connection via an Ethernet port

The Modbus slave supports the following functions and services:

- Binary status
- Measurement values
- Remote control
- Time synchronization
- Event record
- Diagnostics

Modbus protocol data unit

Every Modbus request or response frame includes a Modbus PDU (protocol data unit) made up of 2 fields.

- Function code (1 byte): indicates the type of request (1 to 127)
- Data (0 to n bytes): depends on the function code

The function codes in the reply and in the request are identical.

Function codes

The function codes listed in the table below are supported.

Table 37 - Modbus function codes

Function Codes	Address Space
03	Read Holding Registers
04	Read Input Registers
06	Write single register
07 [11]	Read Exception Status
08 [11]	Diagnostic
11	Get Comm Event Counter
16	Write multiple registers
23	Read/Write multiple registers
43/14	Read Device Identification

The following function codes are not supported, as the binary status value are treated as register and there is no area for them.

- 1 - Read coils
- 2 - Read discrete inputs
- 5 - Write single coil
- 15 - Write multiple coils

The sub-function of diagnostic supported are listing below:

- 0 - Return Query Data (Only the first two bytes' data are returned)
- 1 - Restart Communications Option
- 2 - Return Diagnostic Register (always zero)
- 4 - Force Listen Only Mode

Modbus serial link frames

All the frames exchanged have the same structure, made up of 3 parts:

- Slave address (1 byte): from 1 to 247 (0 for broadcasting)
- Modbus PDU: as previously described
- Check (2 bytes): CRC16 used to check frame integrity

The slave addresses in the reply and in the request are identical.

The maximum size of a frame is 256 bytes.

Synchronization of exchanges

Any character that is received after a silence of more than 3.5 characters is considered as the beginning of a new frame. A minimum silence of 3.5 characters is always observed between two frames.

A slave disregards all frames:

- Received with a physical error for 1 or more characters (format error, parity error, etc.)
- With an incorrect CRC16 result
- For which it is not the recipient.

The slave addresses in the reply and in the request are identical.

The maximum size of a frame is 256 bytes.

11. This function code is only available for serial communication.

Broadcasting

The master can also address all slaves using the conventional address 0. This type of exchange is called broadcasting. Slaves do not respond to broadcast messages. As a result, only messages that do not require the transmission of data by the slaves can be broadcast.

Response time

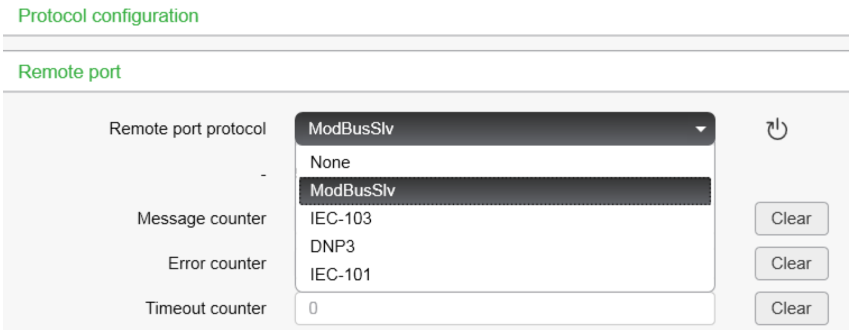
The communication coupler response time (Tr) is less than 15 ms, including a 3-character silence (approximately 3 ms at 9600 bauds).

This time is given with the following parameters:

- 9600 bauds
- Format: 8 bits, odd parity, 1 stop bit

Modbus serial RTU mode configuration

The Modbus RTU protocol is activated by selecting the 'ModBusSlv' option for the 'Remote port protocol' of the Easergy P5 protection relay serial port. This setting can be found by navigating to the Protocol configuration view in the COMMUNICATION menu in eSetup Easergy Pro. The following figures show how to enable the Modbus protocol on the Remote port of an Easergy P5 protection relay.



The protocol can also be enabled via the front panel or Web HMI.

Once the protocol has been activated, it can be configured. This is done in the Modbus main configuration view of the COMMUNICATION menu. In the Modbus main configuration view, the Modbus Slave Address (or number), the bit rate, the parity of the connection, the wire number and polling line can be set. The frame gap is fixed.

Figure 3 - Modbus slave main configuration

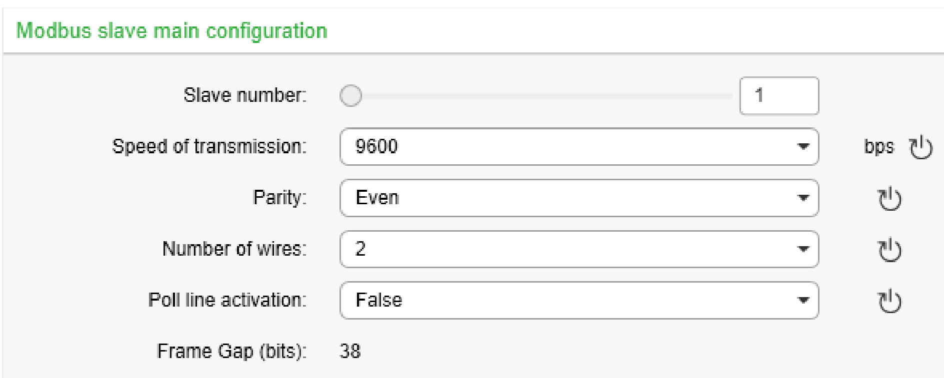


Table 38 - Modbus slave main configuration parameters

Parameter	Value	Description
Slave number	1...247	The Modbus slave address.
Speed of transmission	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps	The communication speed, bits per second.
Parity	None, Even, Odd	The type of parity bit used.
Number of wires	2, 4	The number of wire connection.
Poll line activation	False, True	The polarity of the wire connection.
Frame Gap		Specifies the amount of time (calculated by bits) to use to determine that a frame has been completed. For Modbus RTU this value is fixed at 38 bits.

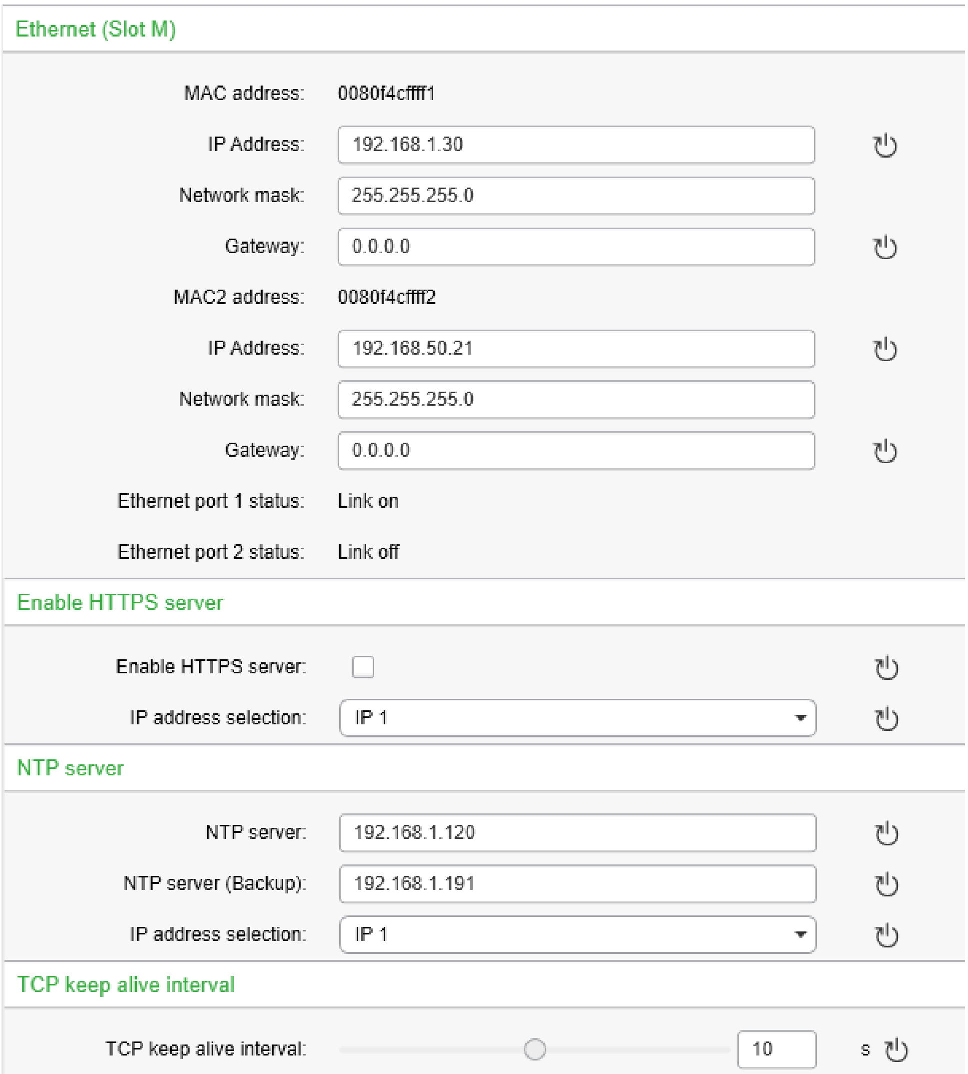
NOTE: The parity and bit rate are set to the same value on all devices connected to the same data link.

Modbus TCP mode configuration

Modbus TCP (or Modbus TCP/IP) is simply the Modbus RTU protocol with a TCP interface that runs on Ethernet. TCP/IP refers to the Transmission Control Protocol and Internet Protocol which provide the transmission medium for Modbus TCP/IP messaging. In practice, Modbus TCP embeds a standard Modbus data frame into a TCP frame.

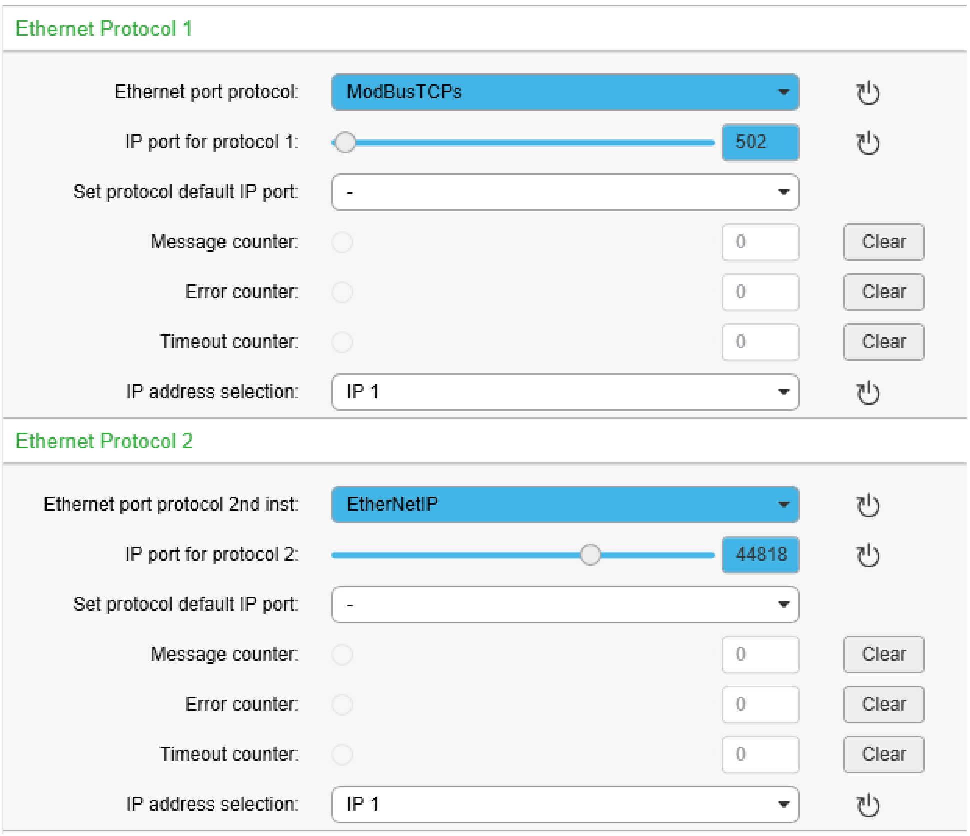
One advantage over serial Modbus (RTU or ASCII) is that the number of nodes is not limited to 247 on one data link, since the addressing of nodes is done with the Internet Protocol. Furthermore, several devices can be connected to one IP address, provided the appropriate equipment is used (some Modbus TCP-to-Modbus RTU bridge). These devices are differentiated from each other with a Unit Identifier, in the TCP frame, which corresponds to the Slave ID. The range of the Unit Identifier is also 1-247. In Easergy P5 protection relays the Modbus Slave ID corresponds to the Unit Identifier when Modbus TCP is used, see Modbus slave main configuration, page 92.

The Modbus TCP protocol is activated by first configuring the Ethernet port settings. First, the IP address, Subnet mask and Gateway are set, and require a static IP address to be configured. This is considered before connecting a relay to an existing network, so that no conflicts emerge.



Once these settings have been configured, one of the Ethernet port protocol selections can be set to “ModBusTCPs” (Modbus TCP, slave).
Before the protocol is activated, a device reboot is required.

> **NOTE:** There are two TCP port instances “Ethernet Protocol 1” and “Ethernet Protocol 2”, that is, two independent sockets for two different protocols. The default TCP IP port for Modbus TCP is 502.



Data access, such as reading and writing to holding registers, event reading, clock synchronisation and scaling work, with the addition that clock synchronisation also can be done by using Simple Network Time Protocol (SNTP). This requires a NTP server, the address of which is set in the Protocol configuration view in eSetup Easergy Pro or Web HMI.

Events

The event buffer of Easergy P5 protection relays can be read via the Modbus Protocol. This is done by reading one event at a time, from holding registers 2101…2105. The event registers contain the latest event, and are cleared when they are read. The registers are then updated to contain the following event from the event buffer. A description of the registers is shown in the table.

Table 39 - Description of events in holding registers

Holding Register	Content
2101	Event code
2102	Event timestamp Bits 15-6 = milliseconds Bits 5-0 = seconds
2103	Event timestamp Upper byte = minute Lower byte = hour
2104	Event timestamp Upper byte = day Lower byte = month
2105	Event timestamp, year

Clock synchronisation

The internal clock of Easergy P5 protection relays can be synchronised via the Modbus protocol. Note this is not a native feature of the Modbus protocol. Therefore, this is an Easergy P5 protection relay specific feature. The accuracy of the clock synchronisation is in the scale of a few hundred milliseconds.

The clock can be synchronised either completely (all fields: seconds, minutes, hours, days, month and year) or by synchronising only the minutes, which in turn will set the seconds and milliseconds to zero.

An example of how minute synchronisation can be done: when the reference clock (the clock which is assumed to be correct) is exactly seven minutes past (any hour), a minute synchronisation is performed. The result will be that the internal clock of the Easergy P5 protection relays will be set to HH:07:00.000 (“Hours: Minutes:Seconds.Milliseconds”) “HH” will not be changed.

These two ways of synchronising the clock are denoted “Set RTC”, where “RTC” stands for “Real-Time Clock” and “Synchronise Minutes” in the data map. The holding register address of the minute synchronisation is 2502.

The holding registers allocated to the Set RTC synchronisation are:

Table 40 - Description of holding registers allocated to Set RTC synchronisation

Holding Register	Content
2504	Lower byte: seconds, milliseconds will be zero
2505	Upper byte: minutes Lower byte: hours
2506	Upper byte: day Lower byte: month
2507	Year

Scaling

Since the Modbus registers are 16 bits in size, they can directly represent 2^16 = 65535 different values, which might not be enough to describe the values of some physical quantity such as voltage or power. Thus, values transmitted over a Modbus data link are scaled to account for this.

The scaling is determined by the float value of the corresponding specific scalings. After multiplication by a scaling value, only the decimals are removed from the original measurements, and such values are easy to read and rescale to actual values on the client side after transmission.

These settings for scaling can be set by navigating to the Modbus and IEC 60870-5-101 specific scalings view in the COMMUNICATION menu in eSetup Easergy Pro or Web HMI.

A short example: The frequency is internally (in the Easergy P5 protection relays) stored as an integer value which also holds three decimal places, that is, 50.000 Hz is represented as 50000. This is a value too large to be represented with 16 bits (signed integer). However, frequency is multipled by default scaled value 0.1, enabling it to be sent over Modbus.

Thus, the value on the receiving side (the Modbus value) will be:

$valueModbus = k \cdot valueInternal = 0.1 \cdot 50000 = 5000$

Modbus&IEC101 specific scalings

Power scaling:	1.000
PF and cos scaling:	1.000
Tanφ scaling:	1.000
Voltage scaling:	1.000
VT primary scaling:	1.000
Frequency scaling:	0.100
VTo secondary scaling:	0.100
Io scaling:	1.000
Io' scaling:	1.000
CLPU dead time scaling:	1.000
Limit for oper.left scaling:	1.000
CB open count scaling:	1.000
Operate delay scaling:	1.000
Pick-up value scaling:	1.000
Fault value scaling:	1.000
Max control pulse length scaling:	1.000

Scaling can be checked in eSetup Easergy Pro by viewing the Scaling column for each register in the Modbus slave COMMUNICATION menu.

ModBus slave: measurement

	Name	Access	Scaling	Setting for scaling	Address	ValueType
[1]	Pos. sequence I1	R -	1 A = 1	-	3001	UInt32
[2]	Negative sequence I2	R -	1 A = 1	-	3002	UInt32
[76]	Frequency	R -	50.000 Hz = 5000	Frequency scaling	3221	float32
[77]	Active power	R -	1000 kW = 1000	Power scaling	3222	Int32
[78]	Reactive power	R -	1000 kVAr = 1000	Power scaling	3223	Int32
[79]	Apparent power	R -	1000 kVA = 1000	Power scaling	3224	Int32
[80]	Power factor	R -	1.00 = 100	PF and cos scaling	3225	float32

NOTE: It is highly recommended to scale values so that they are kept in the interval 0 –32000 to avoid overflow.

The Modbus scaling address can be found in the Modbus specific scalings view in the COMMUNICATION menu in eSetup Easergy Pro or Web HMI.

Modbus scaling address

	Name	Address	ValueType
[1]	Power scaling	10001...10002	float32
[2]	PF and cos scaling	10003...10004	float32
[3]	Tanφ scaling	10005...10006	float32
[4]	Voltage scaling	10007...10008	float32
[5]	VT primary scaling	10009...10010	float32
[6]	Frequency scaling	10011...10012	float32
[7]	VTo secondary scaling	10013...10014	float32
[8]	Io scaling	10015...10016	float32
[9]	Iovs scaling	10017...10018	float32
[10]	CLPU dead time scaling	10019...10020	float32
[11]	Limit for oper.left scaling	10021...10022	float32
[12]	CB Count scaling	10025...10026	float32
[13]	Operate delay scaling	10027...10028	float32
[14]	Pick-up value scaling	10029...10030	float32
[15]	Fault value scaling	10031...10032	float32
[16]	MaxCtrlPulseLength scaling	10033...10034	float32

The following table shows the different values of Voltage scaling, and the values to be filled in the frame. When the client reads a 2 register value for voltage scaling, it needs to combine these 2 values together and convert them to a float 32 value.

For example, when voltage scaling value is 0.001, the values 0x126f and 0x3A83 will be merged to 4 bytes value 0x3A83126F.

Table 41 - Voltage scaling values

Voltage scaling	IEEE 754 / Float32	Value in address 10007	Value in address 10008
1.0000	0x3F800000	0x0000	0x3F80
0.0010	0x3A83126F	0x126F	0x3A83
1000.0000	0x447A0000	0x0000	0x447A
500.0000	0x43FA0000	0x0000	0x43FA

Read exception status

This function code 7 is used to read the contents of eight exception status. Eight bits make up one byte.

The following table shows the status supported:

Table 42 - Read exception status

Bit	Status	Description
0	Test Mode	If test mode is not in normal, set bit 0.
1	Time Synchronization	If the synchronizing source is internal, set bit 1.
2	New Event	If a new event is generated, set bit 2.
3	Hardware Status	If the hardware has problem, set bit 3.
4...7	Reserved	

Read device identification

Both basic and regular device identification are supported though function code 43 and 14. The Modbus slave will respond with the exception code 3 if receive the unsupported category.

Table 43 - Read device identification

Object ID	Object Name	Value
0x00	VendorName	Schneider Electric
0x01	ProductCode	If P5U20: 16700 If P5V20: 16701 If P5M30: 16702 If P5F30: 16703 If P5U20 LPCT/LPVT: 16707
0x02	MajorMinorRevision	11 chars, e.g. 001.300.003
0x03	VendorUrl	http://www.se.com
0x04	ProductName (product range)	Easergy P5
0x05	ModelName	P5U20 / P5V20 / P5F30 / P5M30 / P5U20 LPCT/LPVT depending on type
0x06	UserApplicationName	If P5U20: Universal current protection If P5V20: Voltage and Frequency protection If P5F30: Directional Feeder and Transformer protection If P5M30: Motor protection If P5U20 LPCT/LPVT: Universal current protection with LPCT/LPVT

Data model of Modbus

Scalings

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
1001	CT primary	1	0	3	1 A = 1			■		■	■
1002	CT secondary	1	0	3	1 A = 1			■		■	■
1003	Nominal current (In)	1	0	3	1.00 A = 100	LPCT/VT scaling	■			■	■
1004	LPCT rated primary current (Ipr)	1	0	3	1 A = 1		■			■	■
1005	Current factor	1	0	3	0.25=0;0.5=1;1=2;1.25=3;1.33=4;2=5;2.5=6;3.2=7;4=8;5=9;6.3=10;6.66=11;10=12;16=13;20=14;25=15;31.5=16		■			■	■
1006	Earth CT primary	1	0	3	1 A = 1			■		■	■
1007	Earth CT secondary	1	0	3	1.0 A = 10			■		■	■
1008	Io primary CSH rate	1	0	3	1 A = 1		■	■		■	■
1009	Io secondary	1	0	3	1.0 A = 10		■	■		■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
1010	Earth fault input (CSH)	1	0	3	1.0 A = 10		■	■		■	■
1011	Earth CT' primary	1	0	3	1 A = 1			■		■	■
1012	Earth CT' secondary	1	0	3	1.0 A = 10			■		■	■
1013	VT primary / Rated voltage	1	0	3	1000 V = 1000	VT primary scaling			■	■	■
1014	Nominal voltage (Un)	1	0	3	1.00 V = 100	LPVT/VT scaling	■			■	■
1015	LPVT or VT rated primary voltage	1	0	3	1000 V = 1000	LPVT/VT scaling	■			■	■
1016	VT secondary	1	0	3	1 V = 1				■	■	■
1017	VTy secondary	1	0	3	1 V = 1				■	■	■
1018	VTo primary	1	0	3	1000 V = 1000	VTo primary scaling			■	■	■
1019	VTo secondary	1	0	3	1.000 V = 100	VTo secondary scaling			■	■	■
1020	Voltage factor	1	0	3	1.000 = 1000		■			■	■
1021	Phase Rotation	1	0	3	1-2-3=0;1-3-2=1		■	■	■	■	■
1022	Voltage measurement mode	1	0	3	Value [12]		■		■	■	■
1023	Nominal frequency	1	0	3	50 Hz = 50		■	■	■	■	■
1024	Power direction	1	0	3	Outgoing=0; Incoming=1		■			■	■
1025	Number of connected phase CT	1	0	3	I1/I2/I3=0;I1/I3=1			■		■	■
1026	VL1 magnitude correction	1	0	3	1.000 = 10000		■			■	■
1027	VL2 magnitude correction	1	0	3	1.000 = 10000		■			■	■
1028	VL3 magnitude correction	1	0	3	1.000 = 10000		■			■	■
1029	VL1 Angle correction	1	0	3	1.000 ° = 10000	LPCT/VT scaling	■			■	■
1030	VL2 Angle correction	1	0	3	1.000 ° = 10000	LPCT/VT scaling	■			■	■
1031	VL3 Angle correction	1	0	3	1.000 ° = 10000	LPCT/VT scaling	■			■	■
1032	VL1y magnitude correction	1	0	3	1.000 = 10000		■			■	■
1033	VL1y Angle correction	1	0	3	1.000 ° = 10000	LPCT/VT scaling	■			■	■
1034	VL2y magnitude correction	1	0	3	1.000 = 10000		■			■	■
1035	VL2y Angle correction	1	0	3	1.000 ° = 10000	LPCT/VT scaling	■			■	■
1036	VT type	1	0	3	VT+Adapter=0; LPVT=1		■			■	■

12. 2LL+Uo=0;3LN=1;1LL+Uo/LLy=2;2LL/LLy=3;LL/LLy/LLz=4;1LL=5;1LN=6;3LL=8;3LN/LNy=9;3LN/LLy=10;2LL+Uo/LNy=11;2LL+Uo+LLy=12;3LN+Uo=13;LL+Uo/y/z=14;LN+Uo/y/z=15;LL/LLy=16;3LN/2LNy=17

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
1037	VT secondary	1	0	3	1 V = 1		■			■	■
1038	VL1 adapter mag correction	1	0	3	1.000 = 1000	LPCT/VT scaling	■			■	■
1039	VL2 adapter mag correction	1	0	3	1.000 = 1000	LPCT/VT scaling	■			■	■
1040	VL3 adapter mag correction	1	0	3	1.000 = 1000	LPCT/VT scaling	■			■	■
1041	VTy secondary	1	0	3	1 V = 1		■			■	■
1042	VL1y adapter mag correction	1	0	3	1.000 = 1000	LPCT/VT scaling	■			■	■
1044	VTo secondary	1	0	3	1 V = 1		■			■	■
1045	Uo adapter mag correction	1	0	3	1.000 = 1000	LPCT/VT scaling	■			■	■

Read and command

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
2001	Alive indicator	1	0	3	1 = 1		■	■	■	■	■
2006	Digital Inputs 01...16	1	0	3	1 = 1		■	■	■	■	■
2007	Digital Inputs 17...32	1	0	3	1 = 1					■	■
2008	Digital Inputs 33...40	1	0	3	1 = 1					■	■
2042	Object1 state	1	0	3	Open=0;Close=1; Undef=2		■	■	■	■	■
2043	Object2 state	1	0	3	Open=0;Close=1; Undef=2		■	■	■	■	■
2044	Object3 state	1	0	3	Open=0;Close=1; Undef=2		■	■	■	■	■
2045	Object4 state	1	0	3	Open=0;Close=1; Undef=2		■	■	■	■	■
2046	Object5 state	1	0	3	Open=0;Close=1; Undef=2		■	■	■	■	■
2047	Object6 state	1	0	3	Open=0;Close=1; Undef=2		■	■	■	■	■
2048	Object7 state	1	0	3	Open=0;Close=1; Undef=2		■	■	■	■	■
2049	Object8 state	1	0	3	Open=0;Close=1; Undef=2		■	■	■	■	■
2057	Run hours/10^0	1	0	3	1 = 1		■	■	■	■	■
2058	Run hours/10^4	1	0	3	1 = 1		■	■	■	■	■
2059	Engine running (in seconds)	1	1	3, 6	1 s = 1		■	■	■	■	■
2060	Start counter	1	1	3, 6	1 = 1		■	■	■	■	■
2101... 2105	Events	1	0	3	1 = 1		■	■	■	■	■
2301	Mode of use	1	0	3	Normal=0;Test=1; Test Block=2		■	■	■	■	■
2302	Remote/Local State	1	0	3	REMOTE=0; LOCAL=1		■	■	■	■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
2303	Port 1 status (Slot M)	1	0	3	Link off=0; Link on=1		■	■	■	■	■
2304	Port 2 status (Slot M)	1	0	3	Link off=0; Link on=1		■	■	■	■	■
2305	Port 1 status (Slot L)	1	0	3	Link off=0; Link on=1		■	■	■	■	■
2306	Port 2 status (Slot L)	1	0	3	Link off=0; Link on=1		■	■	■	■	■
2307	Port 1 status (Slot M&N)	1	0	3	Link off=0; Link on=1		■	■	■	■	■
2308	Port 2 status (Slot M&N)	1	0	3	Link off=0; Link on=1		■	■	■	■	■
2351	External AI1	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2352	External AI2	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2353	External AI3	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2354	External AI4	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2355	External AI5	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2356	External AI6	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2357	External AI7	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2358	External AI8	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2359	External AI9	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2360	External AI10	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2361	External AI11	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2362	External AI12	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2363	External AI13	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2364	External AI14	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2365	External AI15	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2366	External AI16	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2367	External AI17	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2368	External AI18	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2369	External AI19	1	0	3	Value [13]	External AI scaling	■	■	■	■	■
2370	External AI20	1	0	3	Value [13]	External AI scaling	■	■	■	■	■

13. 1 °C = 1 / 1 F = 1 / 1 K = 1 / 1 V/A = 1 / 1 mA = 1 / 1 Ohm = 1 / 1 A = 1 / 1 V = 1 / 1 kW = 1 / 1 kVA = 1 / 1 kvar = 1 / 1 - = 1

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
2371	External AI21	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2372	External AI22	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2373	External AI23	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2374	External AI24	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2375	External AI25	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2376	External AI26	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2377	External AI27	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2378	External AI28	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2379	External AI29	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2380	External AI30	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2381	External AI31	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2382	External AI32	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2383	External AI33	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2384	External AI34	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2385	External AI35	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2386	External AI36	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2387	External AI37	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2388	External AI38	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2389	External AI39	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2390	External AI40	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2391	External AI41	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2392	External AI42	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2393	External AI43	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2394	External AI44	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2395	External AI45	1	0	3	Value [14]	External AI scaling	■	■	■	■	■
2396	External AI46	1	0	3	Value [14]	External AI scaling	■	■	■	■	■

14. 1 °C = 1 / 1 F = 1 / 1 K = 1 / 1 V/A = 1 / 1 mA = 1 / 1 Ohm = 1 / 1 A = 1 / 1 V = 1 / 1 kW = 1 / 1 kVA = 1 / 1 kvar = 1 / 1 - = 1

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
2397	External AI47	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2398	External AI48	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2399	External AI49	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2400	External AI50	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2401	External AI51	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2402	External AI52	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2403	External AI53	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2404	External AI54	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2405	External AI55	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2406	External AI56	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2407	External AI57	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2408	External AI58	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2409	External AI59	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2410	External AI60	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2411	External AI61	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2412	External AI62	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2413	External AI63	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2414	External AI64	1	0	3	Value [15]	External AI scaling	■	■	■	■	■
2415	External DI1	1	0	3	1 = 1		■	■	■	■	■
2416	External DI2	1	0	3	1 = 1		■	■	■	■	■
2417	External DI3	1	0	3	1 = 1		■	■	■	■	■
2418	External DI4	1	0	3	1 = 1		■	■	■	■	■
2419	External DI5	1	0	3	1 = 1		■	■	■	■	■
2420	External DI6	1	0	3	1 = 1		■	■	■	■	■
2421	External DI7	1	0	3	1 = 1		■	■	■	■	■
2422	External DI8	1	0	3	1 = 1		■	■	■	■	■
2423	External DI9	1	0	3	1 = 1		■	■	■	■	■
2424	External DI10	1	0	3	1 = 1		■	■	■	■	■
2425	External DI11	1	0	3	1 = 1		■	■	■	■	■
2426	External DI12	1	0	3	1 = 1		■	■	■	■	■
2427	External DI13	1	0	3	1 = 1		■	■	■	■	■

15. 1 °C = 1 / 1 F = 1 / 1 K = 1 / 1 V/A = 1 / 1 mA = 1 / 1 Ohm = 1 / 1 A = 1 / 1 V = 1 / 1 kW = 1 / 1 kVA = 1 / 1 kvar = 1 / 1 - = 1

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
2428	External DI14	1	0	3	1 = 1		■	■	■	■	■
2429	External DI15	1	0	3	1 = 1		■	■	■	■	■
2430	External DI16	1	0	3	1 = 1		■	■	■	■	■
2431	External DI17	1	0	3	1 = 1		■	■	■	■	■
2432	External DI18	1	0	3	1 = 1		■	■	■	■	■
2501	Release latches	1	1	3, 6	Release=1		■	■	■	■	■
2502	Synchronize minutes	1	1	3, 6	1 = 1		■	■	■	■	■
2504...-2507	Set Real Time Clock (RTC)	0	1	6	1 = 1		■	■	■	■	■
2508	Open select object 1	1	1	3, 6	1 = 1		■	■	■	■	■
2509	Close select object 1	1	1	3, 6	1 = 1		■	■	■	■	■
2510	Execute operation Object1	0	1	6	1 = 1		■	■	■	■	■
2511	Max ctrl pulse length of Object1	1	1	3, 6	1.00 s = 100	Max control pulse length scaling	■	■	■	■	■
2512	Open select object 2	1	1	3, 6	1 = 1		■	■	■	■	■
2513	Close select object 2	1	1	3, 6	1 = 1		■	■	■	■	■
2514	Execute operation Object2	0	1	6	1 = 1		■	■	■	■	■
2515	Max ctrl pulse length of Object2	1	1	3, 6	1.00 s = 100	Max control pulse length scaling	■	■	■	■	■
2516	Cancel selected operation	0	1	6	1 = 1		■	■	■	■	■
2517	Open select object 3	1	1	3, 6	1 = 1		■	■	■	■	■
2518	Close select object 3	1	1	3, 6	1 = 1		■	■	■	■	■
2519	Execute operation Object3	0	1	6	1 = 1		■	■	■	■	■
2520	Max ctrl pulse length of Object3	1	1	3, 6	1.00 s = 100	Max control pulse length scaling	■	■	■	■	■
2521	Open select object 4	1	1	3, 6	1 = 1		■	■	■	■	■
2522	Close select object 4	1	1	3, 6	1 = 1		■	■	■	■	■
2523	Execute operation Object4	0	1	6	1 = 1		■	■	■	■	■
2524	Max ctrl pulse length of Object4	1	1	3, 6	1.00 s = 100	Max control pulse length scaling	■	■	■	■	■
2525	Open select object 5	1	1	3, 6	1 = 1		■	■	■	■	■
2526	Close select object 5	1	1	3, 6	1 = 1		■	■	■	■	■
2527	Execute operation Object5	0	1	6	1 = 1		■	■	■	■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
2528	Max ctrl pulse length of Object5	1	1	3, 6	1.00 s = 100	Max control pulse length scaling	■	■	■	■	■
2529	Open select object 6	1	1	3, 6	1 = 1		■	■	■	■	■
2530	Close select object 6	1	1	3, 6	1 = 1		■	■	■	■	■
2531	Execute operation Object6	0	1	6	1 = 1		■	■	■	■	■
2532	Max ctrl pulse length of Object6	1	1	3, 6	1.00 s = 100	Max control pulse length scaling	■	■	■	■	■
2534	Set. group common change	1	1	3, 6	1=0;2=1;3=2;4=3		■	■	■	■	■
2536	Clear min/max/ demand	1	1	3, 6	Clear=1		■	■	■	■	■

Measurement

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
3001	Positive sequence I1	1	0	3	1 A = 1		■	■		■	■
3002	Negative sequence I2	1	0	3	1 A = 1		■	■		■	■
3003	Current ratio I2/I1	1	0	3	1.0 % = 10		■	■		■	■
3004	Current phase sequence	1	0	3	??=0;OK=1; Reverse=2		■	■		■	■
3005	Phase current THD	1	0	3	1.0 % = 10		■	■		■	■
3006	Phase current IL1 THD	1	0	3	1.0 % = 10		■	■		■	■
3007	Phase current IL2 THD	1	0	3	1.0 % = 10		■	■		■	■
3008	Phase current IL3 THD	1	0	3	1.0 % = 10		■	■		■	■
3009	Phase current IL	1	0	3	1 A = 1		■	■		■	■
3010	Min. of IL1 IL2 IL3	1	0	3	1 A = 1		■	■		■	■
3011	Max. of IL1 IL2 IL3	1	0	3	1 A = 1		■	■		■	■
3012	Phase current ILRMS	1	0	3	1 A = 1		■	■		■	■
3015	Phase current IL1RMS	1	0	3	1 A = 1		■	■		■	■
3016	Phase current IL2RMS	1	0	3	1 A = 1		■	■		■	■
3017	Phase current IL3RMS	1	0	3	1 A = 1		■	■		■	■
3019	Ambient temperature	1	0	3, 6	1 °C = 1 / 1 °F = 1		■	■		■	
3020	Phase current IL1da demand	1	0	3	1 A = 1		■	■		■	■
3021	Phase current IL2da demand	1	0	3	1 A = 1		■	■		■	■
3022	Phase current IL3da demand	1	0	3	1 A = 1		■	■		■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
3031	Positive sequence U1	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3032	Negative sequence U2	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3033	Voltage U2/U1	1	0	3	1.0 % = 10		■		■	■	■
3034	Voltage phase sequence	1	0	3	??=0;OK=1; Reverse=2		■		■	■	■
3035	Voltage THD	1	0	3	1.0 % = 10		■		■	■	■
3036	Phase-Earth VL1 THD	1	0	3	1.0 % = 10		■		■	■	■
3037	Phase-Earth VL2 THD	1	0	3	1.0 % = 10		■		■	■	■
3038	Phase-Earth VL3 THD	1	0	3	1.0 % = 10		■		■	■	■
3039	Average Phase-Phase voltage	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3040	Min of Phase-Phase voltages	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3041	Max of Phase-Phase voltages	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3042	Average Phase-Earth voltage	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3043	Min. of Phase-Earth voltages	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3044	Max. of Phase-Earth voltages	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3045	RMS average voltage	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3048	Phase-Phase voltage U12RMS / Phase-Earth voltage VL1RMS	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3049	Phase-Phase voltage U23RMS / Phase-Earth voltage VL2RMS	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3050	Phase-Earth voltage VL3RMS / Phase-Phase voltage U12yRMS	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3058	Cosφ	1	0	3	1.00 = 100	PF and cos scaling	■			■	■
3059	Tangent φ	1	0	3	1.000 = 1000	Tanφ scaling	■			■	■
3060	Power angle	1	0	3	1 ° = 1		■			■	■
3061	RMS active power	1	0	3	1000 kW = 1000	Power scaling	■			■	■
3062	RMS reactive power	1	0	3	1000 kVAr = 1000	Power scaling	■			■	■
3063	RMS apparent power	1	0	3	1000 kVA = 1000	Power scaling	■			■	■
3066	Active power demand	1	0	3	1000 kW = 1000	Power scaling	■			■	■
3067	Reactive power demand	1	0	3	1000 kVAr = 1000	Power scaling	■			■	■
3068	Apparent power demand	1	0	3	1000 kVA = 1000	Power scaling	■			■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
3069	Power factor demand	1	0	3	1.00 = 100	PF and cos scaling	■			■	■
3071	RMS active power demand	1	0	3	1000 kW = 1000	Power scaling	■			■	■
3072	RMS reactive power demand	1	0	3	1000 kVAr = 1000	Power scaling	■			■	■
3073	RMS apparent power demand	1	0	3	1000 kVA = 1000	Power scaling	■			■	■
3081	Phase L1 active power	1	0	3	1000 kW = 1000	Power scaling	■			■	■
3082	Phase L2 active power	1	0	3	1000 kW = 1000	Power scaling	■			■	■
3083	Phase L3 active power	1	0	3	1000 kW = 1000	Power scaling	■			■	■
3084	Phase L1 reactive power	1	0	3	1000 kVAr = 1000	Power scaling	■			■	■
3085	Phase L2 reactive power	1	0	3	1000 kVAr = 1000	Power scaling	■			■	■
3086	Phase L3 reactive power	1	0	3	1000 kVAr = 1000	Power scaling	■			■	■
3087	Phase L1 apparent power	1	0	3	1000 kVA = 1000	Power scaling	■			■	■
3088	Phase L2 apparent power	1	0	3	1000 kVA = 1000	Power scaling	■			■	■
3089	Phase L3 apparent power	1	0	3	1000 kVA = 1000	Power scaling	■			■	■
3090	Cosφ of phase L1	1	0	3	1.00 = 100	PF and cos scaling	■			■	■
3091	Cosφ of phase L2	1	0	3	1.00 = 100	PF and cos scaling	■			■	■
3092	Cosφ of phase L3	1	0	3	1.00 = 100	PF and cos scaling	■			■	■
3101	Frequency fy	1	0	3	50.000 Hz = 5000	Frequency scaling	■		■	■	
3102	Phase-to-Phase voltage U12y	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	
3103	Phase angle difference	1	0	3	1 ° = 10	-	■		■	■	
3111	Frequency fz	1	0	3	50.000 Hz = 5000	Frequency scaling	■		■	■	
3112	Phase-to-Phase voltage U12z	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	
3113	Phase angle difference	1	0	3	1 ° = 1	-					
3207	Earth fault calculated	1	0	3	1.00 A = 100	Io scaling	■	■		■	■
3208	Io CSH residual current	1	0	3	1.00 A = 100	Io scaling (CSH)	■	■		■	■
3209	Phase current IL1	1	0	3	1 A = 1		■	■		■	■
3210	Phase current IL2	1	0	3	1 A = 1		■	■		■	■
3211	Phase current IL3	1	0	3	1 A = 1		■	■		■	■
3212	Io residual current	1	0	3	1.00 A = 100	Io scaling		■		■	■
3213	Io' residual current	1	0	3	1.000 A = 1000	Io' scaling		■		■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
3214	Phase-to-Phase voltage U12	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3215	Phase-to-Phase voltage U23	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3216	Phase-to-Phase voltage U31	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3217	Phase-to-earth voltage VL1	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3218	Phase-to-earth voltage VL2	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3219	Phase-to-earth voltage VL3	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3220	Residual voltage	1	0	3	1.0 % = 10		■		■	■	■
3221	Frequency	1	0	3	50.000 Hz = 5000	Frequency scaling	■	■	■	■	■
3222	Active power	1	0	3	1000 kW = 1000	Power scaling	■			■	■
3223	Reactive power	1	0	3	1000 kVAr = 1000	Power scaling	■			■	■
3224	Apparent power	1	0	3	1000 kVA = 1000	Power scaling	■			■	■
3225	Power factor	1	0	3	1.00 = 100	PF and cos scaling	■			■	■
3226	Energy Eexp	1	0	3	1 = 1		■			■	■
3227	Eexp/10^4	1	0	3	10^4 = 1		■			■	■
3228	Eexp/10^8	1	0	3	10^8 = 1		■			■	■
3229	Energy EqExp	1	0	3	1 = 1		■			■	■
3230	EqExp/10^4	1	0	3	10^4 = 1		■			■	■
3231	EqExp/10^8	1	0	3	10^8 = 1		■			■	■
3232	Energy Eimp	1	0	3	1 = 1		■			■	■
3233	Eimp/10^4	1	0	3	10^4 = 1		■			■	■
3234	Eimp/10^8	1	0	3	10^8 = 1		■			■	■
3235	Energy EqImp	1	0	3	1 = 1		■			■	■
3236	EqImp/10^4	1	0	3	10^4 = 1		■			■	■
3237	EqImp/10^8	1	0	3	10^8 = 1		■			■	■
3238	Tangent φ	1	0	3	1.000 = 1000	Tanφ scaling	■			■	■
3239	Phase current IL	1	0	3	1 A = 1		■	■		■	■
3240	Average Phase-Phase voltage	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3241	Average Phase-Earth voltage	1	0	3	1000 V = 1000	Voltage scaling	■		■	■	■
3256... 3271	Harmonics of IL1	1	0	3	1 % = 1		■	■		■	■
3276... 3291	Harmonics of IL2	1	0	3	1 % = 1		■	■		■	■
3296... 3311	Harmonics of IL3	1	0	3	1 % = 1		■	■		■	■
3316... 3331	Harmonics of U12 / Harmonics of VL1	1	0	3	1 % = 1		■		■	■	■
3336... 3351	Harmonics of U23 / Harmonics of VL2	1	0	3	1 % = 1		■		■	■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
3356... 3371	Harmonics of VL3 / Harmonics of U12y	1	0	3	1 % = 1		■		■	■	■
3381	Temperature 1	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3382	Temperature 2	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3383	Temperature 3	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3384	Temperature 4	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3385	Temperature 5	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3386	Temperature 6	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3387	Temperature 7	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3388	Temperature 8	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3389	Temperature 9	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3390	Temperature 10	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3391	Temperature 11	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3392	Temperature 12	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3393	Temperature 13	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3394	Temperature 14	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3395	Temperature 15	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3396	Temperature 16	1	0	3	1 °C = 1 / 1 °F = 1		■	■		■	■
3410	Last fault current	1	1	3, 6	1.00 xIn = 100 / 1.00 A = 100	Fault value scaling	■	■		■	■
3411	I> fault value	1	0	3	1.00 xIn = 100 / 1.00 A = 100	Fault value scaling	■	■		■	■
3412	I>> fault value	1	0	3	1.00 xIn = 100 / 1.00 A = 100	Fault value scaling	■	■		■	■
3413	I>>> fault value	1	0	3	1.00 xIn = 100 / 1.00 A = 100	Fault value scaling	■	■		■	■
3415	Fault reactance	1	0	3	1.00 ohm = 100					■	
3416	Algorithm condition	1	0	3	OK=0;NegX=1; BigX=2;Long fault=3;No DI=4; No pre-fault=5;No post-fault=6; ShrtFlt=7; PreUns=8; FltUns=9; PostUns=10; Blocked=11;Off= 12					■	
3417	Fault value Ω>	1	0	3	1.0 %Ωn = 10 / 1 rpm = 1		■	■			■
3418	Fault value Ω>>	1	0	3	1.0 %Ωn = 10 / 1 rpm = 1		■	■			■
3419	Fault value Ω<	1	0	3	1.0 %Ωn = 10 / 1 rpm = 1		■	■			■
3420	Fault value Ω<<	1	0	3	1.0 %Ωn = 10 / 1 rpm = 1		■	■			■
3430	Last fault Io current	1	0	3	1.00 pu = 100 / 1.00 A = 100	Fault value scaling		■		■	■
3431	Io> fault value	1	0	3	1.00 pu = 100 / 1.00 A = 100	Fault value scaling	■	■		■	■
3432	Io>> fault value	1	0	3	1.00 pu = 100 / 1.00 A = 100	Fault value scaling	■	■		■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
3433	Io>>> fault value	1	0	3	1.00 pu = 100 / 1.00 A = 100	Fault value scaling	■	■		■	■
3434	Io>>>> fault value	1	0	3	1.00 pu = 100 / 1.00 A = 100	Fault value scaling		■		■	■
3435	Io>>>>> fault value	1	0	3	1.00 pu = 100 / 1.00 A = 100	Fault value scaling		■		■	■
3436	Last fault Ioφ> current	1	0	3	1.00 pu = 100 / 1.00 A = 100	Fault value scaling	■			■	■
3437	Ioφ> fault value	1	0	3	1.00 pu = 100 / 1.00 A = 100	Fault value scaling	■			■	■
3438	Ioφ>> fault value	1	0	3	1.00 pu = 100 / 1.00 A = 100	Fault value scaling	■			■	■
3439	Ioφ>>> fault value	1	0	3	1.00 pu = 100 / 1.00 A = 100	Fault value scaling	■			■	■
3440	SOTF fault value	1	0	3	1.00 xIn = 100 / 1.00 A = 100	Fault value scaling	■	■		■	■
3441	Uo> fault value	1	0	3	1.0 % = 10	Fault value scaling	■		■	■	■
3442	Uo>> fault value	1	0	3	1.0 % = 10	Fault value scaling	■		■	■	■
3443	Uo>>> fault value	1	0	3	1.0 % = 10	Fault value scaling	■		■	■	■
3444	Io'> fault value	1	0	3	1.000 pu = 1000 / 1.000 A = 1000	Fault value scaling		■		■	■
3445	Io'>> fault value	1	0	3	1.000 pu = 1000 / 1.000 A = 1000	Fault value scaling		■		■	■
3446	Io'>>> fault value	1	0	3	1.000 pu = 1000 / 1.000 A = 1000	Fault value scaling		■		■	■
3447	IoUo> fault value	1	0	3	1.00 %Pno = 100 / 1 kW = 1	Fault value scaling				■	■
3448	IoUo>> fault value	1	0	3	1.00 %Pno = 100 / 1 kW = 1	Fault value scaling				■	■
3449	I2> fault value	1	0	3	1.00 xIn = 100 / 1.00 A = 100	Fault value scaling	■	■		■	■
3452	Cold load pickup	1	0	3	Start=1;Timeout=2		■	■		■	■
3453	Inrush detection	1	0	3	Start=1;Timeout=2		■	■		■	■
3454	df/dt> fault value	1	0	3	1.00 Hz/s = 100	Fault value scaling	■		■	■	
3455	df/dt>> fault value	1	0	3	1.00 Hz/s = 100	Fault value scaling	■		■	■	
3456	Motor speed	1	0	3	1 rpm = 1		■	■			■

Statistics and virtual Input/Output

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
3501	DI1 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3502	DI2 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3503	DI3 counter	1	1	3, 6	1 = 1		■	■	■	■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
3504	DI4 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3505	DI5 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3506	DI6 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3507	DI7 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3508	DI8 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3509	DI9 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3510	DI10 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3511	DI11 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3512	DI12 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3513	DI13 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3514	DI14 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3515	DI15 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3516	DI16 counter	1	1	3, 6	1 = 1		■	■	■	■	■
3517	DI17 counter	1	1	3, 6	1 = 1					■	■
3518	DI18 counter	1	1	3, 6	1 = 1					■	■
3519	DI19 counter	1	1	3, 6	1 = 1					■	■
3520	DI20 counter	1	1	3, 6	1 = 1					■	■
3521	DI21 counter	1	1	3, 6	1 = 1					■	■
3522	DI22 counter	1	1	3, 6	1 = 1					■	■
3523	DI23 counter	1	1	3, 6	1 = 1					■	■
3524	DI24 counter	1	1	3, 6	1 = 1					■	■
3525	DI25 counter	1	1	3, 6	1 = 1					■	■
3526	DI26 counter	1	1	3, 6	1 = 1					■	■
3527	DI27 counter	1	1	3, 6	1 = 1					■	■
3528	DI28 counter	1	1	3, 6	1 = 1					■	■
3529	DI29 counter	1	1	3, 6	1 = 1					■	■
3530	DI30 counter	1	1	3, 6	1 = 1					■	■
3531	DI31 counter	1	1	3, 6	1 = 1					■	■
3532	DI32 counter	1	1	3, 6	1 = 1					■	■
3533	DI33 counter	1	1	3, 6	1 = 1					■	■
3534	DI34 counter	1	1	3, 6	1 = 1					■	■
3535	DI35 counter	1	1	3, 6	1 = 1					■	■
3536	DI36 counter	1	1	3, 6	1 = 1					■	■
3537	DI37 counter	1	1	3, 6	1 = 1					■	■
3538	DI38 counter	1	1	3, 6	1 = 1					■	■
3539	DI39 counter	1	1	3, 6	1 = 1					■	■
3540	DI40 counter	1	1	3, 6	1 = 1					■	■
3571	Shot1 start counter	1	1	3, 6	1 = 1		■	■		■	
3572	Shot2 start counter	1	1	3, 6	1 = 1		■	■		■	
3573	Shot3 start counter	1	1	3, 6	1 = 1		■	■		■	
3574	Shot4 start counter	1	1	3, 6	1 = 1		■	■		■	

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
3575	Shot5 start counter	1	1	3, 6	1 = 1		■	■		■	
3576	AR start counter	1	1	3, 6	1 = 1		■	■		■	
3577	AR fail counter	1	1	3, 6	1 = 1		■	■		■	
3578	AR shot number	1	0	3	1;2;3;4;5;END=6		■	■		■	
3579	Direct trip AR request	1	0	3	1 = 1		■	■		■	
3580	Recloser locked	1	0	3	1 = 1		■	■		■	
3581	Recloser running	1	0	3	1 = 1		■	■		■	
3582	Final trip	1	0	3	1 = 1		■	■		■	
3583	Auto-Recloser on	1	0	3	1 = 1		■	■		■	
3611	Motor starting	1	0	3	1 = 1		■	■			■
3612	Motor running	1	0	3	1 = 1		■	■			■
3613	Voltage interrupt	1	0	3	Low=0;ok=1		■		■	■	■
3614	Voltage status	1	0	3	OK=0;Low=1; High=2;Low/ High=3;(OK)=4; (Low)=5;(High) =6;(Low)/High=7		■		■	■	■
3615	Timer 1 status	1	1	3, 6	0=1;1=2		■	■	■	■	■
3616	Timer 2 status	1	1	3, 6	0=1;1=2		■	■	■	■	■
3617	Timer 3 status	1	1	3, 6	0=1;1=2		■	■	■	■	■
3618	Timer 4 status	1	1	3, 6	0=1;1=2		■	■	■	■	■
3619	CB monitoring alarm 1	1	0	3	1 = 1		■	■		■	■
3620	CB monitoring alarm 2	1	0	3	1 = 1		■	■		■	■
3621	Logic output status 1...8	1	0	3	1 = 1		■	■	■	■	■
3622	Logic output status 9...16	1	0	3	1 = 1		■	■	■	■	■
3623	Logic output status 17...20	1	0	3	1 = 1		■	■	■	■	■
3626	Virtual outputs 1...10	1	0	3	1 = 1		■	■	■	■	■
3627	Virtual outputs 11...20	1	0	3	1 = 1		■	■	■	■	■
3631	Sync1 request	1	0	3	1 = 1		■		■	■	
3632	Sync1 OK	1	0	3	1 = 1		■		■	■	
3633	Bypass	1	1	3, 6	1 = 1		■		■	■	
3634	Sync1 fail	1	0	3	1 = 1		■		■	■	
3657	Virtual input 1	1	1	3, 6	0;1		■	■	■	■	■
3658	Virtual input 2	1	1	3, 6	0;1		■	■	■	■	■
3659	Virtual input 3	1	1	3, 6	0;1		■	■	■	■	■
3660	Virtual input 4	1	1	3, 6	0;1		■	■	■	■	■
3661	Virtual input 5	1	1	3, 6	0;1		■	■	■	■	■
3662	Virtual input 6	1	1	3, 6	0;1		■	■	■	■	■
3663	Virtual input 7	1	1	3, 6	0;1		■	■	■	■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
3664	Virtual input 8	1	1	3, 6	0;1		■	■	■	■	■
3665	Virtual input 9	1	1	3, 6	0;1		■	■	■	■	■
3666	Virtual input 10	1	1	3, 6	0;1		■	■	■	■	■
3667	Virtual input 11	1	1	3, 6	0;1		■	■	■	■	■
3668	Virtual input 12	1	1	3, 6	0;1		■	■	■	■	■
3669	Virtual input 13	1	1	3, 6	0;1		■	■	■	■	■
3670	Virtual input 14	1	1	3, 6	0;1		■	■	■	■	■
3671	Virtual input 15	1	1	3, 6	0;1		■	■	■	■	■
3672	Virtual input 16	1	1	3, 6	0;1		■	■	■	■	■
3673	Virtual input 17	1	1	3, 6	0;1		■	■	■	■	■
3674	Virtual input 18	1	1	3, 6	0;1		■	■	■	■	■
3675	Virtual input 19	1	1	3, 6	0;1		■	■	■	■	■
3676	Virtual input 20	1	1	3, 6	0;1		■	■	■	■	■

Minimum value, maximum value, ARC and circuit breaker

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
4001	Minimum frequency	1	1	3, 6	50.000 Hz = 5000	Frequency scaling	■	■	■	■	■
4002	Minimum active power	1	1	3, 6	1000 kW = 1000	Power scaling	■			■	■
4003	Minimum react. power	1	1	3, 6	1000 kVAr = 1000	Power scaling	■			■	■
4004	Minimum apparent power	1	1	3, 6	1000 kVA = 1000	Power scaling	■			■	■
4005	Min power factor	1	1	3, 6	1.000 = 1000	PF and cos scaling	■			■	■
4006	Minimum of Io	1	1	3, 6	1.0 % = 10	Io scaling	■	■		■	■
4007	Minimum of Io'	1	1	3, 6	1.0 % = 10	Io' scaling		■		■	■
4008	Demand Minimum active power	1	1	3, 6	1000 kW = 1000	Power scaling	■			■	■
4009	Demand minimum reactive power	1	1	3, 6	1000 kVAr = 1000	Power scaling	■			■	■
4010	Demand Minimum apparent power	1	1	3, 6	1000 kVA = 1000	Power scaling	■			■	■
4011	Demand minimum power factor	1	1	3, 6	1.000 = 1000	PF and cos scaling	■			■	■
4012	RMS Demand mini active power	1	1	3, 6	1000 kW = 1000	Power scaling	■			■	■
4013	RMS Demand min reactive power	1	1	3, 6	1000 kVAr = 1000	Power scaling	■			■	■
4014	RMS Demand mini apparent power	1	1	3, 6	1000 kVA = 1000	Power scaling	■			■	■
4015	Minimum of IL1	1	1	3, 6	1 A = 1		■	■		■	■
4016	Minimum of IL2	1	1	3, 6	1 A = 1		■	■		■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
4017	Minimum of IL3	1	1	3, 6	1 A = 1		■	■		■	■
4018	RMS minimum of IL1	1	1	3, 6	1 A = 1		■	■		■	■
4019	RMS minimum of IL2	1	1	3, 6	1 A = 1		■	■		■	■
4020	RMS minimum of IL3	1	1	3, 6	1 A = 1		■	■		■	■
4021	Demand Minimum of IL1	1	1	3, 6	1 A = 1		■	■		■	■
4022	Demand Minimum of IL2	1	1	3, 6	1 A = 1		■	■		■	■
4023	Demand Minimum of IL3	1	1	3, 6	1 A = 1		■	■		■	■
4024	RMS Demand minimum of IL1	1	1	3, 6	1 A = 1		■	■		■	■
4025	RMS Demand minimum of IL2	1	1	3, 6	1 A = 1		■	■		■	■
4026	RMS Demand minimum of IL3	1	1	3, 6	1 A = 1		■	■		■	■
4027	Minimum of EF current	1	1	3, 6	1.0 pu = 10	Io scaling (CSH)	■	■		■	■
4028	Minimum of Uo	1	1	3, 6	1.0 % = 10	Voltage scaling	■		■	■	■
4030	Minimum of U12	1	1	3, 6	1000 V = 1000	Voltage scaling	■		■	■	■
4031	Minimum of U23	1	1	3, 6	1000 V = 1000	Voltage scaling	■		■	■	■
4032	Minimum of U31	1	1	3, 6	1000 V = 1000	Voltage scaling	■		■	■	■
4033	Minimum U12 RMS voltage / Minimum VL1 RMS voltage	1	1	3, 6	1000 V = 1000	Voltage scaling	■		■	■	■
4034	Minimum U23 RMS voltage / Minimum VL2 RMS voltage	1	1	3, 6	1000 V = 1000	Voltage scaling	■		■	■	■
4035	Minimum VL3 RMS voltage / Minimum U12y RMS voltage	1	1	3, 6	1000 V = 1000	Voltage scaling	■		■	■	■
4101	Maximum frequency	1	1	3, 6	50.000 Hz = 5000	Frequency scaling	■	■	■	■	■
4102	Maximum active power	1	1	3, 6	1000 kW = 1000	Power scaling	■			■	■
4103	Maximum react. power	1	1	3, 6	1000 kVAr = 1000	Power scaling	■			■	■
4104	Maximum apparent power	1	1	3, 6	1000 kVA = 1000	Power scaling	■			■	■
4105	Max power factor	1	1	3, 6	1.000 = 1000	PF and cos scaling	■			■	■
4106	Maximum of Io	1	1	3, 6	1.0 % = 10	Io scaling	■	■		■	■
4107	Maximum of Io'	1	1	3, 6	1.0 % = 10	Io' scaling		■		■	■
4108	Demand Maximum active power	1	1	3, 6	1000 kW = 1000	Power scaling	■			■	■
4109	Demand maximum reactive power	1	1	3, 6	1000 kVAr = 1000	Power scaling	■			■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
4110	Demand Maximum apparent power	1	1	3, 6	1000 kVA = 1000	Power scaling	■			■	■
4111	Demand maximum power factor	1	1	3, 6	1.000 = 1000	PF and cos scaling	■			■	■
4112	RMS Demand Max active power	1	1	3, 6	1000 kW = 1000	Power scaling	■			■	■
4113	RMS Demand max reactive power	1	1	3, 6	1000 kVAr = 1000	Power scaling	■			■	■
4114	RMS Demand Max apparent power	1	1	3, 6	1000 kVA = 1000	Power scaling	■			■	■
4115	Maximum of IL1	1	1	3, 6	1 A = 1		■	■		■	■
4116	Maximum of IL2	1	1	3, 6	1 A = 1		■	■		■	■
4117	Maximum of IL3	1	1	3, 6	1 A = 1		■	■		■	■
4118	RMS maximum of IL1	1	1	3, 6	1 A = 1		■	■		■	■
4119	RMS maximum of IL2	1	1	3, 6	1 A = 1		■	■		■	■
4120	RMS maximum of IL3	1	1	3, 6	1 A = 1		■	■		■	■
4121	Demand Maximum of IL1	1	1	3, 6	1 A = 1		■	■		■	■
4122	Demand Maximum of IL2	1	1	3, 6	1 A = 1		■	■		■	■
4123	Demand Maximum of IL3	1	1	3, 6	1 A = 1		■	■		■	■
4124	RMS Demand maximum of IL1	1	1	3, 6	1 A = 1		■	■		■	■
4125	RMS Demand maximum of IL2	1	1	3, 6	1 A = 1		■	■		■	■
4126	RMS Demand maximum of IL3	1	1	3, 6	1 A = 1		■	■		■	■
4127	Maximum of EF current	1	1	3, 6	1.0 pu = 10	Io scaling (CSH)	■	■		■	■
4128	Maximum of Uo	1	1	3, 6	1.0 % = 10	Voltage scaling	■		■	■	■
4130	Maximum of U12	1	1	3, 6	1000 V = 1000	Voltage scaling	■		■	■	■
4131	Maximum of U23	1	1	3, 6	1000 V = 1000	Voltage scaling	■		■	■	■
4132	Maximum of U31	1	1	3, 6	1000 V = 1000	Voltage scaling	■		■	■	■
4133	Maximum U12 RMS voltage / Maximum VL1 RMS voltage	1	1	3, 6	1000 V = 1000	Voltage scaling	■		■	■	■
4134	Maximum U23 RMS voltage / Maximum VL2 RMS voltage /	1	1	3, 6	1000 V = 1000	Voltage scaling	■		■	■	■
4135	Maximum VL3 RMS voltage / Maximum U12y RMS voltage	1	1	3, 6	1000 V = 1000	Voltage scaling	■		■	■	■
4299	Arc Io state	1	0	3	1 = 1					■	■
4300	Arc I state	1	0	3	1 = 1					■	■
4301	Clear I/O units' registers	1	1	3, 6	Clear=1						

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
4302	Release all latches	1	1	3, 6	Release=1					■	■
4303	Arc Stages	1	0	3	1 = 1					■	■
4304... 4309	Arc sensor status	1	0	3	OK=1;Active=2; Not conn=3;Shrt circ=4;Daylight=5; Not Inst.=6;Null=0					■	■
4351... 4355	Low limit (primary value)	1	0	3	1.0 kA = 10		■	■		■	■
4349	Minimum CB trip cmd. Time	1	1	3.6	1.0s = 1		■	■		■	■
4356... 4359	High limit (xIn)	1	0	3	1.00 xIn = 100		■	■		■	■
4360... 4361	Sum of broken current IL11	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4362... 4363	Sum of broken current IL12	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4364... 4365	Sum of broken current IL13	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4366... 4367	Sum of broken current IL14	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4368... 4369	Sum of broken current IL15	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4370... 4374	IL1 broken current counter	1	0	3	1000 = 1000	CB open count scaling	■	■		■	■
4375... 4376	Sum of broken current IL21	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4377... 4378	Sum of broken current IL22	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4379... 4380	Sum of broken current IL23	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4381... 4382	Sum of broken current IL24	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4383... 4384	Sum of broken current IL25	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4385... 4389	IL2 broken current counter	1	0	3	1000 = 1000	CB open count scaling	■	■		■	■
4390... 4391	Sum of broken current IL31	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4392... 4393	Sum of broken current IL32	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4394... 4395	Sum of broken current IL33	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4396... 4397	Sum of broken current IL34	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4398... 4399	Sum of broken current IL35	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
4400... 4404	IL3 broken current counter	1	0	3	1000 = 1000	CB open count scaling	■	■		■	■
4405... 4406	Cumul. broken current IL1	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4407... 4408	Cumul. broken current IL2	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4409... 4410	Cumul. broken current IL3	1	0	3	neighbouring two register combine to a float32 value		■	■		■	■
4411	CB Open Counter	1	0	3	1 = 1	CB open count scaling	■	■		■	■
4412	Protection Trip counter	1	0	3	1000 = 1000	CB open count scaling	■	■		■	■
4413	Rack out counter	1	0	3	1000 = 1000	CB open count scaling	■	■		■	■
4414... 4453	CB opening time	1	0	3	1 = 1		■	■		■	■
4455... 4494	CB Closing time	1	0	3	1 = 1		■	■		■	■
4496... 4535	Spring Charging times	1	0	3	1 = 1		■	■		■	■
4536… 4538	Alarm1	1	0	3	1000 = 1000	Limit for oper. left scaling	■	■		■	■
4539… 4541	Alarm2	1	0	3	1000 = 1000	Limit for oper. left scaling	■	■		■	■

Settings

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
ARC setting items:											
5001	I>int. pick-up value	1	1	3, 6	1.00 xIn = 100					■	■
5002	Io>int. pick-up value	1	1	3, 6	1.00 xIn = 100					■	■
5003	Arc stage 1 enabled	1	1	3, 6	Off=0;On=1					■	■
5004	Arc stage 2 enabled	1	1	3, 6	Off=0;On=1					■	■
5005	Arc stage 3 enabled	1	1	3, 6	Off=0;On=1					■	■
5006	Arc stage 4 enabled	1	1	3, 6	Off=0;On=1					■	■
5007	Arc stage 5 enabled	1	1	3, 6	Off=0;On=1					■	■
5008	Arc stage 6 enabled	1	1	3, 6	Off=0;On=1					■	■
5009	Arc stage 7 enabled	1	1	3, 6	Off=0;On=1					■	■
5010	Arc stage 8 enabled	1	1	3, 6	Off=0;On=1					■	■
5011	Stage 1 Mode	1	1	3, 6	Light=0; Light&Current=1					■	■
5012	Stage 2 Mode	1	1	3, 6	Light=0; Light&Current=1					■	■
5013	Stage 3 Mode	1	1	3, 6	Light=0; Light&Current=1					■	■
5014	Stage 4 Mode	1	1	3, 6	Light=0; Light&Current=1					■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
5015	Stage 5 Mode	1	1	3, 6	Light=0; Light&Current=1					■	■
5016	Stage 6 Mode	1	1	3, 6	Light=0; Light&Current=1					■	■
5017	Stage 7 Mode	1	1	3, 6	Light=0; Light&Current=1					■	■
5018	Stage 8 Mode	1	1	3, 6	Light=0; Light&Current=1					■	■
5019	Trip 1 delay [x1ms]	1	1	3, 6	1 = 1					■	■
5020	Trip 2 delay [x1ms]	1	1	3, 6	1 = 1					■	■
5021	Trip 3 delay [x1ms]	1	1	3, 6	1 = 1					■	■
5022	Trip 4 delay [x1ms]	1	1	3, 6	1 = 1					■	■
5023	Trip 5 delay [x1ms]	1	1	3, 6	1 = 1					■	■
5024	Trip 6 delay [x1ms]	1	1	3, 6	1 = 1					■	■
5025	Trip 7 delay [x1ms]	1	1	3, 6	1 = 1					■	■
5026	Trip 8 delay [x1ms]	1	1	3, 6	1 = 1					■	■
5027	Min. hold time [x1ms]	1	1	3, 6	1 = 1					■	■
5028	Min. hold time2 [x1ms]	1	1	3, 6	1 = 1					■	■
5029	Min. hold time3 [x1ms]	1	1	3, 6	1 = 1					■	■
5030	Min. hold time4 [x1ms]	1	1	3, 6	1 = 1					■	■
5031	Min. hold time5 [x1ms]	1	1	3, 6	1 = 1					■	■
5032	Min. hold time6 [x1ms]	1	1	3, 6	1 = 1					■	■
5033	Min. hold time7 [x1ms]	1	1	3, 6	1 = 1					■	■
5034	Min. hold time8 [x1ms]	1	1	3, 6	1 = 1					■	■
Inrush setting											
5101	Enable for Inrush	1	1	3, 6	Off=0;On=1		■	■		■	■
5102	Max inrush current	1	1	3, 6	1.00 xIn = 100		■	■		■	■
5103	Pickup for 2nd harmonic	1	1	3, 6	1 % = 1		■	■		■	■
OverCurrent I> setting											
5151	Enable for I>	1	1	3, 6	Off=0;On=1		■	■		■	■
5152... 5155	Pick-up value	1	1	3, 6	1.00 xIn = 100		■	■		■	■
5156... 5159	Delay curve family	1	1	3, 6	DT=0;IEC=1; IEEE=2;IEEE2=3; Others=4;Prg1=5; Prg2=6;Prg3=7		■	■		■	■
5160... 5163	Delay type	1	1	3, 6	DT=0;NI=1;VI=2; EI=3;LTI=4;LTEI= 5;LTVI=6;MI=7; STI=8;STEI=9; CO8=10;RI=11; RXIDG=12		■	■		■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
5164... 5167	Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
5168... 5171	Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
5172... 5175	Reset time	1	1	3, 6	1.00 s = 100		■	■		■	■
5176... 5179	Inrush status for I>	1	1	3, 6	Off=0;On=1		■	■		■	■
5180... 5183	SOL use by I>	1	1	3, 6	Off=0;On=1		■	■		■	■
5184... 5187	SOL Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
5188... 5191	SOL Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
5192... 5195	CLPU status for I>	1	1	3, 6	Off=0;On=1		■	■		■	■
5196... 5199	CLPU pick-up value	1	1	3, 6	1.00 xIn = 100		■	■		■	■
5200... 5203	CLPU operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
5204... 5207	CLPU Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
5208	Include harmonics	1	1	3, 6	Off=0;On=1		■	■		■	■
5209... 5212	Reset type	1	1	3, 6	DT=0;IDMT=1		■	■		■	■
OverCurrent I>> setting											
5251	Enable for I>>	1	1	3, 6	Off=0;On=1		■	■		■	■
5252... 5255	Pick-up value	1	1	3, 6	1.00 xIn = 100		■	■		■	■
5256... 5259	Delay curve family	1	1	3, 6	DT=0;IEC=1; IEEE=2;IEEE2=3; Others=4;Prg1=5; Prg2=6;Prg3=7		■	■		■	■
5260... 5263	Delay type	1	1	3, 6	DT=0;NI=1;VI=2; EI=3;LTI=4;LTEI= 5;LTVI=6;MI=7; STI=8;STEI=9; CO8=10;RI=11; RXIDG=12		■	■		■	■
5264... 5267	Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
5268... 5271	Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
5272... 5275	Inrush status for I>>	1	1	3, 6	Off=0;On=1		■	■		■	■
5276... 5279	SOL use by I>>	1	1	3, 6	Off=0;On=1		■	■		■	■
5280... 5283	SOL Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
5284... 5287	SOL Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
5288... 5291	CLPU status for I>>	1	1	3, 6	Off=0;On=1		■	■		■	■
5292... 5295	CLPU pick-up value	1	1	3, 6	1.00 xIn = 100		■	■		■	■
5296... 5299	CLPU Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
5300... 5303	CLPU Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
5304	Include harmonics	1	1	3, 6	Off=0;On=1		■	■		■	■
5305... 5308	Reset type	1	1	3, 6	DT=0;IDMT=1		■	■		■	■
5309... 5312	Reset time	1	1	3, 6	1.00 s = 100		■	■		■	■
OverCurrent I>>> setting											
5351	Enable for I>>>	1	1	3, 6	Off=0;On=1		■	■		■	■
5352... 5355	Pick-up value	1	1	3, 6	1.00 xIn = 100		■	■		■	■
5356... 5359	Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
5360... 5363	Inrush status for I>>>	1	1	3, 6	Off=0;On=1		■	■		■	■
5364... 5367	SOL use by I>>>	1	1	3, 6	Off=0;On=1		■	■		■	■
5368... 5371	SOL Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
5372... 5375	CLPU status for I>>>	1	1	3, 6	Off=0;On=1		■	■		■	■
5376... 5379	CLPU pick-up value	1	1	3, 6	1.00 xIn = 100		■	■		■	■
5380... 5383	CLPU Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
SOTF setting											
5401	Enable for SOTF	1	1	3, 6	Off=0;On=1		■	■		■	■
5402	Pick-up value	1	1	3, 6	1.00 xIn = 100		■	■		■	■
5403	Dead line detection delay	1	1	3, 6	1.00 s = 100		■	■		■	■
5404	SOTF active Timer	1	1	3, 6	1.00 s = 100		■	■		■	■
5405	Dead line detection input	1	1	3, 6	Value [16]		■	■		■	■
Iφ> setting											
5411	Enable for Iφ>	1	1	3, 6	Off=0;On=1		■			■	■
5412... 5415	Pick-up value	1	1	3, 6	1.00 xIn = 100		■			■	■
5416... 5419	Direction mode	1	1	3, 6	Dir+Backup=0; Undir=1;Dir=2		■			■	■
5420... 5423	Angle offset	1	1	3, 6	1 ° = 1		■			■	■
5424... 5427	Delay curve family	1	1	3, 6	DT=0;IEC=1; IEEE=2;IEEE2=3; Others=4;Prg1=5; Prg2=6;Prg3=7		■			■	■
5428... 5431	Delay type	1	1	3, 6	DT=0;NI=1;VI=2; EI=3;LTI=4;LTEI= 5;LTVI=6;MI=7; STI=8;STEI=9;		■			■	■

16. DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DO1(B)=33;DO2(B)=34;DO3(B)=35; Watchdog=36;SF=37;SF=38;SF=39;SF=40;SF=41;BO=42;DO1(C)=43;DO2(C)=44;DO3(C)=45;DO4(C)=46;LedAl=49;LedTr=50;LedA=51;LedB=52;LedC=53;LedDR=54;VO1=55;VO2=56;...;VO5=59;VO6=60;DI21=65;DI22=66;...;DI39=83;DI40=84;F1=85;F2=86;...;F6=90;F7=91;DO1(D)=97;DO2(D)=98;DO3(D)=99;SF=100;DO1(E)=101;DO2(E)=102;NI1=129;NI2=130;...;NI63=191;NI64=192;POC1=193;POC2=194;...;POC15=207;POC16=208;VI5=225;VI6=226;...;VI19=239;VI20=240;VO7=257;VO8=258;...;VO19=269;VO20=270;NI65=289;NI66=290;...;NI127=351;NI128=352

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
					CO8=10;RI=11; RXIDG=12						
5432... 5435	Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
5436... 5439	Inv. time coefficient	1	1	3, 6	1.000 = 1000		■			■	■
5440... 5443	Reset time	1	1	3, 6	1.00 s = 100		■			■	■
5444... 5447	Inrush status for Iφ>	1	1	3, 6	Off=0;On=1		■			■	■
5448... 5451	SOL status for Iφ>	1	1	3, 6	Off=0;On=1		■			■	■
5452... 5455	SOL Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
5456... 5459	SOL Inv. time coefficient	1	1	3, 6	1.000 = 1000		■			■	■
5460... 5463	CLPU status for Iφ>	1	1	3, 6	Off=0;On=1		■			■	■
5464... 5467	CLPU pick-up value	1	1	3, 6	1.00 xIn = 100		■			■	■
5468... 5471	CLPU Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
5472... 5475	CLPU Inv. time coefficient	1	1	3, 6	1.000 = 1000		■			■	■
5476... 5479	Reset type	1	1	3, 6	DT=0;IDMT=1		■			■	■
Iφ>> setting											
5481	Enable for Iφ>>	1	1	3, 6	Off=0;On=1		■			■	■
5482... 5485	Pick-up value	1	1	3, 6	1.00 xIn = 100		■			■	■
5486... 5489	Direction mode	1	1	3, 6	Dir+Backup=0; Undir=1;Dir=2		■			■	■
5490... 5493	Angle offset	1	1	3, 6	1 ° = 1		■			■	■
5494... 5497	Delay curve family	1	1	3, 6	DT=0;IEC=1; IEEE=2;IEEE2=3; Others=4;Prg1=5; Prg2=6;Prg3=7		■			■	■
5498... 5501	Delay type	1	1	3, 6	DT=0;NI=1;VI=2; EI=3;LTI=4;LTEI= 5;LTVI=6;MI=7; STI=8;STEI=9; CO8=10;RI=11; RXIDG=12		■			■	■
5502... 5505	Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
5506... 5509	Inv. time coefficient	1	1	3, 6	1.000 = 1000		■			■	■
5510... 5513	Reset time	1	1	3, 6	1.00 s = 100		■			■	■
5514... 5517	Inrush status for Iφ>>	1	1	3, 6	Off=0;On=1		■			■	■
5518... 5521	SOL status for Iφ>>	1	1	3, 6	Off=0;On=1		■			■	■
5522... 5525	SOL Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
5526... 5529	SOL Inv. time coefficient	1	1	3, 6	1.000 = 1000		■			■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
5530... 5533	CLPU status for Iφ>>	1	1	3, 6	Off=0;On=1		■			■	■
5534... 5537	CLPU Pick-up value	1	1	3, 6	1.00 xIn = 100		■			■	■
5538... 5541	CLPU Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
5542... 5545	CLPU Inv. time coefficient	1	1	3, 6	1.000 = 1000		■			■	■
5546... 5549	Reset type	1	1	3, 6	DT=0;IDMT=1		■			■	■
Iφ>>> setting											
5551	Enable for Iφ>>>	1	1	3, 6	Off=0;On=1		■			■	■
5552... 5555	Pick-up value	1	1	3, 6	1.00 xIn = 100		■			■	■
5556... 5559	Direction mode	1	1	3, 6	Dir+Backup=0; Undir=1;Dir=2		■			■	■
5560... 5563	Angle offset	1	1	3, 6	1 ° = 1		■			■	■
5564... 5567	Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
5568... 5571	Inrush status for Iφ>>>	1	1	3, 6	Off=0;On=1		■			■	■
5572... 5575	SOL status for Iφ>>>	1	1	3, 6	Off=0;On=1		■			■	■
5576... 5579	SOL Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
5580... 5583	CLPU status for Iφ>>>	1	1	3, 6	Off=0;On=1		■			■	■
5584... 5587	CLPU Pick-up value	1	1	3, 6	1.00 xIn = 100		■			■	■
5588... 5591	CLPU Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
Iφ>>>> setting											
5601	Enable for Iφ>>>>	1	1	3, 6	Off=0;On=1		■			■	■
5602... 5605	Pick-up value	1	1	3, 6	1.00 xIn = 100		■			■	■
5606... 5609	Direction mode	1	1	3, 6	Dir+Backup=0; Undir=1;Dir=2		■			■	■
5610... 5613	Angle offset	1	1	3, 6	1 ° = 1		■			■	■
5614... 5617	Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
5618... 5621	Inrush status for Iφ>>>>	1	1	3, 6	Off=0;On=1		■			■	■
5622... 5625	SOL status for Iφ>>>>	1	1	3, 6	Off=0;On=1		■			■	■
5626... 5629	SOL Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
5630... 5633	CLPU status for Iφ>>>>	1	1	3, 6	Off=0;On=1		■			■	■
5634... 5637	CLPU Pick-up value	1	1	3, 6	1.00 xIn = 100		■			■	■
5638... 5641	CLPU Operation delay	1	1	3, 6	1.00 s = 100		■			■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
P< setting											
5651	Enable for P<	1	1	3, 6	Off=0;On=1		■			■	■
5652... 5655	Pick-up value	1	1	3, 6	1 %Sn = 1		■			■	■
5656... 5659	Operation delay	1	1	3, 6	1.0 s = 10		■			■	■
P<< setting											
5701	Enable for P<<	1	1	3, 6	Off=0;On=1		■			■	■
5702... 5705	Pick-up value	1	1	3, 6	1 %Sn = 1		■			■	■
5706... 5709	Operation delay	1	1	3, 6	1.0 s = 10		■			■	■
I< setting											
5751	Enable for I<	1	1	3, 6	Off=0;On=1		■	■			■
5752... 5755	Pick-up value	1	1	3, 6	1.00 %In = 100		■	■			■
5756... 5759	Operation delay	1	1	3, 6	1.0 s = 10		■	■			■
I2>I1 setting											
5801	Enable for I2/I1>	1	1	3, 6	Off=0;On=1		■	■		■	■
5802... 5805	Pick-up value	1	1	3, 6	1 % = 1		■	■		■	■
5806... 5809	Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
I2> setting											
5901	Enable for I2>	1	1	3, 6	Off=0;On=1		■	■		■	■
5902... 5905	Pick-up value	1	1	3, 6	1.00 xIn = 100		■	■		■	■
5906... 5909	Delay curve family	1	1	3, 6	DT=0;IEC=1; IEEE=2;IEEE2=3; Others=4;Prg1=5; Prg2=6;Prg3=7		■	■		■	■
5910... 5913	Delay type	1	1	3, 6	DT=0;NI=1;VI=2; EI=3;LTI=4;LTEI= 5;LTVI=6;MI=7; STI=8;STEI=9; CO8=10;RI=11; RXIDG=12		■	■		■	■
5914... 5917	Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
5918... 5921	Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
5922... 5925	Reset type	1	1	3, 6	DT=0;IDMT=1		■	■		■	■
5926... 5929	Reset time	1	1	3, 6	1.00 s = 100		■	■		■	■
Ist> setting											
5951	Enable for Ist>	1	1	3, 6	Off=0;On=1		■	■			■
5952	Delay type	1	1	3, 6	DT=0;INV=1		■	■			■
5953	Motor start time	1	1	3, 6	1.0 s = 10		■	■			■
IIr> setting											
6001	Enable for IIr>	1	1	3, 6	Off=0;On=1		■	■			■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
6002	Pick-up value	1	1	3, 6	1.0 % = 10		■	■			■
6003	Delay type	1	1	3, 6	DT=0;INV=1		■	■			■
6004	Operation delay	1	1	3, 6	1.0 s = 10		■	■			■
N> setting											
6051	Enable for N>	1	1	3, 6	Off=0;On=1		■	■			■
6052	Max motor Hot starts	1	1	3, 6	1 = 1		■	■			■
6053	Max motor cold starts	1	1	3, 6	1 = 1		■	■			■
6054	Min time between motor starts	1	1	3, 6	1.0 min = 10		■	■			■
6055	Reference period	1	1	3, 6	1.0 min = 10		■	■			■
6056	Hot Status Limit	1	1	3, 6	1.0 % = 10		■	■			■
Motor T°> setting											
6101	Enable for Motor T>	1	1	3, 6	Off=0;On=1		■	■			■
6102... 6105	Basic current setting	1	1	3, 6	1.00 xIn = 100		■	■			■
6106... 6109	Max permissive I factor	1	1	3, 6	1.00 = 100		■	■			■
6110... 6113	Heating time constant	1	1	3, 6	1.0 min = 10		■	■			■
6114... 6117	Time constant for motor starting	1	1	3, 6	1.0 min = 10		■	■			■
6118... 6121	Cooling time constant	1	1	3, 6	1.0 min = 10		■	■			■
6130... 6133	Unbalance factor	1	1	3, 6	1.0 = 10		■	■			■
6134... 6137	Thermal alarm value	1	1	3, 6	1 % = 1		■	■			■
6138... 6141	Reserve time thermal alarm	1	1	3, 6	1.0 min = 10		■	■			■
6142... 6145	Temperature based mode	1	1	3, 6	Current=0; Ambient=1		■	■			■
6146... 6149	Nominal ambient temp	1	1	3, 6	1 °C = 1 / 1 °F = 1		■	■			■
6150... 6153	Max object temperature	1	1	3, 6	1 °C = 1 / 1 °F = 1		■	■			■
6154... 6157	Alarm temperature	1	1	3, 6	1 °C = 1 / 1 °F = 1		■	■			■
6158... 6161	Min ambient temperature	1	1	3, 6	1 °C = 1 / 1 °F = 1		■	■			■
6162... 6165	Default ambient temperature	1	1	3, 6	1 °C = 1 / 1 °F = 1		■	■			■
Feeder T°> setting											
6201	Enable for feeder T>	1	1	3, 6	Off=0;On=1		■	■		■	
6202... 6205	Basic current setting	1	1	3, 6	1.00 xIn = 100		■	■		■	
6206... 6209	Max permissive I factor	1	1	3, 6	1.00 = 100		■	■		■	
6210... 6213	Heating time constant	1	1	3, 6	1.0 min = 10		■	■		■	

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
6214... 6217	Thermal alarm value	1	1	3, 6	1 % = 1		■	■		■	
6218... 6221	Reserve time thermal alarm	1	1	3, 6	1.0 min = 10		■	■		■	
6222... 6225	Temperature based mode	1	1	3, 6	Current=0; Ambient=1		■	■		■	
6226... 6229	Nominal ambient temp	1	1	3, 6	1 °C = 1 / 1 °F = 1		■	■		■	
6230... 6233	Max object temperature	1	1	3, 6	1 °C = 1 / 1 °F = 1		■	■		■	
6234... 6237	Alarm temperature	1	1	3, 6	1 °C = 1 / 1 °F = 1		■	■		■	
6238... 6241	Min ambient temperature	1	1	3, 6	1 °C = 1 / 1 °F = 1		■	■		■	
6242... 6245	Default ambient temperature	1	1	3, 6	1 °C = 1 / 1 °F = 1		■	■		■	
Io> setting											
6261	Enable for Io>	1	1	3, 6	Off=0;On=1		■	■		■	■
6262... 6265	Pick-up value	1	1	3, 6	1.000 pu = 1000		■	■		■	■
6266... 6269	Delay curve family	1	1	3, 6	DT=0;IEC=1; IEEE=2;IEEE2=3; Others=4;Prg1=5; Prg2=6;Prg3=7		■	■		■	■
6270... 6273	Delay type	1	1	3, 6	DT=0;NI=1;VI=2; EI=3;LTI=4;LTEI= 5;LTVI=6;MI=7; STI=8;STEI=9; CO8=10;RI=11; RXIDG=12		■	■		■	■
6274... 6277	Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
6278... 6281	Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
6282... 6285	Network earthing	1	1	3, 6	Res=0;Cap=1		■	■		■	■
6286... 6289	Reset time	1	1	3, 6	1.00 s = 100		■	■		■	■
6291... 6294	Inrush status for Io>	1	1	3, 6	Off=0;On=1		■	■		■	■
6295... 6298	SOL use for Io>	1	1	3, 6	Off=0;On=1		■	■		■	■
6299... 6302	SOL Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
6303... 6306	SOL Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
6307... 6310	CLPU status for Io>	1	1	3, 6	Off=0;On=1		■	■		■	■
6311... 6314	CLPU Pick-up value	1	1	3, 6	1.00 xIn = 100		■	■		■	■
6315... 6318	CLPU Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
6319... 6322	CLPU Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
6323... 6326	Reset type	1	1	3, 6	DT=0;IDMT=1		■	■		■	■
6327	Enable faulty phase detection	1	1	3, 6	Off=0;On=1		■	■		■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
6328	Phase currents change limit	1	1	3, 6	1 % = 1		■	■		■	■
Io>> setting											
6331	Enable for Io>>	1	1	3, 6	Off=0;On=1		■	■		■	■
6332... 6335	Pick-up value	1	1	3, 6	1.00 pu = 100		■	■		■	■
6336... 6339	Delay curve family	1	1	3, 6	DT=0;IEC=1; IEEE=2;IEEE2=3; Others=4;Prg1=5; Prg2=6;Prg3=7		■	■		■	■
6340... 6343	Delay type	1	1	3, 6	DT=0;NI=1;VI=2; EI=3;LTI=4;LTEI= 5;LTVI=6;MI=7; STI=8;STEI=9; CO8=10;RI=11; RXIDG=12		■	■		■	■
6344... 6347	Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
6348... 6351	Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
6352... 6355	Network earthing	1	1	3, 6	Res=0;Cap=1		■	■		■	■
6356... 6359	Inrush status for Io>>	1	1	3, 6	Off=0;On=1		■	■		■	■
6360... 6363	SOL use for Io>>	1	1	3, 6	Off=0;On=1		■	■		■	■
6364... 6367	SOL Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
6368... 6371	SOL Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
6372... 6375	CLPU status for Io>>	1	1	3, 6	Off=0;On=1		■	■		■	■
6376... 6379	CLPU Pick-up value	1	1	3, 6	1.00 xIn = 100		■	■		■	■
6380... 6383	CLPU Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
6384... 6387	CLPU Inv. time coefficient	1	1	3, 6	1.000 = 1000		■	■		■	■
6388... 6391	Reset type	1	1	3, 6	DT=0;IDMT=1		■	■		■	■
6392... 6395	Reset time	1	1	3, 6	1.00 s = 100		■	■		■	■
6396	Enable faulty phase detection	1	1	3, 6	Off=0;On=1		■	■		■	■
6397	Phase currents change limit	1	1	3, 6	1 % = 1		■	■		■	■
Io>>> setting											
6401	Enable for Io>>>	1	1	3, 6	Off=0;On=1		■	■		■	■
6402... 6405	Pick-up value	1	1	3, 6	1.00 pu = 100		■	■		■	■
6406... 6409	Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
6410... 6413	Network earthing	1	1	3, 6	Res=0;Cap=1			■		■	■
6414... 6417	Inrush status for Io>>>	1	1	3, 6	Off=0;On=1			■		■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
6418... 6421	SOL use for Io>>>	1	1	3, 6	Off=0;On=1			■		■	■
6422... 6425	SOL Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
6426... 6429	CLPU status for Io>>>	1	1	3, 6	Off=0;On=1			■		■	■
6430... 6433	CLPU Pick-up value	1	1	3, 6	1.00 xIn = 100			■		■	■
6434... 6437	CLPU Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
6438	Enable faulty phase detection	1	1	3, 6	Off=0;On=1			■		■	■
6439	Phase currents change limit	1	1	3, 6	1 % = 1			■		■	■
Io>>>> setting											
6451	Enable for Io>>>>	1	1	3, 6	Off=0;On=1			■		■	■
6452... 6455	Pick-up value	1	1	3, 6	1.00 pu = 100			■		■	■
6456... 6459	Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
6460... 6463	Network earthing	1	1	3, 6	Res=0;Cap=1			■		■	■
6464... 6467	Inrush status for Io>>>>	1	1	3, 6	Off=0;On=1			■		■	■
6468... 6471	SOL use for Io>>>>	1	1	3, 6	Off=0;On=1			■		■	■
6472... 6475	SOL Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
6476... 6479	CLPU status for Io>>>>	1	1	3, 6	Off=0;On=1			■		■	■
6480... 6483	CLPU Pick-up value	1	1	3, 6	1.00 xIn = 100			■		■	■
6484... 6487	CLPU Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
6488	Enable faulty phase detection	1	1	3, 6	Off=0;On=1			■		■	■
6489	Phase currents change limit	1	1	3, 6	1 % = 1			■		■	■
Io>>>>> setting											
6501	Enable for Io>>>>>	1	1	3, 6	Off=0;On=1			■		■	■
6502... 6505	Pick-up value	1	1	3, 6	1.00 pu = 100			■		■	■
6506... 6509	Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
Ioφ> setting											
6551	Enable for Ioφ>	1	1	3, 6	Off=0;On=1		■			■	■
6552... 6555	Direction mode	1	1	3, 6	ResCap=0; Sector=1;Undir=2		■			■	■
6556... 6559	Char ctrl. in ResCap mode	1	1	3, 6	Res=0;Cap=1; DI1=2;DI2=3;...; DI19=20;DI20= 21;Arc1=26; Arc2=27;BI=28; VI1=30;VI2=31; VI3=32;VI4=33; DI21=66;DI22=		■			■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
					67;...;DI31=76; DI32=77						
6560... 6563	Pick-up value	1	1	3, 6	1.000 pu = 1000		■			■	■
6564... 6567	Uo setting for Ioφ> stage	1	1	3, 6	1.0 % = 10		■			■	■
6568... 6571	Angle offset	1	1	3, 6	1 ° = 1		■			■	■
6572... 6575	Pick up sector size	1	1	3, 6	1 ±° = 1		■			■	■
6576... 6579	Delay curve family	1	1	3, 6	DT=0;IEC=1; IEEE=2;IEEE2=3; Others=4;Prg1=5; Prg2=6;Prg3=7		■			■	■
6580... 6583	Delay type	1	1	3, 6	DT=0;NI=1;VI=2; EI=3;LTI=4;LTEI= 5;LTVI=6;MI=7; STI=8;STEI=9; CO8=10;RI=11; RXIDG=12		■			■	■
6584... 6587	Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
6588... 6591	Inv. time coefficient	1	1	3, 6	1.000 = 1000		■			■	■
6592... 6595	Reset type	1	1	3, 6	DT=0;IDMT=1		■			■	■
6596... 6599	Reset time	1	1	3, 6	1.00 s = 100		■			■	■
Ioφ>> setting											
6601	Enable for Ioφ>>	1	1	3, 6	Off=0;On=1		■			■	■
6602... 6605	Direction mode	1	1	3, 6	ResCap=0; Sector=1;Undir=2		■			■	■
6606... 6609	Char ctrl. in ResCap mode	1	1	3, 6	Res=0;Cap=1; DI1=2;DI2=3;...; DI19=20;DI20= 21;Arc1=26; Arc2=27;BI=28; VI1=30;VI2=31; VI3=32;VI4=33; DI21=66;DI22= 67;...;DI31=76; DI32=77		■			■	■
6610... 6613	Pick-up value	1	1	3, 6	1.000 pu = 1000		■			■	■
6614... 6617	Uo setting for Ioφ>> stage	1	1	3, 6	1.0 % = 10		■			■	■
6618... 6621	Angle offset	1	1	3, 6	1 ° = 1		■			■	■
6622... 6625	Pick up sector size	1	1	3, 6	1 ±° = 1		■			■	■
6626... 6629	Delay curve family	1	1	3, 6	DT=0;IEC=1; IEEE=2;IEEE2=3; Others=4;Prg1=5; Prg2=6;Prg3=7		■			■	■
6630... 6633	Delay type	1	1	3, 6	DT=0;NI=1;VI=2; EI=3;LTI=4;LTEI= 5;LTVI=6;MI=7; STI=8;STEI=9; CO8=10;RI=11; RXIDG=12		■			■	■
6634... 6637	Operation delay	1	1	3, 6	1.00 s = 100		■			■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
6638... 6641	Inv. time coefficient	1	1	3, 6	1.000 = 1000		■			■	■
6642... 6645	Reset type	1	1	3, 6	DT=0;IDMT=1		■			■	■
6646... 6649	Reset time	1	1	3, 6	1.00 s = 100		■			■	■
Ioφ>>> setting											
6651	Enable for Ioφ>>>	1	1	3, 6	Off=0;On=1		■			■	■
6652... 6655	Direction mode	1	1	3, 6	ResCap=0; Sector=1;Undir=2		■			■	■
6656... 6659	Char ctrl. in ResCap mode	1	1	3, 6	Res=0;Cap=1; DI1=2;DI2=3;...; DI19=20;DI20= 21;Arc1=26; Arc2=27;BI=28; VI1=30;VI2=31; VI3=32;VI4=33; DI21=66;DI22= 67;...;DI31=76; DI32=77		■			■	■
6660... 6663	Pick-up value	1	1	3, 6	1.000 pu = 1000		■			■	■
6664... 6667	Uo setting for Ioφ>>> stage	1	1	3, 6	1.0 % = 10		■			■	■
6668... 6671	Angle offset	1	1	3, 6	1 ° = 1		■			■	■
6672... 6675	Pick up sector size	1	1	3, 6	1 ±° = 1		■			■	■
6676... 6679	Delay curve family	1	1	3, 6	DT=0;IEC=1; IEEE=2;IEEE2=3; Others=4;Prg1=5; Prg2=6;Prg3=7		■			■	■
6680... 6683	Delay type	1	1	3, 6	DT=0;NI=1;VI=2; EI=3;LTI=4;LTEI= 5;LTVI=6;MI=7; STI=8;STEI=9; CO8=10;RI=11; RXIDG=12		■			■	■
6684... 6687	Operation delay	1	1	3, 6	1.00 s = 100		■			■	■
6688... 6691	Inv. time coefficient	1	1	3, 6	1.000 = 1000		■			■	■
6692... 6695	Reset type	1	1	3, 6	DT=0;IDMT=1		■			■	■
6696... 6699	Reset time	1	1	3, 6	1.00 s = 100		■			■	■
IoUo> setting											
6701	Enable for IoUo>	1	1	3, 6	Off=0;On=1					■	■
6702... 6705	Direction mode	1	1	3, 6	Forward=0; Reverse=1					■	■
6706... 6709	Inhibit ctrl.	1	1	3, 6	DI1=1;DI2=2;...; DI19=19;DI20= 20;Arc1=25; Arc2=26;BI=27; VI1=29;VI2=30; VI3=31;VI4=32; DI21=65;DI22= 66;...;DI39=83; DI40=84;VI5= 225;VI6=226;...; VI19=239;VI20= 240					■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
6710... 6713	Timer instant delay ctrl.	1	1	3, 6	DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DI21=65;DI22=66;...;DI31=75;DI32=76					■	■
6714... 6717	Pick-up value	1	1	3, 6	1.00 %Pno = 100	Pick-up value scaling				■	■
6718... 6721	Uo pick-up value	1	1	3, 6	1.0 % = 10					■	■
6722... 6725	Pick-up sector size	1	1	3, 6	1 ±° = 1					■	■
6726... 6729	Operation delay	1	1	3, 6	1.00 s = 100					■	■
6730... 6733	SOL Mode	1	1	3, 6	Off=0;On=1					■	■
6734... 6737	SOL Operation delay	1	1	3, 6	1.00 s = 100					■	■
6738... 6741	Memory Mode	1	1	3, 6	None=0;Voltage=1;Time=2;Both=3					■	■
6742... 6745	Uo pick-up value	1	1	3, 6	1.0 % = 10					■	■
6746... 6749	Memory time	1	1	3, 6	1.00 s = 100					■	■
6750	Reset time	1	1	3, 6	1.00 s = 100					■	■
IoUo>> setting											
6751	Enable for IoUo>>	1	1	3, 6	Off=0;On=1					■	■
6752... 6755	Direction mode	1	1	3, 6	Forward=0; Reverse=1					■	■
6756... 6759	Input for inhibit control	1	1	3, 6	DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DI21=65;DI22=66;...;DI39=83;DI40=84;VI5=225;VI6=226;...;VI19=239;VI20=240					■	■
6760... 6763	Timer instant delay ctrl.	1	1	3, 6	DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DI21=65;DI22=66;...;DI39=83;DI40=84;VI5=225;VI6=226;...;VI19=239;VI20=240					■	■
6764... 6767	Pick-up value	1	1	3, 6	1.00 %Pno = 100	Pick-up value scaling				■	■
6768... 6771	Uo pick-up value	1	1	3, 6	1.0 % = 10					■	■
6772... 6775	Pick up sector size	1	1	3, 6	1 ±° = 1					■	■
6776... 6779	Operation delay	1	1	3, 6	1.00 s = 100					■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
6780... 6783	SOL Mode	1	1	3, 6	Off=0;On=1					■	■
6784... 6787	SOL Operation delay	1	1	3, 6	1.00 s = 100					■	■
6788... 6791	Memory Mode	1	1	3, 6	None=0;Voltage=1;Time=2;Both=3					■	■
6792... 6795	Uo memory value	1	1	3, 6	1.0 % = 10					■	■
6796... 6799	Memory time	1	1	3, 6	1.00 s = 100					■	■
6800	Reset time	1	1	3, 6	1.00 s = 100					■	■
U> setting											
6801	Enable for U>	1	1	3, 6	Off=0;On=1		■		■	■	■
6802... 6805	Pick-up value	1	1	3, 6	1.0 %Un = 10		■		■	■	■
6806... 6809	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
6810	Reset time	1	1	3, 6	1.00 s = 100		■		■	■	■
6811	Hysteresis	1	1	3, 6	1.0 % = 10		■		■	■	■
U>> setting											
6851	Enable for U>>	1	1	3, 6	Off=0;On=1		■		■	■	■
6852... 6855	Pick-up value	1	1	3, 6	1.0 %Un = 10		■		■	■	■
6856... 6859	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
6860	Hysteresis	1	1	3, 6	1.0 % = 10		■		■	■	■
U>>> setting											
6901	Enable for U>>>	1	1	3, 6	Off=0;On=1		■		■	■	■
6902... 6905	Pick-up value	1	1	3, 6	1.0 %Un = 10		■		■	■	■
6906... 6909	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
6910	Hysteresis	1	1	3, 6	1.0 % = 10		■		■	■	■
U< setting											
6951	Enable for U<	1	1	3, 6	Off=0;On=1		■		■	■	■
6952... 6955	Pick-up value	1	1	3, 6	1.0 %Un = 10		■		■	■	■
6956... 6959	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
6960	Reset time	1	1	3, 6	1.00 s = 100		■		■	■	■
6961	Hysteresis	1	1	3, 6	1.0 % = 10		■		■	■	■
U<< setting											
7001	Enable for U<<	1	1	3, 6	Off=0;On=1		■		■	■	■
7002... 7005	Pick-up value	1	1	3, 6	1.0 %Un = 10		■		■	■	■
7006... 7009	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
7010	Hysteresis	1	1	3, 6	1.0 % = 10		■		■	■	■
U<<< setting											

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
7051	Enable for U<<<	1	1	3, 6	Off=0;On=1		■		■	■	■
7052... 7055	Pick-up value	1	1	3, 6	1.0 %Un = 10		■		■	■	■
7056... 7059	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
7060	Hysteresis	1	1	3, 6	1.0 % = 10		■		■	■	■
U1< setting											
7101	Enable for U1<	1	1	3, 6	Off=0;On=1				■		■
7102... 7105	Pick-up value	1	1	3, 6	1 %Vn = 1				■		■
7106... 7109	Operation delay	1	1	3, 6	1.00 s = 100				■		■
7110	Low voltage blocking	1	1	3, 6	1.0 %Un = 10				■		■
U1<< setting											
7151	Enable for U1<<	1	1	3, 6	Off=0;On=1				■		■
7152... 7155	Pick-up value	1	1	3, 6	1 %Vn = 1				■		■
7156... 7159	Operation delay	1	1	3, 6	1.00 s = 100				■		■
7160	Low voltage blocking	1	1	3, 6	1.0 %Un = 10				■		■
Uo> setting											
7201	Enable for Uo>	1	1	3, 6	Off=0;On=1		■		■	■	■
7202... 7205	Pick-up value	1	1	3, 6	1 % = 1		■		■	■	■
7206... 7209	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
7210... 7213	Reset time	1	1	3, 6	1.00 s = 100		■		■	■	■
Uo>> setting											
7251	Enable for Uo>>	1	1	3, 6	Off=0;On=1		■		■	■	■
7252... 7255	Pick-up value	1	1	3, 6	1 % = 1		■		■	■	■
7256... 7259	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
7260... 7263	Reset time	1	1	3, 6	1.00 s = 100		■		■	■	■
Uo>>> setting											
7301	Enable for Uo>>>	1	1	3, 6	Off=0;On=1		■		■	■	■
7302... 7305	Pick-up value	1	1	3, 6	1 % = 1		■		■	■	■
7306... 7309	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
7310... 7313	Reset time	1	1	3, 6	1.00 s = 100		■		■	■	■
fX setting											
7351	Enable for fX	1	1	3, 6	Off=0;On=1		■		■	■	■
7352... 7355	Pick-up value	1	1	3, 6	50.00 Hz = 5000		■		■	■	■
7356... 7359	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
7360	Low voltage blocking	1	1	3, 6	1.0 %Un = 10		■		■	■	■
fXX setting											
7401	Enable for fXX	1	1	3, 6	Off=0;On=1		■		■	■	■
7402... 7405	Pick-up value	1	1	3, 6	50.00 Hz = 5000		■		■	■	■
7406... 7409	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
7410	Low voltage blocking	1	1	3, 6	1.0 %Un = 10		■		■	■	■
f< setting											
7451	Enable for f<	1	1	3, 6	Off=0;On=1		■		■	■	■
7452... 7455	Pick-up value	1	1	3, 6	50.00 Hz = 5000		■		■	■	■
7456... 7459	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
7460	Low voltage blocking	1	1	3, 6	1.0 %Un = 10		■		■	■	■
f<< setting											
7501	Enable for f<<	1	1	3, 6	Off=0;On=1		■		■	■	■
7502... 7505	Pick-up value	1	1	3, 6	50.00 Hz = 5000		■		■	■	■
7506... 7509	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
7510	Low voltage blocking	1	1	3, 6	1.0 %Un = 10		■		■	■	■
CBFail setting											
7551	Enable for CB fail	1	1	3, 6	Off=0;On=1		■	■	■	■	■
7552	Enable CBF timer1	1	1	3, 6	Off=0;On=1		■	■	■	■	■
7553	Timer1 Operation Delay	1	1	3, 6	1.00 s = 100		■	■	■	■	■
7554	Enable CBF timer2	1	1	3, 6	Off=0;On=1		■	■	■	■	■
7555	Timer2 Operation Delay	1	1	3, 6	1.00 s = 100		■	■	■	■	■
7556	Noncurrent CBF reset mode	1	1	3, 6	I<Only=0; PoleDead=1; ProtRst=2		■	■	■	■	■
7557	Ext. CBF reset mode	1	1	3, 6	I<Only=0; PoleDead=1; ProtRst=2		■	■	■	■	■
7558	I< current set	1	1	3, 6	1.00 xIn = 100		■	■		■	■
7559	Io< current set	1	1	3, 6	1.000 pu = 1000		■	■		■	■
7560	Io'< current set	1	1	3, 6	1.000 pu = 1000			■		■	■
Ih5> setting											
7651	Enable for Ih5>	1	1	3, 6	Off=0;On=1		■	■		■	■
7652	Pick-up value	1	1	3, 6	1 % = 1		■	■		■	■
7653	Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
CT setting											
7701	Enable for CT supervision	1	1	3, 6	Off=0;On=1		■	■		■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
7702	CTS Operate mode	1	1	3, 6	3I only=0;I0&U0=1;Both=2		■	■		■	■
7703	CTS reset input	1	1	3, 6	Value [17]		■	■		■	■
7704	Operation delay	1	1	3, 6	1.00 s = 100		■	■		■	■
7721	Residual current >	1	1	3, 6	1.00 xIn = 100		■			■	■
7722	Residual voltage <	1	1	3, 6	1.0 %Un = 10		■			■	■
VT setting											
7751	Enable for VTS	1	1	3, 6	Off=0;On=1		■		■	■	■
7752	U2> setting	1	1	3, 6	1.0 %Vn = 10		■			■	■
7753	I2< setting	1	1	3, 6	1.00 xIn = 100		■			■	■
7754	Operation delay	1	1	3, 6	1.00 s = 100	Operate delay scaling	■			■	■
7755	VTS output reset	1	1	3, 6	Value [18]		■			■	■
7756	DI for MCB position	1	1	3, 6	DI1=1;DI2=2;...;DI39=39;DI40=40		■		■	■	■
Io'> setting											
7761	Enable for Io'>	1	1	3, 6	Off=0;On=1			■		■	■
7762... 7765	Pick-up value	1	1	3, 6	1.000 pu = 1000			■		■	■
7766... 7769	Delay curve family	1	1	3, 6	DT=0;IEC=1;IEEE=2;IEEE2=3;Others=4;Prg1=5;Prg2=6;Prg3=7			■		■	■
7770... 7773	Delay type	1	1	3, 6	DT=0;NI=1;VI=2;EI=3;LTI=4;LTEI=5;LTVI=6;MI=7;STI=8;STEI=9;CO8=10;RI=11;RXIDG=12			■		■	■
7774... 7777	Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
7778... 7781	Inv. time coefficient	1	1	3, 6	1.000 = 1000			■		■	■
7782... 7785	Network grounding	1	1	3, 6	Res=0;Cap=1			■		■	■
7786... 7789	Reset time	1	1	3, 6	1.00 s = 100			■		■	■
7791... 7794	Inrush status for Io'>	1	1	3, 6	Off=0;On=1			■		■	■
7795... 7798	SOL status for Io'>	1	1	3, 6	Off=0;On=1			■		■	■
7799... 7802	SOL Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
7803... 7806	SOL Inv. time coefficient	1	1	3, 6	1.000 = 1000			■		■	■

17. DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DO1(B)=33;DO2(B)=34;DO3(B)=35;Watchdog=36;SF=37;SF=38;SF=39;SF=40;SF=41;BO=42;DO1(C)=43;DO2(C)=44;DO3(C)=45;DO4(C)=46;LedAl=49;LedTr=50;LedA=51;LedB=52;LedC=53;LedDR=54;VO1=55;VO2=56;...;VO5=59;VO6=60;DI21=65;DI22=66;...;DI39=83;DI40=84;F1=85;F2=86;...;F6=90;F7=91;DO1(D)=97;DO2(D)=98;DO3(D)=99;SF=100;DO1(E)=101;DO2(E)=102;NI1=129;NI2=130;...;NI63=191;NI64=192;POC1=193;POC2=194;...;POC15=207;POC16=208;VI5=225;VI6=226;...;VI19=239;VI20=240;VO7=257;VO8=258;...;VO19=269;VO20=270;NI65=289;NI66=290;...;NI127=351;NI128=352
18. DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DO1(B)=33;DO2(B)=34;DO3(B)=35;Watchdog=36;SF=37;SF=38;SF=39;SF=40;SF=41;BO=42;DO1(C)=43;DO2(C)=44;DO3(C)=45;DO4(C)=46;LedAl=49;LedTr=50;LedA=51;LedB=52;LedC=53;LedDR=54;VO1=55;VO2=56;...;VO5=59;VO6=60;DI21=65;DI22=66;...;DI39=83;DI40=84;F1=85;F2=86;...;F6=90;F7=91;DO1(D)=97;DO2(D)=98;DO3(D)=99;SF=100;DO1(E)=101;DO2(E)=102;NI1=129;NI2=130;...;NI127=351;NI128=352

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
7807... 7810	CLPU status for Io'>	1	1	3, 6	Off=0;On=1			■		■	■
7811... 7814	CLPU Pick-up value	1	1	3, 6	1.00 xIn = 100			■		■	■
7815... 7818	CLPU Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
7819... 7822	CLPU Inv. time coefficient	1	1	3, 6	1.000 = 1000			■		■	■
7823... 7826	Reset type	1	1	3, 6	DT=0;IDMT=1			■		■	■
7827	Enable faulty phase detection	1	1	3, 6	Off=0;On=1			■		■	■
7828	Phase currents change limit	1	1	3, 6	1 % = 1			■		■	■
Io'>> setting											
7831	Enable for Io'>>	1	1	3, 6	Off=0;On=1			■		■	■
7832... 7835	Pick-up value	1	1	3, 6	1.000 pu = 1000			■		■	■
7836... 7839	Delay curve family	1	1	3, 6	DT=0;IEC=1; IEEE=2;IEEE2=3; Others=4;Prg1=5; Prg2=6;Prg3=7			■		■	■
7840... 7843	Delay type	1	1	3, 6	DT=0;NI=1;VI=2; EI=3;LTI=4;LTEI= 5;LTVI=6;MI=7; STI=8;STEI=9; CO8=10;RI=11; RXIDG=12			■		■	■
7844... 7847	Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
7848... 7851	Inv. time coefficient	1	1	3, 6	1.000 = 1000			■		■	■
7852... 7855	Network earthing	1	1	3, 6	Res=0;Cap=1			■		■	■
7856... 7859	Inrush status for Io'>>	1	1	3, 6	Off=0;On=1			■		■	■
7860... 7863	SOL status for Io'>>	1	1	3, 6	Off=0;On=1			■		■	■
7864... 7867	SOL Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
7868... 7871	SOL Inv. time coefficient	1	1	3, 6	1.000 = 1000			■		■	■
7872... 7875	CLPU status for Io'>>	1	1	3, 6	Off=0;On=1			■		■	■
7876... 7879	CLPU Pick-up value	1	1	3, 6	1.00 xIn = 100			■		■	■
7880... 7883	CLPU Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
7884... 7887	CLPU Inv. time coefficient	1	1	3, 6	1.000 = 1000			■		■	■
7888... 7891	Reset type	1	1	3, 6	DT=0;IDMT=1			■		■	■
7892... 7895	Reset time	1	1	3, 6	1.00 s = 100			■		■	■
7896	Enable faulty phase detection	1	1	3, 6	Off=0;On=1			■		■	■
7897	Phase currents change limit	1	1	3, 6	1 % = 1			■		■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
Io'>>> setting											
7901	Enable for Io'>>>	1	1	3, 6	Off=0;On=1			■		■	■
7902... 7905	Pick-up value	1	1	3, 6	1.000 pu = 1000			■		■	■
7906... 7909	Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
7910... 7913	Network grounding	1	1	3, 6	Res=0;Cap=1			■		■	■
7914... 7917	Inrush status for Io'>>>	1	1	3, 6	Off=0;On=1			■		■	■
7918... 7921	SOL status for Io'>>>	1	1	3, 6	Off=0;On=1			■		■	■
7922... 7925	SOL Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
7926... 7929	CLPU status for Io'>>>	1	1	3, 6	Off=0;On=1			■		■	■
7930... 7933	CLPU Pick-up value	1	1	3, 6	1.00 xIn = 100			■		■	■
7934... 7937	CLPU Operation delay	1	1	3, 6	1.00 s = 100			■		■	■
7938	Enable faulty phase detection	1	1	3, 6	Off=0;On=1			■		■	■
7939	Phase currents change limit	1	1	3, 6	1 % = 1			■		■	■
Uc> setting											
7951	Enable for Uc>	1	1	3, 6	Off=0;On=1			■		■	
7952... 7955	Pick-up value	1	1	3, 6	1.00 xUcLN = 100			■		■	
7956... 7959	Operation delay	1	1	3, 6	1.0 s = 10			■		■	
df/dt> setting											
8001	Enable for df/dt>	1	1	3, 6	Off=0;On=1		■		■	■	
8002... 8005	Direction of change	1	1	3, 6	Negative=0; Positive=1; Either=2		■		■	■	
8006... 8009	Pick-up value	1	1	3, 6	1.0 Hz/s = 10		■		■	■	
8010... 8013	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	
8014	Low voltage blocking	1	1	3, 6	1.0 %Un = 10		■		■	■	
df/dt>> setting											
8051	Enable for df/dt>>	1	1	3, 6	Off=0;On=1		■		■	■	
8052... 8055	Direction of change	1	1	3, 6	Negative=0; Positive=1; Either=2		■		■	■	
8056... 8059	Pick-up value	1	1	3, 6	1.0 Hz/s = 10		■		■	■	
8060... 8063	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	
8064	Low voltage blocking	1	1	3, 6	1.0 %Un = 10		■		■	■	
IoInt> setting											

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
8101	Enable for IoInt>	1	1	3, 6	Off=0;On=1					■	
8102... 8105	Direction mode	1	1	3, 6	Forward=0; Reverse=1					■	
8106... 8109	Uo pick-up value	1	1	3, 6	1 % = 1					■	
8110... 8113	Operation delay	1	1	3, 6	1.00 s = 100					■	
8114... 8117	Min number of peaks	1	1	3, 6	1 = 1					■	
8118... 8121	Reset delay	1	1	3, 6	1.00 s = 100					■	
8122	Intermittent time	1	1	3, 6	1.00 s = 100					■	
Feeder Fault Locator setting											
8152	Pick-up value	1	1	3, 6	1.00 xIn = 100					■	
8153	Triggering digital input	1	1	3, 6	Value [19]					■	
8154	Line reactance/unit	1	1	3, 6	1.000 ohm = 1000					■	
8155	Earth factor	1	1	3, 6	1.000 = 1000					■	
8156	Earth factor angle	1	1	3, 6	1 ° = 1					■	
8157	Event enabling	1	1	3, 6	Off=0;On=1					■	
8158	Average voltage limit	1	1	3, 6	1.0 %Un = 10					■	
8159	Io limit	1	1	3, 6	1.00 xIn = 100					■	
8160	DI timeout	1	1	3, 6	1.00 s = 100					■	
8161	Release timeout	1	1	3, 6	1.00 s = 100					■	
Synchro-check 1 setting											
8201	Enable for Synchro check 1	1	1	3, 6	Off=0;On=1		■		■	■	
8202	CB object 1	1	1	3, 6	Object 1=1;Object 2=2;Object 3=3; Object 4=4;Object 5=5;Object 6=6		■		■	■	
8203	CB object 2	1	1	3, 6	Object 1=1;Object 2=2;Object 3=3; Object 4=4;Object 5=5;Object 6=6		■		■	■	
8204	Input for selecting Object2	1	1	3, 6	Value [19]		■		■	■	
8205	Inhibit closing unselected CB	1	1	3, 6	Off=0;On=1		■			■	■
8206	Synchronization mode	1	1	3, 6	Off=0;Async=1; Sync=2		■			■	■
8207	Voltage check mode	1	1	3, 6	DD=1;DL=2;LD=3;DD/DL=4;DD/LD=5;DL/LD=6; DD/DL/LD=7		■			■	■

19. DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DO1(B)=33;DO2(B)=34;DO3(B)=35; Watchdog=36;SF=37;SF=38;SF=39;SF=40;SF=41;BO=42;DO1(C)=43;DO2(C)=44;DO3(C)=45;DO4(C)=46;LedAl=49;LedTr=50;LedA=51;LedB=52;LedC=53;LedDR=54;VO1=55;VO2=56;...;VO5=59;VO6=60;DI21=65;DI22=66;...;DI39=83;DI40=84;F1=85;F2=86;...;F6=90;F7=91;DO1(D)=97;DO2(D)=98;DO3(D)=99;SF=100;DO1(E)=101;DO2(E)=102;NI1=129;NI2=130;...;NI127=351;NI128=352

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
8208	CB closing time	1	1	3, 6	1.00 s = 100		■		■	■	
8209	Bypass DI	1	1	3, 6	Value [20]		■		■	■	
8210	Bypass	1	1	3, 6	1 = 1		■		■	■	
8211	Ok pulse length	1	1	3, 6	1 ms = 1		■		■	■	
8212... 8215	Udead limit setting	1	1	3, 6	1.0 %Un = 10		■		■	■	
8216... 8219	Ulive limit setting	1	1	3, 6	1.0 %Un = 10		■		■	■	
8220... 8223	Frequency difference	1	1	3, 6	50.00 Hz = 5000		■		■	■	
8224... 8227	Voltage difference	1	1	3, 6	1.0 %Un = 10		■		■	■	
8228... 8231	Phase angle difference	1	1	3, 6	1 ° = 1		■		■	■	
8232... 8235	Request timeout	1	1	3, 6	1.0 s = 10		■		■	■	
CB Monitoring setting											
8251	Enable for CB monitoring	1	1	3, 6	Off=0;On=1		■	■		■	■
8252... 8253	Alarm level	1	1	3, 6	1.00 kA = 100		■	■		■	■
8254... 8255	Limit for operation left	1	1	3, 6	1000 = 1000	Limit for oper. left scaling	■	■		■	■
8261... 8264	High limit (primary value)	1	1	3, 6	1.0 kA = 10		■	■		■	■
Motor status setting											
8301	Motor status	1	1	3, 6	Off=0;On=1		■	■			■
8302	Nom motor start current	1	1	3, 6	1.00 xIn = 100		■	■			■
8303	Motor start detection current	1	1	3, 6	1.00 xIn = 100		■	■			■
8304	Motor start detection mode	1	1	3, 6	CB Position=0; Current=1; CB&Current=2		■	■			■
8305	Enable motor speed detection	1	1	3, 6	Off=0;On=1		■	■			■
8306	Motor speed input DI	1	1	3, 6	Slot C DI1=0;Slot D DI1=1;Slot E DI1=2		■	■			■
8307	Rated motor speed Ωn	1	1	3, 6	1 rpm = 1		■	■			■
8308	Pulse per rotation	1	1	3, 6	1 = 1		■	■			■
8309	Zero speed confirm time	1	1	3, 6	1 s = 1		■	■			■
SOL setting											
8351	Enable for SOL	1	1	3, 6	off=0;On=1		■	■		■	■
8352	SOL signal number	1	1	3, 6	1=0;2=1		■	■		■	■

20. DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DO1(B)=33;DO2(B)=34;DO3(B)=35;Watchdog=36;SF=37;SF=38;SF=39;SF=40;SF=41;BO=42;DO1(C)=43;DO2(C)=44;DO3(C)=45;DO4(C)=46;LedAl=49;LedTr=50;LedA=51;LedB=52;LedC=53;LedDR=54;VO1=55;VO2=56;...;VO5=59;VO6=60;DI21=65;DI22=66;...;DI39=83;DI40=84;F1=85;F2=86;...;F6=90;F7=91;DO1(D)=97;DO2(D)=98;DO3(D)=99;SF=100;DO1(E)=101;DO2(E)=102;NI1=129;NI2=130;...;NI63=191;NI64=192;POC1=193;POC2=194;...;POC15=207;POC16=208;VI5=225;VI6=226;...;VI19=239;VI20=240;VO7=257;VO8=258;...;VO19=269;VO20=270;NI65=289;NI66=290;...;NI127=351;NI128=352

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
8353	CB Trip Clearing time	1	1	3, 6	1.00 s = 100		■	■		■	■
Admittance E/F Io/Uo> setting											
8361	Enable for Io/Uo>	1	1	3, 6	Off=0;On=1					■	■
8362	Io input	1	1	3, 6	Io=0;Io CSH=1; Iocalc=2;Io'=3					■	■
8363... 8366	Uo pick-up value	1	1	3, 6	1.0 % = 10					■	■
8367... 8370	Correction angle	1	1	3, 6	1 ° = 1					■	■
Admittance E/F Io/Uo> YN>											
8371	Enable for YN>	1	1	3, 6	Off=0;On=1					■	■
8373... 8376	Pick-up value	1	1	3, 6	1.0 Yn% = 10	Pick-up value scaling				■	■
8377... 8380	Input for inhibit control	1	1	3, 6	DI1=1;DI2=2;...; DI19=19;DI20= 20;Arc1=25; Arc2=26;BI=27; VI1=29;VI2=30; VI3=31;VI4=32; DI21=65;DI22= 66;...;DI39=83; DI40=84;VI5= 225;VI6=226;...; VI19=239;VI20= 240					■	■
8381... 8384	Operation delay	1	1	3, 6	1.00 s = 100					■	■
8385... 8388	Reset time	1	1	3, 6	1.00 s = 100					■	■
8389... 8392	SOL Mode	1	1	3, 6	Off=0;On=1					■	■
8393... 8396	SOL Operation delay	1	1	3, 6	1.00 s = 100					■	■
Admittance E/F Io/Uo> GN>											
8411	Enable for GN>	1	1	3, 6	Off=0;On=1					■	■
8413... 8416	Pick-up value	1	1	3, 6	1.0 Gn% = 10	Pick-up value scaling				■	■
8417... 8420	Input for inhibit control	1	1	3, 6	DI1=1;DI2=2;...; DI19=19;DI20= 20;Arc1=25; Arc2=26;BI=27; VI1=29;VI2=30; VI3=31;VI4=32; DI21=65;DI22= 66;...;DI39=83; DI40=84;VI5= 225;VI6=226;...; VI19=239;VI20= 240					■	■
8421... 8424	Direction mode	1	1	3, 6	Undir=0; Forward=1; Reverse=2					■	■
8425... 8428	Operation delay	1	1	3, 6	1.00 s = 100					■	■
8429... 8432	Reset time	1	1	3, 6	1.00 s = 100					■	■
8433... 8436	SOL Mode	1	1	3, 6	Off=0;On=1					■	■
8437... 8440	SOL Operation delay	1	1	3, 6	1.00 s = 100					■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
Admittance E/F Io/Uo> BN>											
8461	Enable for BN>	1	1	3, 6	Off=0;On=1					■	■
8463... 8466	Pick-up value	1	1	3, 6	1.0 Bn% = 10	Pick-up value scaling				■	■
8467... 8470	Input for inhibit control	1	1	3, 6	DI1=1;DI2=2;...; DI19=19;DI20= 20;Arc1=25; Arc2=26;BI=27; VI1=29;VI2=30; VI3=31;VI4=32; DI21=65;DI22= 66;...;DI39=83; DI40=84;VI5= 225;VI6=226;...; VI19=239;VI20= 240					■	■
8471... 8474	Direction mode	1	1	3, 6	Undir=0; Forward=1; Reverse=2					■	■
8475... 8478	Operation delay	1	1	3, 6	1.00 s = 100					■	■
8479... 8482	Reset time	1	1	3, 6	1.00 s = 100					■	■
8483... 8486	SOL Mode	1	1	3, 6	Off=0;On=1					■	■
8487... 8490	SOL Operation delay	1	1	3, 6	1.00 s = 100					■	■
Admittance E/F Io/Uo>> setting											
8511	Enable for Io/Uo>>	1	1	3, 6	Off=0;On=1					■	■
8512	Io input	1	1	3, 6	Io=0;Io CSH=1; Iocalc=2;Io'=3					■	■
8513... 8516	Uo pick-up value	1	1	3, 6	1.0 % = 10					■	■
8517... 8520	Angle correction	1	1	3, 6	1 ° = 1					■	■
Admittance E/F Io/Uo>> YN>											
8521	Enable for YN>>	1	1	3, 6	Off=0;On=1					■	■
8523... 8526	Pick-up value	1	1	3, 6	1.0 Yn% = 10	Pick-up value scaling				■	■
8527... 8530	Input for inhibit control	1	1	3, 6	DI1=1;DI2=2;...; DI19=19;DI20= 20;Arc1=25; Arc2=26;BI=27; VI1=29;VI2=30; VI3=31;VI4=32; DI21=65;DI22= 66;...;DI39=83; DI40=84;VI5= 225;VI6=226;...; VI19=239;VI20= 240					■	■
8531... 8534	Operation delay	1	1	3, 6	1.00 s = 100					■	■
8535... 8538	Reset time	1	1	3, 6	1.00 s = 100					■	■
8539... 8542	SOL Mode	1	1	3, 6	Off=0;On=1					■	■
8543... 8546	SOL Operation delay	1	1	3, 6	1.00 s = 100					■	■
Admittance E/F Io/Uo>> GN>											

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
8561	Enable for GN>>	1	1	3, 6	Off=0;On=1					■	■
8563... 8566	Pick-up value	1	1	3, 6	1.0 Gn% = 10	Pick-up value scaling				■	■
8567... 8570	Input for inhibit control	1	1	3, 6	DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DI21=65;DI22=66;...;DI39=83;DI40=84;VI5=225;VI6=226;...;VI19=239;VI20=240					■	■
8571... 8574	Direction mode	1	1	3, 6	Undir=0; Forward=1; Reverse=2					■	■
8575... 8578	Operation delay	1	1	3, 6	1.00 s = 100					■	■
8579... 8582	Reset time	1	1	3, 6	1.00 s = 100					■	■
8583... 8586	SOL Mode	1	1	3, 6	Off=0;On=1					■	■
8587... 8590	SOL Operation delay	1	1	3, 6	1.00 s = 100					■	■
Admittance E/F Io/Uo>> BN>											
8611	Enable for BN>>	1	1	3, 6	Off=0;On=1					■	■
8613... 8616	Pick-up value	1	1	3, 6	1.0 Bn% = 10	Pick-up value scaling				■	■
8617... 8620	Input for inhibit control	1	1	3, 6	DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DI21=65;DI22=66;...;DI39=83;DI40=84;VI5=225;VI6=226;...;VI19=239;VI20=240					■	■
8621... 8624	Direction mode	1	1	3, 6	Undir=0; Forward=1; Reverse=2					■	■
8625... 8628	Operation delay	1	1	3, 6	1.00 s = 100					■	■
8629... 8632	Reset time	1	1	3, 6	1.00 s = 100					■	■
8633... 8636	SOL Mode	1	1	3, 6	Off=0;On=1					■	■
8637... 8640	SOL Operation delay	1	1	3, 6	1.00 s = 100					■	■
U2> setting											
8661	Enable for U2>	1	1	3, 6	Off=0;On=1		■		■	■	■
8662... 8665	VTS Operating Mode	1	1	3, 6	NO ACTION=0; BLOCKING=1		■		■	■	■
8666... 8669	Pick-up value	1	1	3, 6	1.0 %Un = 10		■		■	■	■
8670... 8673	Delay type	1	1	3, 6	DT=0;INV=1		■		■	■	■

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
8674... 8677	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
8678... 8681	Reset time	1	1	3, 6	1.00 s = 100		■		■	■	■
U2>> setting											
8701	Enable for U2>>	1	1	3, 6	Off=0;On=1		■		■	■	■
8702... 8705	VTS Operating Mode	1	1	3, 6	NO ACTION=0; BLOCKING=1		■		■	■	■
8706... 8709	Pick-up value	1	1	3, 6	1.0 %Un = 10		■		■	■	■
8710... 8713	Delay type	1	1	3, 6	DT=0;INV=1		■		■	■	■
8714... 8717	Operation delay	1	1	3, 6	1.00 s = 100		■		■	■	■
8718... 8721	Reset time	1	1	3, 6	1.00 s = 100		■		■	■	■
Motor overspeed Ω>											
8751	Enable for Ω>	1	1	3, 6	Off=0;On=1		■	■			■
8752	Pick-up value	1	1	3, 6	1 %Ωn = 1		■	■			■
8753	Operation delay	1	1	3, 6	1 s = 1		■	■			■
Motor overspeed Ω>>											
8801	Enable for Ω>>	1	1	3, 6	Off=0;On=1		■	■			■
8802	Pick-up value	1	1	3, 6	1 %Ωn = 1		■	■			■
8803	Operation delay	1	1	3, 6	1 s = 1		■	■			■
Motor underspeed Ω<											
8851	Enable for Ω<	1	1	3, 6	Off=0;On=1		■	■			■
8852	Pick-up value	1	1	3, 6	1 %Ωn = 1		■	■			■
8853	Operation delay	1	1	3, 6	1 s = 1		■	■			■
Motor underspeed Ω<<											
8901	Enable for Ω<<	1	1	3, 6	Off=0;On=1		■	■			■
8902	Pick-up value	1	1	3, 6	1 %Ωn = 1		■	■			■
8903	Operation delay	1	1	3, 6	1 s = 1		■	■			■
Motor Anti-backspin (ABS)											
8951	Enable motor anti-backspin	1	1	3, 6	Off=0;On=1		■	■			■
8952	Measured Zero Speed Mode	1	1	3, 6	Off=0;On=1		■	■			■
8953	Zero speed external mode	1	1	3, 6	Off=0;On=1		■	■			■
8954	Zero speed input DI	1	1	3, 6	Value [21]		■	■			■
8955	Anti-backspin Time	1	1	3, 6	1 s = 1		■	■			■
Cold load pick-up CLPU											
9001	Enable for CLPU	1	1	3, 6	Off=0;On=1		■	■		■	■

21. DI1=1;DI2=2;...;DI19=19;DI20=20;Arc1=25;Arc2=26;BI=27;VI1=29;VI2=30;VI3=31;VI4=32;DO1(B)=33;DO2(B)=34;DO3(B)=35; Watchdog=36;SF=37;SF=38;SF=39;SF=40;SF=41;BO=42;DO1(C)=43;DO2(C)=44;DO3(C)=45;DO4(C)=46;LedAl=49;LedTr=50;LedA=51;LedB=52;LedC=53;LedDR=54;VO1=55;VO2=56;...;VO5=59;VO6=60;DI21=65;DI22=66;...;DI39=83;DI40=84;F1=85;F2=86;...;F6=90;F7=91;DO1(D)=97;DO2(D)=98;DO3(D)=99;SF=100;DO1(E)=101;DO2(E)=102;NI1=129;NI2=130;...;NI127=351;NI128=352

Add.	Name	Read	Write	FC	Scalling	Setting for Scalling	P5 U20 LPCT LPVT	P5 U20	P5 V20	P5 F30	P5 M30
9002	Idle current	1	1	3, 6	1.00 xIn = 100		■	■		■	■
9003	Pickup current	1	1	3, 6	1.00 xIn = 100		■	■		■	■
9004	CLPU dead time	1	1	3, 6	1.00 s = 100	CLPU dead time scaling	■	■		■	■
9005	CLPU time delay	1	1	3, 6	1.00 s = 100		■	■		■	■

Specific scalings

Add.	Name	Read	Write	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
10001...10002	Power scaling	1	0	■			■	■
10003...10004	PF and cos scaling	1	0	■			■	■
10005...10006	Tanφ scaling	1	0	■			■	■
10007...10008	Voltage scaling	1	0	■		■	■	■
10009...10010	VT primary scaling	1	0	■		■	■	■
10011...10012	Frequency scaling	1	0	■	■	■	■	■
10013...10014	VTo secondary scaling	1	0	■		■	■	■
10015...10016	Io scaling	1	0	■	■		■	■
10017...10018	Io' scaling	1	0		■		■	■
10019...10020	CLPU dead time scaling	1	0	■	■		■	■
10021...10022	Limit for oper.left scaling	1	0	■	■		■	■
10025...10026	CB open count scaling	1	0	■	■		■	■
10027...10028	Operate delay scaling	1	0	■	■	■	■	■
10029...10030	Pick-up value scaling	1	0	■	■	■	■	■
10031...10032	Fault value scaling	1	0	■	■	■	■	■
10033...10034	Max control pulse length scaling	1	0	■	■	■	■	■
10035...10036	LPCT/VT scaling	1	0	■			■	■
10037...10038	External AI scaling	1	0	■	■	■	■	■
10039...10040	Io scaling (CSH)	1	0	■	■		■	■

Modbus master

External analog inputs and digital inputs or outputs can be added to the Easergy P5 protection relay via external Modbus I/O. This protocol is based on Modbus RTU master and RS-485 bus structure. User can configure and read external AI/DI/DO through eSetup Easergy Pro. User can also read these external AI/DI/DO through the HMI.

Function description

The Easergy P5 protection relay supports application functions include:

- Modbus master: analog inputs and alarms
- Modbus master: digital inputs
- Modbus master: digital outputs
- Modbus master: DO matrix
- Modbus master: names config

Main configuration parameters

The picture and table below explain how to configure an Easergy P5 protection relay to use the Modbus master protocol.

Figure 4 - Modbus master main configuration view

Table 44 - Modbus master main configuration parameters

Parameter	Value	Description
External I/O speed transm	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200	The communication speed, bits per second
Parity	None, Even, Odd	The type of parity bit used

Modbus master analog inputs

Find the "Modbus master: analog inputs" and "Modbus master: analog input alarm" menus in eSetup Easergy Pro. Up to 64 points of External AI can be configured. All External AI can be read through HMI control / ExtAI.

Figure 5 - Modbus master: analog inputs menu

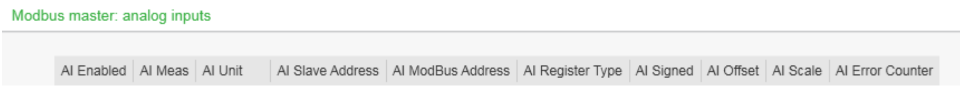
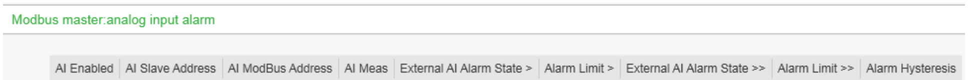


Figure 6 - Modbus master: analog inputs alarm menu



Refer to the table below for the proper values to the parameters "AI Enabled", "AI Unit", "AI slave address", "AI Modbus address", "AI register type" and "AI signed".

Table 45 - Modbus master: analog inputs configuration parameters

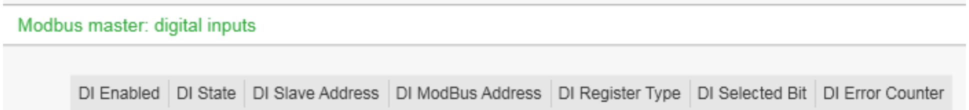
Parameter	Value	Description
AI Enabled	On, Off	Enable or disable this AI.
AI Unit	°C, F, K, V/A, mA, A, V, kW, kVA, kvar	Unit of this AI
AI slave address	1-247	Modbus slave address
AI Modbus address	1-9999	Modbus register address
AI register type	InputR, HoldingR	AI Modbus register type
AI signed	On, Off	Signed interger or Unsigned integer
AI offset	-32768 - 32767	Offset of AI Meas
AI scale	0.001-1000.000	Scale of AI Meas
Alarm 1 pick-up value	float	Threshold for this AI alarm1
Alarm 2 pick-up value	float	Threshold for this AI alarm2
Alarm hysteresis	0.0-10000.0	Hysteresis for alarms

Since holding registers are 16 bits in size, the external analog inputs menu give proper values to AI specific scaling. AI Meas is the product of the received value multiplied by the AI scale. The scaling is determined by the float value of AI scale. It is common to use scaling factors with base ten (0.100,1.000,10.000, 100.000…). In such cases, the original measurements only lose decimals and such values are easy to read and rescale to actual values on the client side after transmission.

Modbus master digital inputs

Find the "Modbus master: digital inputs" menu on eSetup Easergy Pro. Up to 18 points of External DI can be configured. All External DI can be read through HMI control / ExtDI.

Figure 7 - Modbus master: digital inputs menu



Refer to the table below for a more detailed explanation on the values that can be assigned to the parameters of this menu.

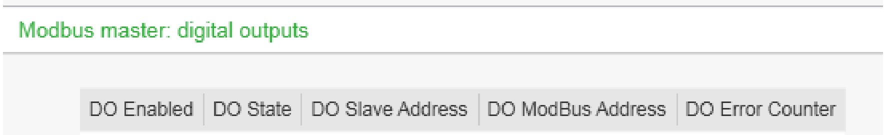
Table 46 - Modbus master: digital inputs configuration parameters

Parameter	Value	Description
DI Enabled	On, Off	Enable or disable this DI.60870-5-101
DI slave address	1-247	Modbus slave address
DI Modbus address	1-9999	Modbus register/coil address
DI register type	InputR, HoldingR, CoilS, InputS	AI Modbus register type
DI selected bit	1-16	Select DI bit for DI state

Modbus master digital outputs

Find the "Modbus master: digital outputs" menu on the eSetup Easergy Pro. Up to 16 points of External DO can be configured. All External DO can be read through HMI control / ExtDO.

Figure 8 - Modbus master: digital outputs menu



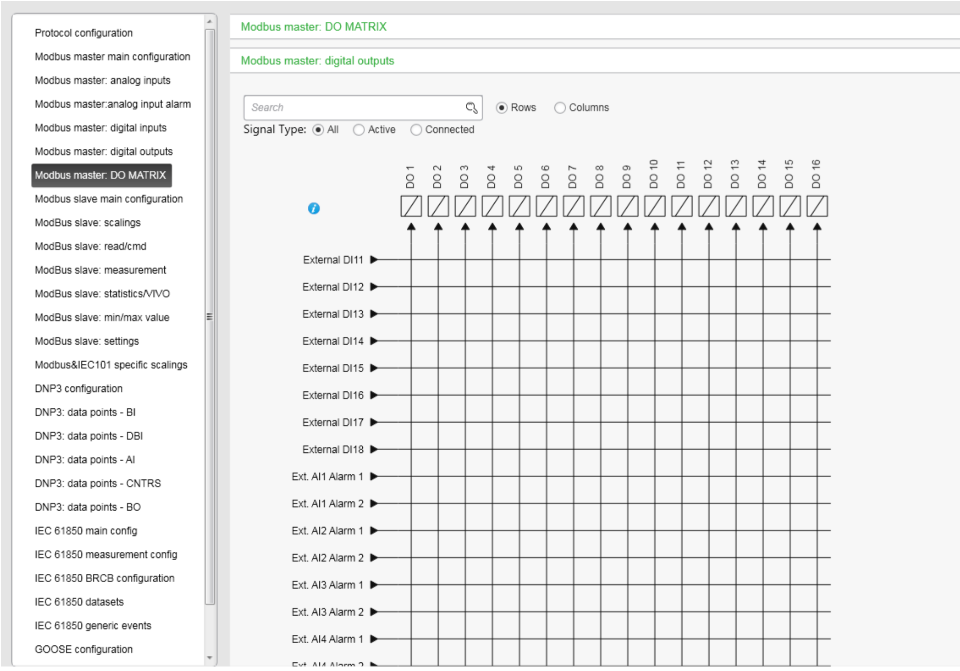
Refer to the table below for a more detailed explanation on the values that can be assigned to the parameters of this menu.

Table 47 - Modbus master: digital outputs configuration parameters

Parameter	Value	Description
DO Enabled	On, Off	Enable or disable this DO
DO slave address	1-247	Modbus slave address
DO Modbus address	1-9999	Modbus coil address

"Modbus master DO matrix is used to link protection Events (e.g. I> start, External AI alarm/trip, …..) or External DI states to DO.

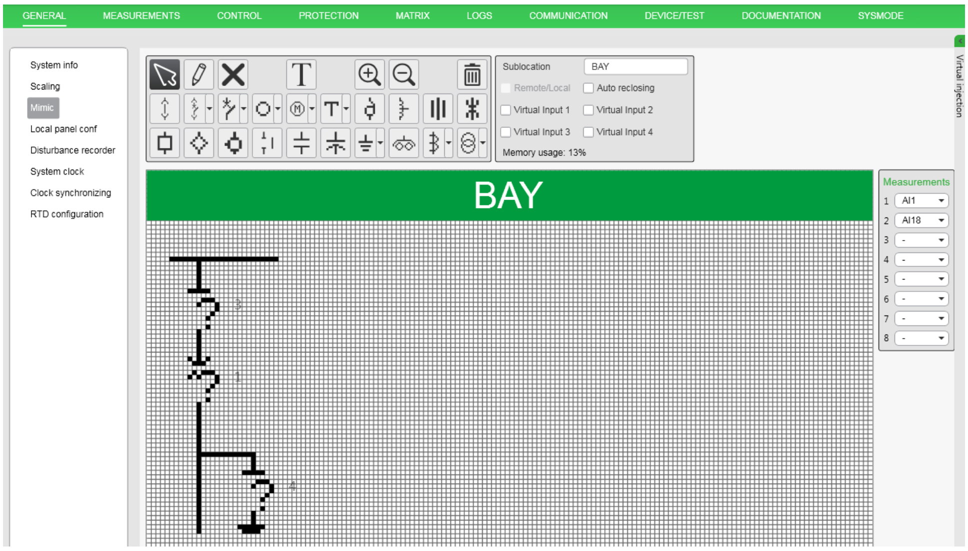
Figure 9 - Modbus master DO matrix



Measurements

The external AI can be obtained by mimic through eSetup Easergy Pro or the HMI. Six or eight measurements can be shown in the main display of the Easergy P5 protection relay with small LCD screen or large one, respectively.

Figure 10 - External AI shown on the mimic screen in eSetup Easergy Pro



Modbus master names configuration

The user can configure the labels and descriptions of Modbus master AI, DI and DO through eSetup Easergy Pro. Corresponding description in Mimic, Matrix and events log will be updated too.

Figure 11 - The External AI names configuration view

External AI names config

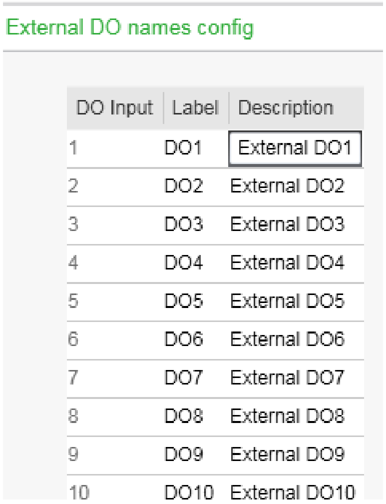
AI Input	Label	Description
1	AI1	External AI1
2	AI2	External AI2
3	AI3	External AI3
4	AI4	External AI4
5	AI5	External AI5
6	AI6	External AI6
7	AI7	External AI7
8	AI8	External AI8
9	AI9	External AI9
10	AI10	External A10
11	AI11	External AI11
12	AI12	External AI12
13	AI13	External AI13
14	AI14	External AI14
15	AI15	External AI15

Figure 12 - The External DI names configuration view

External DI names config

DI Input	Label	Description
1	DI1	External DI1
2	DI2	External DI2
3	DI3	External DI3
4	DI4	External DI4
5	DI5	External DI5
6	DI6	External DI6
7	DI7	External DI7
8	DI8	External DI8
9	DI9	External DI9
10	DI10	External DI10
11	DI11	External DI11
12	DI12	External DI12
13	DI13	External DI13
14	DI14	External DI14
15	DI15	External DI15
16	DI16	External DI16
17	DI17	External DI17
18	DI18	External DI18

Figure 13 - The External DO names configuration view



External DO names config

DO Input	Label	Description
1	DO1	External DO1
2	DO2	External DO2
3	DO3	External DO3
4	DO4	External DO4
5	DO5	External DO5
6	DO6	External DO6
7	DO7	External DO7
8	DO8	External DO8
9	DO9	External DO9
10	DO10	External DO10

EtherNet/IP

Presentation

The Easergy P5 protection relays support communication using EtherNet/IP protocol which is a part of Common Industrial Protocol (CIP) family. EtherNet/IP protocol is available with the optional inbuilt Ethernet port. The protocol can be used to read/write data from/to the Easergy P5 protection relays using request/response communication or via cyclic messages transporting data assigned to assemblies (data sets).

Messaging

EtherNet/IP supports two modes of messaging, unconnected and connected messaging.

- Unconnected messaging refers to peer-to-peer communication, where opening and closing of connections is allowed via unconnected messaging. This is handled by the UnConnected Message Manager (UCMM). Messages are sent over TCP/IP.
- Connected messaging, on the other hand, is dedicated to a particular purpose, such as frequent explicit message transactions or real-time I/O data transfers. Connection resources are reserved and configured using communication services available via the UCMM. Messages are sent over TCIP/IP and User Datagram Protocol (UDP).

EtherNet/IP specifies a special encapsulation protocol to carry CIP messages over TCP/IP and UDP.

There are two types of connections, explicit and implicit.

- Explicit connections refer to request-response connections which are general purpose connections. Explicit connections use TCP/IP and use either unconnected messaging via UCMM (one-time request/response) or Class 3 connections (cyclic request /response).
- In implicit connections, only application data is contained within the messages. Implicit data may be polled, cyclic or Change of State (COS) messages. Implicit connections are either point-to-point (unicast) or one-to-many (multicast) connections. Implicit connections use UDP/IP.

Devices

There are two classes of devices in a CIP network, adapters and scanners.

- Adapters are targets of real-time I/O data connection. Adapters cannot send or receive real-time data unless requested to do so by a scanner device. Adapters can exchange data using explicit messages with any class of devices but cannot originate a connection.
- Scanners are originators of I/O data connection requests and originators or targets of explicit connection requests.

Objects

Objects in CIP (and thereby EtherNet/IP) are defined by:

- A description – a description of an object being specified.
- A class code (Class ID) – hexadecimal identifier assigned to each CIP object
- Attributes – data elements associated with the object.
- Common services – list of the common services defined for the object.
- Object-specific Services – the full specifications of any services unique to the object
- Connections – connections supported by the object.
- Behaviour – the relationship between attribute values and services.

The CIP also includes an Object Library, which is a set of standardized objects that covers protocol objects such as the Identity Object, Assembly Object, etc. as well as Application Objects. The Object Library covers basic automation blocks and some more complex devices, including Digital Input, Digital Output, etc.

Figure 14 - CIP object model

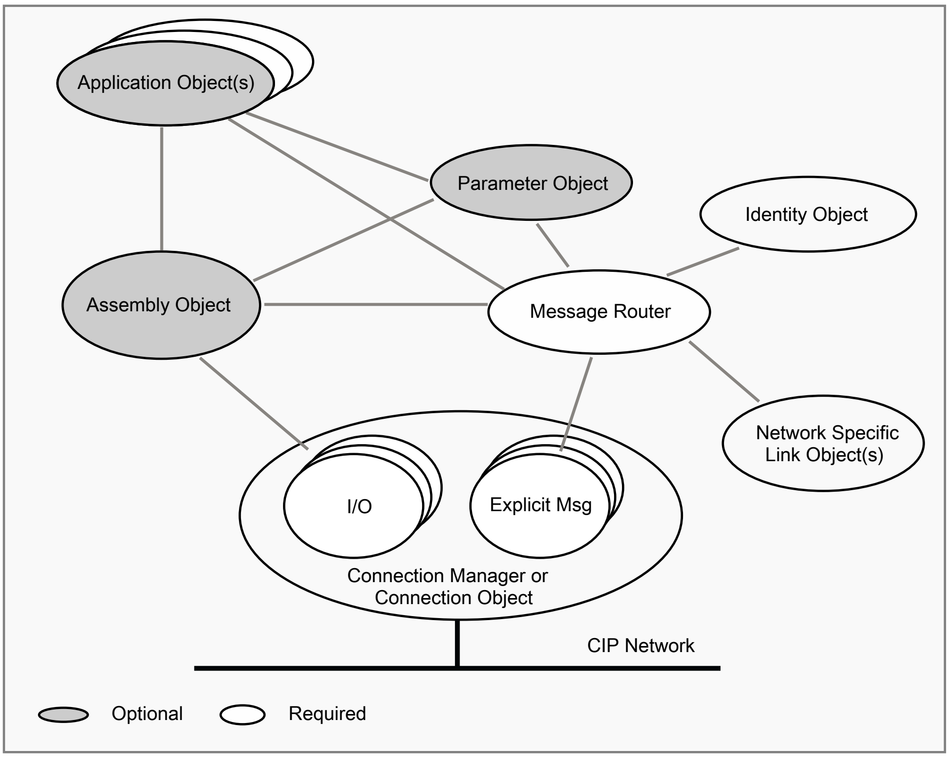


Table 48 - CIP object description

Object	Description
Connection object	The CIP Communication Object manages and provides the runtime exchange of messages.
Message router	The Message Router Object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device. It routes explicit messages over requested paths.
Assembly object	The Assembly Object binds attributes of multiple objects, which in allows data to or from each of these objects to be sent or received over a single connection (like a data set). Assembly objects can be used to group input data (producing instance of an Assembly Object – information transmitted to the network) or output data (consuming instance of an Assembly Object – information received from the network). I/O connections are established between Assembly Object instances of the devices – between inputs and outputs. Assembly object instances are accessible via explicit messaging.
Identity object	Provides device identification and general information about the device, such as vendor identifier, product code, name, status, etc. The Identity Object shall be present in all CIP products.

Application Objects are based on the standard objects from the Object Library if possible, if not, vendors can define their own, private (vendor specific) Application Objects. CIP specifies the Class ID ranges for that purpose.

Table 49 - CIP Class ID ranges

Range (hexadecimal)	Meaning	Quantity
0x00…0x63	Open	100
0x64…0xC7	Vendor specific	100

Table 49 - CIP Class ID ranges (Continued)

Range (hexadecimal)	Meaning	Quantity
0xC8…0xEF	Reserved by CIP for future use	40
0xF0…0x2FF	Open	528
0x300…0x4FF	Vendor specific	512
0x500…0xFFFF	Reserved by CIP for future use	64256

Device profile

The series of application objects for Easergy P5 is known as the device profile. A large number of profiles for many device types have been defined. An example of a device profile is shown in Device profile, page 153.

EtherNet/IP main features

EtherNet/IP main features:

- Static data model:
  - 2 standard objects (Overload and Control Supervisor)
  - 2 private objects (one for digital data and one for analog data)
  - 4 configuration objects for configuration of protection functions
- Two configurable assemblies (one producing and one consuming) with the maximum capacity of 128 bytes. Each configuration is described in an Electronic Data Sheet (EDS) file. Each EDS file that can be fed to any client supporting EDS files and can be generated at any time, all changes to EtherNet/IP configuration or to assemblies' content require generating of the new EDS file, see Generating an EDS File with eSetup Easergy Pro, page 160.
- Three types of communications are supported:
  - UCMM (one time request / response)
  - Class 3 connection (cyclic request / response)
  - Class 1 connection (cyclic IO messages containing assemblies' data)

Function description

EtherNet/IP protocol is available on Easergy P5 protection relays with an optional embedded Ethernet card. Easergy P5 protection relays with the EtherNet/IP protocol selected on the Ethernet port serves as an adapter which means that it is not able to initiate communication with other devices on the network.

Objects and messaging

The EtherNet/IP implementation on Easergy P5 protection relays supports all required standard objects with their required attributes. There is also a total of 10 application objects from which 8 are private. A list of Easergy P5 device objects and their classes is shown in the table below.

Table 50 - Device profile

Class	Object	Object Category	
0x01	Identity	Protocol	Standard
0x02	Message Router		
0x04	Assembly		
0x06	Connection Manager		

Table 50 - Device profile (Continued)

<table>
<tr><th>Class</th><th>Object</th><th colspan="2">Object Category</th></tr>
<tr><td>0xF5</td><td>TCP/IP Interface</td><td rowspan="2"></td><td rowspan="4"></td></tr>
<tr><td>0xF6</td><td>Ethernet Link</td></tr>
<tr><td>0x29</td><td>Control Supervisor</td><td rowspan="10">Application</td></tr>
<tr><td>0x2C</td><td>Overload</td></tr>
<tr><td>0x64</td><td>Digital</td><td rowspan="8">Private
(vendor specific)</td></tr>
<tr><td>0x65</td><td>Analog</td></tr>
<tr><td>0x66</td><td>StgProtCurrent</td></tr>
<tr><td>0x67</td><td>StgProtEF</td></tr>
<tr><td>0x68</td><td>StgProtOther</td></tr>
<tr><td>0x69</td><td>StgGeneral</td></tr>
<tr><td>0x70</td><td>Analog2</td></tr>
<tr><td>0x71</td><td>Special</td></tr>
</table>

The EtherNet/IP implementation in Easergy P5 protection relays supports three types of communication:

- Unconnected Explicit Requests and Responses – used mainly for establishing explicit and I/O connections, but can also be used for one time requests to attributes of data model objects.
- Explicit Messaging (Class 3) connections – these are strictly point-to-point connections used to cyclically query the adapter for some data or to cyclically write data to the adapter. Transmitted using TCP.
- I/O Messaging (Class 1) connections – can be point-to-point or multicast. Used for very frequent exchange of process data. Easergy P5 protection relays support only cyclic I/O connections. Transmitted using UDP.

Connection limits:

- For Class 3 connections – a maximum of six connections at the same time.
- For Class 1 connections – only one connection at the same time.

Supported services

Easergy P5 protection relays support following services for objects:

- GAA = Get Attribute All
- GAS = Get Attribute Single
- SAS = Set Attribute Single

GAS service is available for all attributes with the GET or GET (to access) | SET (to modify) access type and the SAS service is available for all attributes with the GET | SET or SET access type.

A list of Easergy P5 device services for objects is shown in the table below.

Table 51 - Supported services for objects

Class	Object	Object Category	
		Get	Set
0x01	Identity	GAA, GAS	–
0x02	Message router	–	–
0x04	Assembly	GAS	SAS
0x06	Connection manager	–	–
0xF5	TCP/IP interface	GAA, GAS	–

Table 51 - Supported services for objects (Continued)

Class	Object	Object Category	
		Get	Set
0xF6	Ethernet link	GAA, GAS	–
0x29	Control supervisor	GAS	SAS
0x2C	Overload	GAS	SAS
0x64	Digital	GAS	SAS
0x65	Analog	GAS	SAS
0x66	StgProtCurrent	GAS	SAS
0x67	StgProtEF	GAS	SAS
0x68	StgProtOther	GAS	SAS
0x69	StgGeneral	GAS	SAS
0x70	Analog2	GAS	SAS
0x71	Special	GAS	SAS

I/O messaging assemblies

EtherNet/IP implementation on Easergy P5 protection relays includes a total of two producing assemblies (Tx, Target → Originator) and two consuming assemblies (Rx, Target → Originator); see table below.

Table 52 - Available assemblies

Instance no.	Type	Description
2	Producing	Static Basic Output Image
50	Consuming	Static Basic Image
100	Producing	Configurable Output Image (dynamic)
150	Consuming	Configurable Input Image (dynamic)

Additionally, a zero-length configuration assembly with instance number “199” is available.

Assemblies have to be configured during the device setup. Configuring assemblies involve selecting the producing and consuming instances to be used.

If dynamic assemblies (instance numbers 100 and 150) are used it is also needed to configure the contents of both assemblies. By default both assemblies are configured with one byte of data each. By default producing assembly is configured with “Control Supervisor Object” / “Faulted attribute” and consuming assembly with “Control Supervisor Object” / “FaultRst”.

I/O connections with Easergy P5 protection relays are opened with the Requested Packet Interval (RPI) no less than 50 ms and not greater than 5 s. The default Value is 100 ms.

Electronic data sheet (EDS)

Every change to main configuration parameters or assemblies configuration requires a new EDS file to be generated (once all changes are made and the device is about to be used in the network).

Some of the configuration tools are capable of simplifying device configuration based on the EDS file. In the current implementation the EDS file can only be generated from eSetup Easergy Pro – EDS file extraction over the EtherNet/IP network is not supported in the Easergy P5 protection relay.

EDS file cannot be extracted from the Easergy P5 protection relay over the EtherNet/IP network, rather, it must be generated with eSetup Easergy Pro. This operation is explained in Generating an EDS File with eSetup Easergy Pro, page 160.

Events

Easergy P5 protection relay events are available under the following attributes of Digital Object (0x64)

- Attribute 118 – Event code (bits 0-5: code, bits 6-15: channel)
- Attribute 119 – Event milliseconds and seconds (bits 0-5: seconds, bits 6-15: milliseconds)
- Attribute 120 – Event min and hour (bits 0-7: hour, bits 8-15: minutes)
- Attribute 121 – Event day and month (bits 0-7: month, bits 8-15: day)
- Attribute 122 – Event year

Events are read starting from the oldest one in the Event Buffer of the Easergy P5 protection relay. Events are read sequentially, the next event is read when the previous one is acknowledged. Acknowledgement is done by setting attribute 123 of the Digital Object (0x64) – Event Ack. When all events have been read and the event buffer is thus empty, the attributes will contain zero-data (zeroes). This zero-data will automatically be replaced with the data of a new event when one is registered.

Reading of events is the same for all communication types. The Easergy P5 protection relay sends the oldest available event. The next oldest event will be read only after setting the Event Ack parameter (the one previously read is not available any more) or after the event buffer has been cleared and a new event is generated later on.

Fault codes

The table below contains a translation of Easergy P5 protection relay stages to EtherNet/IP Fault Codes.

Table 53 - EtherNet/IP fault code

EtherNet/IP fault code	Description	Protection stage	ANSI
20	CURRENT TRIP	Overcurrent I> Overcurrent I>> Overcurrent I>>>	50/51
21	THERMAL OVERLOAD	Thermal Overload T>	49
26	PHASE UNBALANCE	Unbalance I2>	46
27	GROUND FAULT	Earth Fault Io> Earth Fault Io>> Earth Fault Io>>> Earth Fault Io>>>>	50N/51N
29	UNDERLOAD	Under Current Stage I<	37
31	STALL	Motor Startup Supervision Ist>	48
51	UNDERVOLTAGE	U< U<< U<<<	27
52	OVERVOLTAGE	U> U>> U>>>	59
54	PHASE REVERSAL	Unbalance I2>>	47
55	FREQUENCY	f< f<< f>< f>><<	81U 81
73	START/HOURS EXCEED	Motor Restart Inhibition N>	66

EtherNet/IP main configuration

The configuration of the EtherNet/IP settings is done in the EtherNet/IP main configuration view of the COMMUNICATION menu in eSetup Easergy Pro or Web HMI.

EtherNet/IP main configuration parameters are listed in the table below:

Table 54 - Description of the EtherNet/IP main configuration parameters

Parameter	Value	Description
General		
Multicast IP Address		Multicast IP address used for sending IO messages
Multicast TTL	1–100	Time to live of the IO messages sent to multicast address
Vendor ID	1–65535	Identification of Schneider Electric
Device Type	0–65535	Indication of general type of product
Product Code	1-65535	Identification of a particular product of an individual vendor
Major Revision	1–127	Major revision of the item the Identity Object represents
Minor Revision	1–255	Minor revision of the item the Identity Object represents
Serial Number	0-4294967295	Serial number of device
Product Name	32 chars	Human readable identification
Auto/Manual Header Detection	Manual Auto (default)	Include Run/Idle Header parameters are used to define whether Run/Idle Header is used. Run/Idle Headers are detected automatically
I/O assembly instances in use	2+50, (default) 100+150	Instance numbers of producing and consuming assemblies being used
Producing		
Producing instance number	1–1278	Instance number of producing assembly (not directly editable) [22]
Include Run/Idle Header (Producing)	On/Off	Include or exclude Run/Idle Header in an outgoing IO messages
Producing Instance Size	[bytes]	The size of the producing assembly (not directly editable) [23]
Consuming		
Consuming Instance	1–1278	Instance number of consuming assembly
Include Run/Idle Header (Consuming)	On/Off	Expect presence or absence of Run/Idle Header in an incoming IO messages
Consuming Instance Size	[bytes]	The size of the consuming assembly (not directly editable) [23]
Configuration		
Configuration Instance	1–1279	Instance number of configuration instance
Configuration Instance Size	[bytes]	The size of the consuming assembly (not directly editable) [23]

22. Automatically updated according to the value of “I/O assembly instances in use” parameter.
23. Automatically updated as the assemblies are configured.

Multicast IP

Multicast IP address is a parameter used by the device to send EtherNet/IP multicast packets, if requested to do so by the scanner. Multicast IP is a valid Class D IP address. In device there is only one possible I/O connection at a time and therefore only single Multicast IP is used.

Multicast IP parameter is ignored when scanner requested T → O (target-to-originator, i.e. adapter to scanner) communication to be point-to-point. The default value of this parameter is 239.0.0.1.

Multicast TTL

Multicast TTL value is used for the IP header Time-to-live field when sending EtherNet/IP multicast packets. This value is ignored for the unicast packets and TTL as configured for the TCP/IP stack is used instead.
The default value of this parameter is 1 (the number of network hops over which the multicast packet is propagated – datagrams limited to the local subnet).

Auto/Manual header detection

When this parameter is set to “Manual”, user needs to define manually the presence of Run/Idle header in the I/O messaging. This is done by configuring parameters “Include Run/Idle Header” for more information, see Include Run/Idle header (producing), page 158 and Include Run/Idle header (consuming), page 158.
When “Auto” is selected, Easergy P5 protection relays automatically detect whether Run/Idle header is used in the I/O messaging. The default value of this parameter is “Auto”.

I/O assembly instances in use

Selection of producing and consuming instances to be used. The values of producing and consuming assemblies are available in the EDS file (see Generating an EDS File with eSetup Easergy Pro, page 160) and are used by the configuration tool as a reference path during I/O connection opening.

Every change to this parameter requires restarting the device and generation of a new EDS file.

Include Run/Idle header (producing)

An I/O connection can be established with or without the Run/Idle Header in the Target → Originator direction (adapter to scanner). Including Run/Idle Header in the producing assembly adds additional 4 bytes to the beginning of the data part of an I/O message. Run bit is always set in the outgoing messages if Easergy P5 protection relays are configured to send I/O messages with the Run/Idle Header. Information about whether the Run/Idle Header is included in the outgoing messages is available in the EDS file and can be used by the eSetup Easergy Pro to properly establish communication.

Every change to this parameter requires generation of a new EDS file.

The default value of this parameter is “Off”.

Include Run/Idle header (consuming)

An I/O connection can be established with or without the Run/Idle Header in the Target ← Originator direction (scanner to adapter). Setting this value to “On” inform the eSetup Easergy Pro that Easergy P5 protection relays expect the consuming assembly to contain additional 4 bytes of data. If the Run/Idle Header is included and the Run bit is set in the incoming I/O messages then Easergy P5 protection relays process received data, and if the Run bit is cleared then P5 device ignores received data. If the Run/Idle Header is not included in the incoming I/O messages then the received data is always processed. Information about whether the Run/Idle Header is expected in the incoming I/O messages is available in the EDS file and can be used by the eSetup Easergy Pro to properly establish communication.

Every change to this parameter requires generation of a new EDS file. The default value of this parameter is “On”.

NOTE:

Changing of both "Include Run/Idle Header" parameters while the I/O connection is running is not allowed by Easergy P5 protection relays.

Data point configuration

Available data items, that is, the contents of the Producing Assembly and the Consuming Assembly can be viewed / configured in the following eSetup Easergy Pro menus:

- EtherNet/IP I/O 2+50 (static)
- EtherNet/IP I/O 100+150 (dynamic)

Assembly 2+50 is static, meaning user cannot make changes to the contents of assembly. Assembly 100+150 is dynamic, meaning user can select data items to the assembly by clicking on a row and selecting a desired data point. An example of this is shown in figure below.

Figure 15 - Configuration of the EtherNet/IP producing assembly

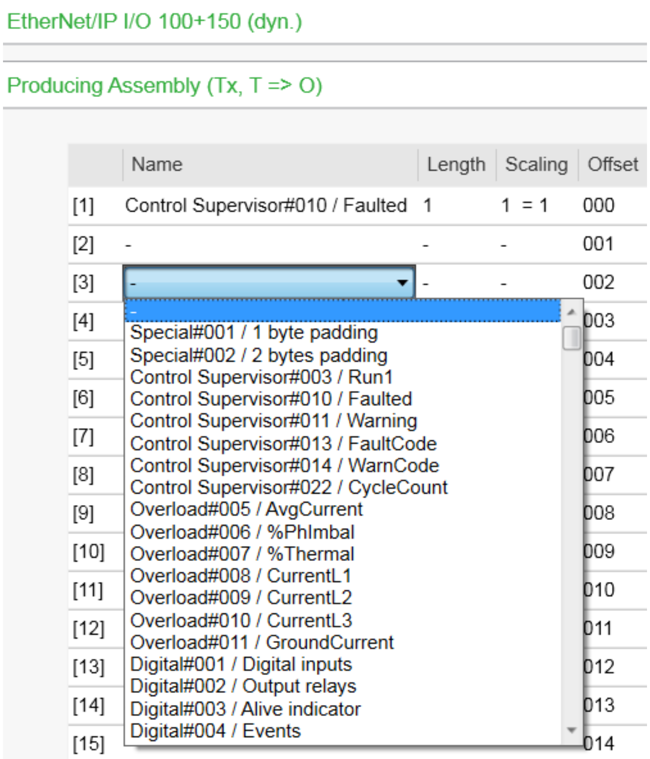


Table 55 - Description of assembly configuration parameters table contents

Attribute	Description
Name	Type and name of the data item
Length	Length of the data item in bytes
Scaling	The scaling used for the data item
Offset	The offset of the data item in the assembly

NOTE: Making changes to the assemblies will require a device reboot for the changes to take effect.

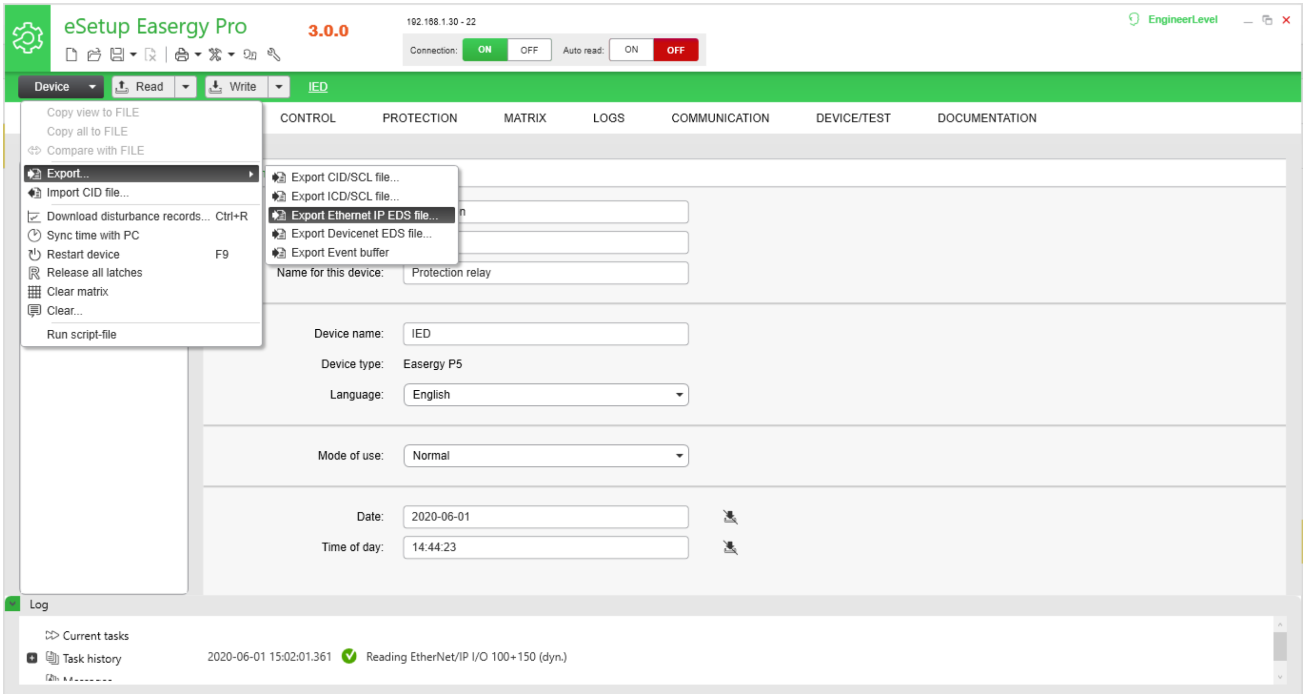
A list of the set of available data items in EtherNet/IP, see Data model of EtherNet/IP, page 160.

Generating an EDS File with eSetup Easergy Pro

Changes to main configuration parameters or the configuration of assemblies requires a new EDS file to be generated (once all changes are made and the device is about to be used in the network).

An EDS file can be generated with eSetup Easergy Pro or Web HMI in the COMMUNICATION menu. Selecting the option "Export EthernetIP EDS file..." will generate the EDS file and bring up a file browser window asking where to save the generated file. After clicking Save the generated EDS file will be stored at the selected location.

Figure 16 - Exporting an EDS file



Data model of EtherNet/IP

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x71	Special#001/1 byte padding	1	1	1	1	■	■	■	■	■
0x71	Special#002/2 bytes padding	2	1	1	1	■	■	■	■	■
0x71	Special#003/Requested packet interval time	4	1	1	0					
0x71	Special#004/Controller Output Image 100 Size	2	1	0	0					
0x71	Special#005/Controller Input Image 150 Size	2	1	0	0					
0x71	Special#006/Controller Input Image 100 Size	2	1	0	0					
0x71	Special#007/Controller Output Image 150 Size	2	1	0	0					

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x29	Control Supervisor#003/Run1	1	1	1	1	■	■	■	■	■
0x29	Control Supervisor#010/Faulted	1	1	0	1	■	■	■	■	■
0x29	Control Supervisor#011/Warning	1	1	0	1	■	■	■	■	■
0x29	Control Supervisor#012/FaultRst	1	0	1	1	■	■	■	■	■
0x29	Control Supervisor#013/Fault code	1	1	0	1	■	■	■	■	■
0x29	Control Supervisor#014/Warning code	1	1	0	1	■	■	■	■	■
0x29	Control Supervisor#022/ CycleCount	4	1	1	1	■	■	■	■	■
0x2C	Overload#005/AvgCurrent	4	1	0	1	■	■	■	■	■
0x2C	Overload#006/%PhImbal	1	1	0	1	■	■	■	■	■
0x2C	Overload#007/%Thermal	1	1	0	1	■	■	■	■	■
0x2C	Overload#008/CurrentL1	4	1	0	1	■	■	■	■	■
0x2C	Overload#009/CurrentL2	4	1	0	1	■	■	■	■	■
0x2C	Overload#010/CurrentL3	4	1	0	1	■	■	■	■	■
0x2C	Overload#011/Earth-fault current	4	1	0	1	■	■	■	■	■
0x64	Digital#001/Digital inputs	4	1	0	1	■	■	■	■	■
0x64	Digital#002/Output relays	4	1	0	1	■	■	■	■	■
0x64	Digital#003/Alive indicator	2	1	0	1	■	■	■	■	■
0x64	Digital#004/Events	4	1	0	1	■	■	■	■	■
0x64	Digital#005/Remote/Local State	1	1	0	1	■	■	■	■	■
0x64	Digital#006/Cancel selected operation	1	0	1	1	■	■	■	■	■
0x64	Digital#007/OM_MB_ ResetLatches	1	1	1	1	■	■	■	■	■
0x64	Digital#008/Synchronize minutes	1	1	1	1	■	■	■	■	■
0x64	Digital#009/Object1 state	1	1	0	1	■	■	■	■	■
0x64	Digital#010/Object2 state	1	1	0	1	■	■	■	■	■
0x64	Digital#011/Object3 state	1	1	0	1	■	■	■	■	■
0x64	Digital#012/Object4 state	1	1	0	1	■	■	■	■	■
0x64	Digital#013/Object5 state	1	1	0	1	■	■	■	■	■
0x64	Digital#014/Object6 state	1	1	0	1	■	■	■	■	■
0x64	Digital#015/Object7 state	1	1	0	1	■	■	■	■	■
0x64	Digital#016/Object8 state	1	1	0	1	■	■	■	■	■
0x64	Digital#017/Open select Object1	1	1	1	1	■	■	■	■	■
0x64	Digital#018/Close select Object1	1	1	1	1	■	■	■	■	■
0x64	Digital#019/Execute operation Object1	1	0	1	1	■	■	■	■	■
0x64	Digital#020/Max ctrl pulse length of Object1	4	1	1	1	■	■	■	■	■
0x64	Digital#021/Open select Object2	1	1	1	1	■	■	■	■	■
0x64	Digital#022/Close select Object2	1	1	1	1	■	■	■	■	■
0x64	Digital#023/Execute operation Object2	1	0	1	1	■	■	■	■	■
0x64	Digital#024/Max ctrl pulse length of Object2	4	1	1	1	■	■	■	■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x64	Digital#025/Open select Object3	1	1	1	1	■	■	■	■	■
0x64	Digital#026/Close select Object3	1	1	1	1	■	■	■	■	■
0x64	Digital#027/Execute operation Object3	1	0	1	1	■	■	■	■	■
0x64	Digital#028/Max ctrl pulse length of Object3	4	1	1	1	■	■	■	■	■
0x64	Digital#029/Open select Object4	1	1	1	1	■	■	■	■	■
0x64	Digital#030/Close select Object4	1	1	1	1	■	■	■	■	■
0x64	Digital#031/Execute operation Object4	1	0	1	1	■	■	■	■	■
0x64	Digital#032/Max ctrl pulse length of Object4	4	1	1	1	■	■	■	■	■
0x64	Digital#033/Open select Object5	1	1	1	1	■	■	■	■	■
0x64	Digital#034/Close select Object5	1	1	1	1	■	■	■	■	■
0x64	Digital#035/Execute operation Object5	1	0	1	1	■	■	■	■	■
0x64	Digital#036/Max ctrl pulse length of Object5	4	1	1	1	■	■	■	■	■
0x64	Digital#037/Open select Object6	1	1	1	1	■	■	■	■	■
0x64	Digital#038/Close select Object6	1	1	1	1	■	■	■	■	■
0x64	Digital#039/Execute operation Object6	1	0	1	1	■	■	■	■	■
0x64	Digital#040/Max ctrl pulse length of Object6	4	1	1	1	■	■	■	■	■
0x64	Digital#041/DirectO1O	1	0	1	1	■	■	■	■	■
0x64	Digital#042/DirectO1C	1	0	1	1	■	■	■	■	■
0x64	Digital#043/DirectO2O	1	0	1	1	■	■	■	■	■
0x64	Digital#044/DirectO2C	1	0	1	1	■	■	■	■	■
0x64	Digital#045/DirectO3O	1	0	1	1	■	■	■	■	■
0x64	Digital#046/DirectO3C	1	0	1	1	■	■	■	■	■
0x64	Digital#047/DirectO4O	1	0	1	1	■	■	■	■	■
0x64	Digital#048/DirectO4C	1	0	1	1	■	■	■	■	■
0x64	Digital#049/DirectO5O	1	0	1	1	■	■	■	■	■
0x64	Digital#050/DirectO5C	1	0	1	1	■	■	■	■	■
0x64	Digital#051/DirectO6O	1	0	1	1	■	■	■	■	■
0x64	Digital#052/DirectO6C	1	0	1	1	■	■	■	■	■
0x64	Digital#053/Pos. sequence I1	4	1	0	1	■	■		■	■
0x64	Digital#054/Negative sequence I2	4	1	0	1	■	■		■	■
0x64	Digital#055/Current ratio I2/I1	4	1	0	1	■	■		■	■
0x64	Digital#056/Current phase sequence	1	1	0	1	■	■		■	■
0x64	Digital#057/Pos. sequence U1	4	1	0	1	■		■	■	■
0x64	Digital#058/Negative sequence U2	4	1	0	1	■		■	■	■
0x64	Digital#059/Voltage U2/U1	4	1	0	1	■		■	■	■
0x64	Digital#060/Voltage phase sequence	1	1	0	1	■		■	■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x64	Digital#061/Voltage interrupt	1	1	0	1	■		■	■	■
0x64	Digital#062/Voltage status	1	1	0	1	■		■	■	■
0x64	Digital#063/Clear min/max/ demand	1	1	1	1	■	■	■	■	■
0x64	Digital#064/Pos. sequence I1'	4	1	1	1					
0x64	Digital#065/Negative sequence I2'	4	1	1	1					
0x64	Digital#066/Current I' -seq./+seq.	4	1	0	1					
0x64	Digital#067/Current I' phase seq.	1	1	0	1					
0x64	Digital#068/Shot1 start counter	2	1	1	1	■	■		■	
0x64	Digital#069/Shot2 start counter	2	1	1	1	■	■		■	
0x64	Digital#070/Shot3 start counter	2	1	1	1	■	■		■	
0x64	Digital#071/Shot4 start counter	2	1	1	1	■	■		■	
0x64	Digital#072/Shot5 start counter	2	1	1	1	■	■		■	
0x64	Digital#073/AR start counter	2	1	1	1	■	■		■	
0x64	Digital#074/AR fail counter	2	1	1	1	■	■		■	
0x64	Digital#075/AR shot number	1	1	0	1	■	■		■	
0x64	Digital#076/Direct trip AR request	2	1	0	1	■	■		■	
0x64	Digital#077/Recloser locked	2	1	0	1	■	■		■	
0x64	Digital#078/Recloser running	2	1	0	1	■	■		■	
0x64	Digital#079/Final trip	2	1	0	1	■	■		■	
0x64	Digital#080/Auto-Recloser on	2	1	0	1	■	■		■	
0x64	Digital#081/Timer 1 status	1	1	1	1	■	■	■	■	■
0x64	Digital#082/Timer 2 status	1	1	1	1	■	■	■	■	■
0x64	Digital#083/Timer 3 status	1	1	1	1	■	■	■	■	■
0x64	Digital#084/Timer 4 status	1	1	1	1	■	■	■	■	■
0x64	Digital#085/Logic output states 1...8	1	1	0	1	■	■	■	■	■
0x64	Digital#086/Logic output states 9...16	1	1	0	1	■	■	■	■	■
0x64	Digital#087/Logic output states 17...20	1	1	0	1	■	■	■	■	■
0x64	Digital#088/Stage start state	1	1	0	1	■	■	■	■	■
0x64	Digital#089/Stage trip state	1	1	0	1	■	■	■	■	■
0x64	Digital#090/N> alarm	1	1	0	1	■	■			■
0x64	Digital#091/Motor start disabled	1	1	0	1	■	■			■
0x64	Digital#092/Motor starting	1	1	0	1	■	■			■
0x64	Digital#093/Motor running	1	1	0	1	■	■			■
0x64	Digital#094/CB operation alarm 1	1	1	0	1	■	■	■	■	■
0x64	Digital#095/CB operation alarm 2	1	1	0	1	■	■	■	■	■
0x64	Digital#096/Alarm L1..L3	1	1	0	1	■	■		■	■
0x64	Digital#097/Fault L1..L3	1	1	0	1	■	■		■	■
0x64	Digital#098/SetGrp common change	1	1	1	1	■	■	■	■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x64	Digital#099/Sync1 request	1	1	0	1	■		■	■	
0x64	Digital#100/Sync1 OK	1	1	0	1	■		■	■	
0x64	Digital#101/Bypass	1	1	1	1	■		■	■	
0x64	Digital#102/Sync1 fail	1	1	0	1	■		■	■	
0x64	Digital#103/Phase angle difference	2	1	0	1					
0x64	Digital#109/Virtual outputs	2	1	0	1	■	■	■	■	■
0x64	Digital#114/Engine running hours	4	1	1	1	■	■	■	■	■
0x64	Digital#115/Engine running (in seconds)	2	1	1	1	■	■	■	■	■
0x64	Digital#116/Start counter	2	1	1	1	■	■	■	■	■
0x64	Digital#117/Reset diagnostics	1	1	1	1	■	■	■	■	■
0x64	Digital#118/Event Code	2	1	0	1	■	■	■	■	■
0x64	Digital#119/Event Millisec And Sec	2	1	0	1	■	■	■	■	■
0x64	Digital#120/Event Min And Hour	2	1	0	1	■	■	■	■	■
0x64	Digital#121/Event Day And Month	2	1	0	1	■	■	■	■	■
0x64	Digital#122/Event Year	2	1	0	1	■	■	■	■	■
0x64	Digital#123/Event Ack	1	1	1	1	■	■	■	■	■
0x64	Digital#124/Device status	1	1	0	1	■	■	■	■	■
0x64	Digital#125/DI1 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#126/DI2 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#127/DI3 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#128/DI4 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#129/DI5 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#130/DI6 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#131/DI7 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#132/DI8 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#133/DI9 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#134/DI10 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#135/DI11 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#136/DI12 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#137/DI13 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#138/DI14 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#139/DI15 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#140/DI16 counter	2	1	1	1	■	■	■	■	■
0x64	Digital#141/DI17 counter	2	1	1	1				■	■
0x64	Digital#142/DI18 counter	2	1	1	1				■	■
0x64	Digital#143/DI19 counter	2	1	1	1				■	■
0x64	Digital#144/DI20 counter	2	1	1	1				■	■
0x64	Digital#145/DI21 counter	2	1	1	1				■	■
0x64	Digital#146/DI22 counter	2	1	1	1				■	■
0x64	Digital#147/DI23 counter	2	1	1	1				■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x64	Digital#148/DI24 counter	2	1	1	1				■	■
0x64	Digital#149/DI25 counter	2	1	1	1				■	■
0x64	Digital#150/DI26 counter	2	1	1	1				■	■
0x64	Digital#151/DI27 counter	2	1	1	1				■	■
0x64	Digital#152/DI28 counter	2	1	1	1				■	■
0x64	Digital#153/DI29 counter	2	1	1	1				■	■
0x64	Digital#154/DI30 counter	2	1	1	1				■	■
0x64	Digital#155/DI31 counter	2	1	1	1				■	■
0x64	Digital#156/DI32 counter	2	1	1	1				■	■
0x64	Digital#157/DI33 counter	2	1	1	1				■	■
0x64	Digital#158/DI34 counter	2	1	1	1				■	■
0x64	Digital#159/DI35 counter	2	1	1	1				■	■
0x64	Digital#160/DI36 counter	2	1	1	1				■	■
0x64	Digital#161/DI37 counter	2	1	1	1				■	■
0x64	Digital#162/DI38 counter	2	1	1	1				■	■
0x64	Digital#163/DI39 counter	2	1	1	1				■	■
0x64	Digital#164/DI40 counter	2	1	1	1				■	■
0x64	Digital#199/Virtual input 1	1	1	1	1	■	■	■	■	■
0x64	Digital#200/Virtual input 2	1	1	1	1	■	■	■	■	■
0x64	Digital#201/Virtual input 3	1	1	1	1	■	■	■	■	■
0x64	Digital#202/Virtual input 4	1	1	1	1	■	■	■	■	■
0x64	Digital#203/Virtual input 5	1	1	1	1	■	■	■	■	■
0x64	Digital#204/Virtual input 6	1	1	1	1	■	■	■	■	■
0x64	Digital#205/Virtual input 7	1	1	1	1	■	■	■	■	■
0x64	Digital#206/Virtual input 8	1	1	1	1	■	■	■	■	■
0x64	Digital#207/Virtual input 9	1	1	1	1	■	■	■	■	■
0x64	Digital#208/Virtual input 10	1	1	1	1	■	■	■	■	■
0x64	Digital#209/Virtual input 11	1	1	1	1	■	■	■	■	■
0x64	Digital#210/Virtual input 12	1	1	1	1	■	■	■	■	■
0x64	Digital#211/Virtual input 13	1	1	1	1	■	■	■	■	■
0x64	Digital#212/Virtual input 14	1	1	1	1	■	■	■	■	■
0x64	Digital#213/Virtual input 15	1	1	1	1	■	■	■	■	■
0x64	Digital#214/Virtual input 16	1	1	1	1	■	■	■	■	■
0x64	Digital#215/Virtual input 17	1	1	1	1	■	■	■	■	■
0x64	Digital#216/Virtual input 18	1	1	1	1	■	■	■	■	■
0x64	Digital#217/Virtual input 19	1	1	1	1	■	■	■	■	■
0x64	Digital#218/Virtual input 20	1	1	1	1	■	■	■	■	■
0x64	Digital#219/Virtual output 1	1	1	1	1	■	■	■	■	■
0x64	Digital#220/Virtual output 2	1	1	1	1	■	■	■	■	■
0x64	Digital#221/Virtual output 3	1	1	1	1	■	■	■	■	■
0x64	Digital#222/Virtual output 4	1	1	1	1	■	■	■	■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x64	Digital#223/Virtual output 5	1	1	1	1	■	■	■	■	■
0x64	Digital#224/Virtual output 6	1	1	1	1	■	■	■	■	■
0x64	Digital#225/Virtual output 7	1	1	1	1	■	■	■	■	■
0x64	Digital#226/Virtual output 8	1	1	1	1	■	■	■	■	■
0x64	Digital#227/Virtual output 9	1	1	1	1	■	■	■	■	■
0x64	Digital#228/Virtual output 10	1	1	1	1	■	■	■	■	■
0x64	Digital#229/Virtual output 11	1	1	1	1	■	■	■	■	■
0x64	Digital#230/Virtual output 12	1	1	1	1	■	■	■	■	■
0x64	Digital#231/Virtual output 13	1	1	1	1	■	■	■	■	■
0x64	Digital#232/Virtual output 14	1	1	1	1	■	■	■	■	■
0x64	Digital#233/Virtual output 15	1	1	1	1	■	■	■	■	■
0x64	Digital#234/Virtual output 16	1	1	1	1	■	■	■	■	■
0x64	Digital#235/Virtual output 17	1	1	1	1	■	■	■	■	■
0x64	Digital#236/Virtual output 18	1	1	1	1	■	■	■	■	■
0x64	Digital#237/Virtual output 19	1	1	1	1	■	■	■	■	■
0x64	Digital#238/Virtual output 20	1	1	1	1	■	■	■	■	■
0x65	Analog#001/Phase current IL1	4	1	0	1	■	■		■	■
0x65	Analog#002/Phase current IL2	4	1	0	1	■	■		■	■
0x65	Analog#003/Phase current IL3	4	1	0	1	■	■		■	■
0x65	Analog#004/Frequency	4	1	0	1	■	■	■	■	■
0x65	Analog#005/Io residual current	4	1	0	1		■		■	■
0x65	Analog#006/Io' residual current	4	1	0	1		■		■	■
0x65	Analog#007/Residual voltage	4	1	0	1	■		■	■	■
0x65	Analog#008/Active power	4	1	0	1	■			■	■
0x65	Analog#009/Reactive power	4	1	0	1	■			■	■
0x65	Analog#010/Apparent power	4	1	0	1	■			■	■
0x65	Analog#011/Phase-to-Phase voltage U12	4	1	0	1	■		■	■	■
0x65	Analog#012/Phase-to-Phase voltage U23	4	1	0	1	■		■	■	■
0x65	Analog#013/Phase-to-Phase voltage U31	4	1	0	1	■		■	■	■
0x65	Analog#014/Exported energy	4	1	1	1	■			■	■
0x65	Analog#015/Imported energy	4	1	1	1	■			■	■
0x65	Analog#016/Exp. reactive energy	4	1	1	1	■			■	■
0x65	Analog#017/Imp. reactive energy	4	1	1	1	■			■	■
0x65	Analog#018/Power factor	4	1	0	1	■			■	■
0x65	Analog#019/Phase-to-earth voltage VL1	4	1	0	1	■		■	■	■
0x65	Analog#020/Phase-to-earth voltage VL2	4	1	0	1	■		■	■	■
0x65	Analog#021/Phase-to-earth voltage VL3	4	1	0	1	■		■	■	■
0x65	Analog#022/Tangent φ	4	1	0	1	■			■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x65	Analog#023/Phase current IL	4	1	0	1	■	■		■	■
0x65	Analog#024/Average Phase-Phase voltage	4	1	0	1	■		■	■	■
0x65	Analog#025/Average Phase-Earth voltage	4	1	0	1	■		■	■	■
0x65	Analog#026/Phase current THD	4	1	0	1	■	■		■	■
0x65	Analog#027/Phase current IL1 THD	4	1	0	1	■	■		■	■
0x65	Analog#028/Phase current IL2 THD	4	1	0	1	■	■		■	■
0x65	Analog#029/Phase current IL3 THD	4	1	0	1	■	■		■	■
0x65	Analog#030/HARMONICS of IL1	4	1	0	1	■	■		■	■
0x65	Analog#031/HARMONICS of IL2	4	1	0	1	■	■		■	■
0x65	Analog#032/HARMONICS of IL3	4	1	0	1	■	■		■	■
0x65	Analog#033/Min. of IL1 IL2 IL3	4	1	0	1	■	■		■	■
0x65	Analog#034/Max. of IL1 IL2 IL3	4	1	0	1	■	■		■	■
0x65	Analog#035/Phase current ILRMS	4	1	0	1	■	■		■	■
0x65	Analog#036/Phase current IL1RMS	4	1	0	1	■	■		■	■
0x65	Analog#037/Phase current IL2RMS	4	1	0	1	■	■		■	■
0x65	Analog#038/Phase current IL3RMS	4	1	0	1	■	■		■	■
0x65	Analog#039/Temperature rise	4	1	0	1	■	■		■	
0x65	Analog#040/Ambient temperature	2	1	1	1	■	■		■	
0x65	Analog#041/Phase current IL1da demand	4	1	0	1	■	■		■	■
0x65	Analog#042/Phase current IL2da demand	4	1	0	1	■	■		■	■
0x65	Analog#043/Phase current IL3da demand	4	1	0	1	■	■		■	■
0x65	Analog#044/IoCalc demand	4	1	0	1	■	■		■	■
0x65	Analog#045/Io demand	4	1	0	1	■			■	■
0x65	Analog#046/Io' demand	4	1	0	1	■			■	■
0x65	Analog#047/Voltage THD	4	1	0	1	■		■	■	■
0x65	Analog#048/Phase-Earth VL1 THD	4	1	0	1	■		■	■	■
0x65	Analog#049/Phase-Earth VL2 THD	4	1	0	1	■		■	■	■
0x65	Analog#050/Phase-Earth VL3 THD	4	1	0	1	■		■	■	■
0x65	Analog#051/Harmonics of VL1	4	1	0	1	■		■	■	■
0x65	Analog#052/Harmonics of VL2	4	1	0	1	■		■	■	■
0x65	Analog#053/Harmonics of VL3	4	1	0	1	■		■	■	■
0x65	Analog#054/Min of Phase-Phase voltages	4	1	0	1	■		■	■	■
0x65	Analog#055/Max of Phase-Phase voltages	4	1	0	1	■		■	■	■
0x65	Analog#056/Min. of Phase-Earth voltages	4	1	0	1	■		■	■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x65	Analog#057/Max. of Phase-Earth voltages	4	1	0	1	■		■	■	■
0x65	Analog#058/RMS voltage mean	4	1	0	1	■		■	■	■
0x65	Analog#059/Phase-Earth voltage VL1RMS	4	1	0	1	■		■	■	■
0x65	Analog#060/Phase-Earth voltage VL2RMS	4	1	0	1	■		■	■	■
0x65	Analog#061/Phase-Earth voltage VL3RMS	4	1	0	1	■		■	■	■
0x65	Analog#062/Phase-Phase U12demand	4	1	0	1	■		■	■	■
0x65	Analog#063/Phase-Phase U23demand	4	1	0	1	■		■	■	■
0x65	Analog#064/Phase-Phase U31demand	4	1	0	1	■		■	■	■
0x65	Analog#065/Phase-Earth VL1demand	4	1	0	1	■		■	■	■
0x65	Analog#066/Phase-Earth VL2demand	4	1	0	1	■		■	■	■
0x65	Analog#067/Phase-Earth VL3demand	4	1	0	1	■		■	■	■
0x65	Analog#068/Cosφ	4	1	0	1	■			■	■
0x65	Analog#069/Cosφ of phase L1	4	1	0	1	■			■	■
0x65	Analog#070/Cosφ of phase L2	4	1	0	1	■			■	■
0x65	Analog#071/Cosφ of phase L3	4	1	0	1	■			■	■
0x65	Analog#072/Power angle	2	1	0	1	■			■	■
0x65	Analog#073/Phase L1 active power	4	1	0	1	■			■	■
0x65	Analog#074/Phase L2 active power	4	1	0	1	■			■	■
0x65	Analog#075/Phase L3 active power	4	1	0	1	■			■	■
0x65	Analog#076/Phase L1 reactive power	4	1	0	1	■			■	■
0x65	Analog#077/Phase L2 reactive power	4	1	0	1	■			■	■
0x65	Analog#078/Phase L3 reactive power	4	1	0	1	■			■	■
0x65	Analog#079/Phase L1 apparent power	4	1	0	1	■			■	■
0x65	Analog#080/Phase L2 apparent power	4	1	0	1	■			■	■
0x65	Analog#081/Phase L3 apparent power	4	1	0	1	■			■	■
0x65	Analog#082/RMS active power	4	1	0	1	■			■	■
0x65	Analog#083/RMS reactive power	4	1	0	1	■			■	■
0x65	Analog#084/RMS apparent power	4	1	0	1	■			■	■
0x65	Analog#085/Active power demand	4	1	0	1	■			■	■
0x65	Analog#086/Reactive power demand	4	1	0	1	■			■	■
0x65	Analog#087/Apparent power demand	4	1	0	1	■			■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x65	Analog#088/Power factor demand	4	1	0	1	■			■	■
0x65	Analog#089/RMS active power demand	4	1	0	1	■			■	■
0x65	Analog#090/RMS reactive power demand	4	1	0	1	■			■	■
0x65	Analog#091/RMS apparent power demand	4	1	0	1	■			■	■
0x65	Analog#092/Calculated Io	4	1	0	1	■	■		■	■
0x65	Analog#093/Fault current of I>	4	1	0	1	■	■		■	■
0x65	Analog#094/Fault current of I>>	4	1	0	1	■	■		■	■
0x65	Analog#095/Fault current of I>>>	4	1	0	1	■	■		■	■
0x65	Analog#096/Fault reactance	4	1	0	1				■	
0x65	Analog#097/Frequency fy	4	1	0	1					
0x65	Analog#098/Phase-to-Phase voltage U12y	4	1	0	1					
0x65	Analog#099/Frequency fz	4	1	1	1					
0x65	Analog#100/Phase-to-Phase voltage U12z	4	1	0	1					
0x65	Analog#101/Phase angle difference	2	1	0	1					
0x65	Analog#102/Minimum frequency	4	1	1	1	■	■	■	■	■
0x65	Analog#103/Minimum active power	4	1	1	1	■			■	■
0x65	Analog#104/Minimum react. power	4	1	1	1	■			■	■
0x65	Analog#105/Minimum apparent power	4	1	1	1	■			■	■
0x65	Analog#106/Min power factor	4	1	1	1	■			■	■
0x65	Analog#107/Minimum of Io	4	1	1	1	■	■		■	■
0x65	Analog#108/Minimum of Io'	4	1	1	1	■	■		■	■
0x65	Analog#109/Demand minimum active power	4	1	1	1	■			■	■
0x65	Analog#110/Demand minimum reactive power	4	1	1	1	■			■	■
0x65	Analog#111/Demand minimum apparent power	4	1	1	1	■			■	■
0x65	Analog#112/Demand minimum power factor	4	1	1	1	■			■	■
0x65	Analog#113/RMS Demand mini active power	4	1	1	1	■			■	■
0x65	Analog#114/RMS Demand min reactive power	4	1	1	1	■			■	■
0x65	Analog#115/RMS Demand mini apparent power	4	1	1	1	■			■	■
0x65	Analog#116/Minimum of IL1	4	1	1	1	■	■		■	■
0x65	Analog#117/Minimum of IL2	4	1	1	1	■	■		■	■
0x65	Analog#118/Minimum of IL3	4	1	1	1	■	■		■	■
0x65	Analog#119/RMS minimum of IL1	4	1	1	1	■	■		■	■
0x65	Analog#120/RMS minimum of IL2	4	1	1	1	■	■		■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x65	Analog#121/RMS minimum of IL3	4	1	1	1	■	■		■	■
0x65	Analog#122/Demand Minimum of IL1	4	1	1	1	■	■		■	■
0x65	Analog#123/Demand Minimum of IL2	4	1	1	1	■	■		■	■
0x65	Analog#124/Demand Minimum of IL3	4	1	1	1	■	■		■	■
0x65	Analog#125/RMS Demand minimum of IL1	4	1	1	1	■	■		■	■
0x65	Analog#126/RMS Demand minimum of IL2	4	1	1	1	■	■		■	■
0x65	Analog#127/RMS Demand minimum of IL3	4	1	1	1	■	■		■	■
0x65	Analog#128/Minimum of U12	4	1	1	1	■		■	■	■
0x65	Analog#129/Minimum of U23	4	1	1	1	■		■	■	■
0x65	Analog#130/Minimum of U31	4	1	1	1	■		■	■	■
0x65	Analog#131/Maximum frequency	4	1	1	1	■	■	■	■	■
0x65	Analog#132/Maximum active power	4	1	1	1	■			■	■
0x65	Analog#133/Maximum react. power	4	1	1	1	■			■	■
0x65	Analog#134/Maximum apparent power	4	1	1	1	■			■	■
0x65	Analog#135/Max power factor	4	1	1	1	■			■	■
0x65	Analog#136/Maximum of Io	4	1	1	1	■	■		■	■
0x65	Analog#137/Maximum of Io'	4	1	1	1	■	■		■	■
0x65	Analog#138/Demand Maximum active power	4	1	1	1	■			■	■
0x65	Analog#139/Demand maximum reactive power	4	1	1	1	■			■	■
0x65	Analog#140/Demand Maximum apparent power	4	1	1	1	■			■	■
0x65	Analog#141/Demand maximum power factor	4	1	1	1	■			■	■
0x65	Analog#142/RMS Demand max active power	4	1	1	1	■			■	■
0x65	Analog#143/RMS Demand max reactive power	4	1	1	1	■			■	■
0x65	Analog#144/RMS Demand max apparent power	4	1	1	1	■			■	■
0x65	Analog#145/Maximum of IL1	4	1	1	1	■	■		■	■
0x65	Analog#146/Maximum of IL2	4	1	1	1	■	■		■	■
0x65	Analog#147/Maximum of IL3	4	1	1	1	■	■		■	■
0x65	Analog#148/RMS maximum of IL1	4	1	1	1	■	■		■	■
0x65	Analog#149/RMS maximum of IL2	4	1	1	1	■	■		■	■
0x65	Analog#150/RMS maximum of IL3	4	1	1	1	■	■		■	■
0x65	Analog#151/Demand Maximum of IL1	4	1	1	1	■	■		■	■
0x65	Analog#152/Demand Maximum of IL2	4	1	1	1	■	■		■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x65	Analog#153/Demand Maximum of IL3	4	1	1	1	■	■		■	■
0x65	Analog#154/RMS Demand maximum of IL1	4	1	1	1	■	■		■	■
0x65	Analog#155/RMS Demand maximum of IL2	4	1	1	1	■	■		■	■
0x65	Analog#156/RMS Demand maximum of IL3	4	1	1	1	■	■		■	■
0x65	Analog#157/Maximum of U12	4	1	1	1	■		■	■	■
0x65	Analog#158/Maximum of U23	4	1	1	1	■		■	■	■
0x65	Analog#159/Maximum of U31	4	1	1	1	■		■	■	■
0x65	Analog#160/Z12 primary impedance	4	1	0	1					
0x65	Analog#161/Z23 primary impedance	4	1	0	1					
0x65	Analog#162/Z31 primary impedance	4	1	0	1					
0x65	Analog#163/Z12 secondary impedance	4	1	0	1					
0x65	Analog#164/Z23 secondary impedance	4	1	0	1					
0x65	Analog#165/Z31 secondary impedance	4	1	0	1					
0x65	Analog#166/Z12 angle	2	1	0	1					
0x65	Analog#167/Z23 angle	2	1	0	1					
0x65	Analog#168/Z31 angle	2	1	0	1					
0x65	Analog#169/Phase current IL1'	4	1	1	1					
0x65	Analog#170/Phase current IL2'	4	1	1	1					
0x65	Analog#171/Phase current IL3'	4	1	1	1					
0x65	Analog#172/IL1 difference	4	1	1	1					
0x65	Analog#173/IL2 difference	4	1	1	1					
0x65	Analog#174/IL3 difference	4	1	1	1					
0x65	Analog#175/Phase current I' THD	4	1	0	1					
0x65	Analog#176/I'L1 THD	4	1	0	1					
0x65	Analog#177/I'L2 THD	4	1	0	1					
0x65	Analog#178/I'L3 THD	4	1	0	1					
0x65	Analog#179/HARMONICS of I'L1	4	1	0	1					
0x65	Analog#180/HARMONICS of I'L2	4	1	0	1					
0x65	Analog#181/HARMONICS of I'L3	4	1	0	1					
0x65	Analog#182/Min. of I'L1 I'L2 I'L3	4	1	0	1					
0x65	Analog#183/Max. of I'L1 I'L2 I'L3	4	1	0	1					
0x65	Analog#184/Phase current I'LRMS	4	1	0	1					
0x65	Analog#185/Phase current IL1'RMS	4	1	1	1					
0x65	Analog#186/Phase current IL2'RMS	4	1	1	1					
0x65	Analog#187/Phase current IL3'RMS	4	1	1	1					

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x65	Analog#251/Io CSH residual current	4	1	0	1	■	■		■	■
0x65	Analog#252/Mode of use	2	1	0	1	■	■	■	■	■
0x66	StgProtCurrent#001/Enable for I>	1	1	1	0	■	■		■	■
0x66	StgProtCurrent#002/Group	1	1	0	0	■	■		■	■
0x66	StgProtCurrent#003/Pick-up value	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#004/Pick-up value	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#005/Delay curve family	1	1	1	0	■	■		■	■
0x66	StgProtCurrent#006/Delay curve family	1	1	1	0	■	■		■	■
0x66	StgProtCurrent#007/Delay type	1	1	1	0	■	■		■	■
0x66	StgProtCurrent#008/Delay type	1	1	1	0	■	■		■	■
0x66	StgProtCurrent#009/Inv. time coefficient	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#010/Inv. time coefficient	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#011/Include harmonics	1	1	1	0	■	■		■	■
0x66	StgProtCurrent#012/Constant A	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#013/Constant B	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#014/Constant C	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#015/Constant D	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#016/Constant E	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#017/Enable for I>>	1	1	1	0	■	■		■	■
0x66	StgProtCurrent#018/Group	1	1	0	0	■	■		■	■
0x66	StgProtCurrent#019/Pick-up value	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#020/Pick-up value	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#021/Operation delay	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#022/Operation delay	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#023/Enable for I>>>	1	1	1	0	■	■		■	■
0x66	StgProtCurrent#024/Group	1	1	0	0	■	■		■	■
0x66	StgProtCurrent#025/Pick-up value	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#026/Pick-up value	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#027/Operation delay	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#028/Operation delay	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#029/Enable for Iφ>	1	1	1	0	■			■	■
0x66	StgProtCurrent#030/Group	1	1	0	0	■			■	■
0x66	StgProtCurrent#031/Pick-up value	4	1	1	0	■			■	■
0x66	StgProtCurrent#032/Pick-up value	4	1	1	0	■			■	■
0x66	StgProtCurrent#033/Direction mode	1	1	1	0	■			■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x66	StgProtCurrent#034/Direction mode	1	1	1	0	■			■	■
0x66	StgProtCurrent#035/Angle offset	2	1	1	0	■			■	■
0x66	StgProtCurrent#036/Angle offset	2	1	1	0	■			■	■
0x66	StgProtCurrent#037/Delay curve family	1	1	1	0	■			■	■
0x66	StgProtCurrent#038/Delay curve family	1	1	1	0	■			■	■
0x66	StgProtCurrent#039/Delay type	1	1	1	0	■			■	■
0x66	StgProtCurrent#040/Delay type	1	1	1	0	■			■	■
0x66	StgProtCurrent#041/Inv. time coefficient	4	1	1	0	■			■	■
0x66	StgProtCurrent#042/Inv. time coefficient	4	1	1	0	■			■	■
0x66	StgProtCurrent#043/Constant A	4	1	1	0	■			■	■
0x66	StgProtCurrent#044/Constant B	4	1	1	0	■			■	■
0x66	StgProtCurrent#045/Constant C	4	1	1	0	■			■	■
0x66	StgProtCurrent#046/Constant D	4	1	1	0	■			■	■
0x66	StgProtCurrent#047/Constant E	4	1	1	0	■			■	■
0x66	StgProtCurrent#048/Enable for Iφ>>	1	1	1	0	■			■	■
0x66	StgProtCurrent#049/Group	1	1	0	0	■			■	■
0x66	StgProtCurrent#050/Pick-up value	4	1	1	0	■			■	■
0x66	StgProtCurrent#051/Pick-up value	4	1	1	0	■			■	■
0x66	StgProtCurrent#052/Direction mode	1	1	1	0	■			■	■
0x66	StgProtCurrent#053/Direction mode	1	1	1	0	■			■	■
0x66	StgProtCurrent#054/Angle offset	2	1	1	0	■			■	■
0x66	StgProtCurrent#055/Angle offset	2	1	1	0	■			■	■
0x66	StgProtCurrent#056/Delay curve family	1	1	1	0	■			■	■
0x66	StgProtCurrent#057/Delay curve family	1	1	1	0	■			■	■
0x66	StgProtCurrent#058/Delay type	1	1	1	0	■			■	■
0x66	StgProtCurrent#059/Delay type	1	1	1	0	■			■	■
0x66	StgProtCurrent#060/Inv. time coefficient	4	1	1	0	■			■	■
0x66	StgProtCurrent#061/Inv. time coefficient	4	1	1	0	■			■	■
0x66	StgProtCurrent#062/Constant A	4	1	1	0	■			■	■
0x66	StgProtCurrent#063/Constant B	4	1	1	0	■			■	■
0x66	StgProtCurrent#064/Constant C	4	1	1	0	■			■	■
0x66	StgProtCurrent#065/Constant D	4	1	1	0	■			■	■
0x66	StgProtCurrent#066/Constant E	4	1	1	0	■			■	■
0x66	StgProtCurrent#067/Enable for Iφ>>>	1	1	1	0	■			■	■
0x66	StgProtCurrent#068/Group	1	1	0	0	■			■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x66	StgProtCurrent#069/Pick-up value	4	1	1	0	■			■	■
0x66	StgProtCurrent#070/Pick-up value	4	1	1	0	■			■	■
0x66	StgProtCurrent#071/Direction mode	1	1	1	0	■			■	■
0x66	StgProtCurrent#072/Direction mode	1	1	1	0	■			■	■
0x66	StgProtCurrent#073/Angle offset	2	1	1	0	■			■	■
0x66	StgProtCurrent#074/Angle offset	2	1	1	0	■			■	■
0x66	StgProtCurrent#075/Operation delay	4	1	1	0	■			■	■
0x66	StgProtCurrent#076/Operation delay	4	1	1	0	■			■	■
0x66	StgProtCurrent#077/Enable for Iφ>>>>	1	1	1	0	■			■	■
0x66	StgProtCurrent#078/Group	1	1	0	0	■			■	■
0x66	StgProtCurrent#079/Pick-up value	4	1	1	0	■			■	■
0x66	StgProtCurrent#080/Pick-up value	4	1	1	0	■			■	■
0x66	StgProtCurrent#081/Direction mode	1	1	1	0	■			■	■
0x66	StgProtCurrent#082/Direction mode	1	1	1	0	■			■	■
0x66	StgProtCurrent#083/Angle offset	2	1	1	0	■			■	■
0x66	StgProtCurrent#084/Angle offset	2	1	1	0	■			■	■
0x66	StgProtCurrent#085/Operation delay	4	1	1	0	■			■	■
0x66	StgProtCurrent#086/Operation delay	4	1	1	0	■			■	■
0x66	StgProtCurrent#087/Enable for I2/I1>	1	1	1	0	■	■		■	■
0x66	StgProtCurrent#088/Group	1	1	0	0	■	■		■	■
0x66	StgProtCurrent#089/Pick-up value K2	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#090/Pick-up value K2	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#093/Operation delay	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#094/Operation delay	4	1	1	0	■	■		■	■
0x66	StgProtCurrent#095/Enable for I2>>	1	1	1	0					
0x66	StgProtCurrent#096/Enable for Ist>	1	1	1	0	■	■			■
0x66	StgProtCurrent#097/Motor start detection current	4	1	1	0	■				■
0x66	StgProtCurrent#098/Nominal motor start current	4	1	1	0	■	■			■
0x66	StgProtCurrent#099/Delay type	1	1	1	0	■	■			■
0x66	StgProtCurrent#100/Motor start time	4	1	1	0	■	■			■
0x66	StgProtCurrent#101/Enable for N>	1	1	1	0	■	■			■
0x66	StgProtCurrent#102/Max motor starts/hour	4	1	1	0	■	■			■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x66	StgProtCurrent#103/Min time between motor starts	4	1	1	0	■	■			■
0x66	StgProtCurrent#104/Alarm on event	1	1	1	0	■	■			■
0x66	StgProtCurrent#105/Alarm off event	1	1	1	0	■	■			■
0x66	StgProtCurrent#106/Motor start disabled	1	1	1	0	■	■			■
0x66	StgProtCurrent#107/Motor start enabled	1	1	1	0	■	■			■
0x66	StgProtCurrent#108/Enable for I<	1	1	1	0	■	■			■
0x66	StgProtCurrent#109/Group	1	1	0	0	■	■			■
0x66	StgProtCurrent#110/Pick-up value	4	1	1	0	■	■			■
0x66	StgProtCurrent#111/Pick-up value	4	1	1	0	■	■			■
0x66	StgProtCurrent#112/Operation delay	4	1	1	0	■	■			■
0x66	StgProtCurrent#113/Operation delay	4	1	1	0	■	■			■
0x66	StgProtCurrent#117/Enable for dI>	1	1	1	0					
0x66	StgProtCurrent#118/dI> pick-up (Ibias < 0.5Ign)	4	1	1	0					
0x66	StgProtCurrent#119/Slope1	4	1	1	0					
0x66	StgProtCurrent#120/Ibias for start of slope 2	4	1	1	0					
0x66	StgProtCurrent#121/Slope2	4	1	1	0					
0x66	StgProtCurrent#122/dI> 2.harm. block enable	1	1	1	0					
0x66	StgProtCurrent#123/dI> 2.harm. block limit	4	1	1	0					
0x66	StgProtCurrent#124/Enable for dI>>	1	1	1	0					
0x66	StgProtCurrent#125/Pick-up value	4	1	1	0					
0x66	StgProtCurrent#126/Enable for I'2>	1	1	1	0					
0x66	StgProtCurrent#127/Group	1	1	1	0					
0x66	StgProtCurrent#128/Pick-up value	4	1	1	0					
0x66	StgProtCurrent#129/Pick-up value	4	1	1	0					
0x66	StgProtCurrent#130/Delay type	1	1	1	0					
0x66	StgProtCurrent#131/Delay type	1	1	1	0					
0x66	StgProtCurrent#132/Operation delay	4	1	1	0					
0x66	StgProtCurrent#133/Operation delay	4	1	1	0					
0x66	StgProtCurrent#134/Enable for I'>	1	1	1	0					
0x66	StgProtCurrent#135/Group	1	1	1	0					
0x66	StgProtCurrent#136/Pick-up value	4	1	1	0					
0x66	StgProtCurrent#137/Pick-up value	4	1	1	0					
0x66	StgProtCurrent#138/Delay curve family	1	1	1	0					

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x66	StgProtCurrent#139/Delay curve family	1	1	1	0					
0x66	StgProtCurrent#140/Delay type	1	1	1	0					
0x66	StgProtCurrent#141/Delay type	1	1	1	0					
0x66	StgProtCurrent#142/Inv. time coefficient	4	1	1	0					
0x66	StgProtCurrent#143/Inv. time coefficient	4	1	1	0					
0x66	StgProtCurrent#144/Constant A	4	1	1	0					
0x66	StgProtCurrent#145/Constant B	4	1	1	0					
0x66	StgProtCurrent#146/Constant C	4	1	1	0					
0x66	StgProtCurrent#147/Constant D	4	1	1	0					
0x66	StgProtCurrent#148/Constant E	4	1	1	0					
0x66	StgProtCurrent#149/Enable for I'>>	1	1	1	0					
0x66	StgProtCurrent#150/Group	1	1	1	0					
0x66	StgProtCurrent#151/Pick-up value	4	1	1	0					
0x66	StgProtCurrent#152/Pick-up value	4	1	1	0					
0x66	StgProtCurrent#153/Operation delay	4	1	1	0					
0x66	StgProtCurrent#154/Operation delay	4	1	1	0					
0x67	StgProtEF#001/Enable for Io>	1	1	1	0	■	■		■	■
0x67	StgProtEF#002/Group	1	1	0	0	■	■		■	■
0x67	StgProtEF#003/Pick-up value	4	1	1	0	■	■		■	■
0x67	StgProtEF#004/Pick-up value	4	1	1	0	■	■		■	■
0x67	StgProtEF#005/Delay curve family	1	1	1	0	■	■		■	■
0x67	StgProtEF#006/Delay curve family	1	1	1	0	■	■		■	■
0x67	StgProtEF#007/Delay type	1	1	1	0	■	■		■	■
0x67	StgProtEF#008/Delay type	1	1	1	0	■	■		■	■
0x67	StgProtEF#009/Operation delay	4	1	1	0	■	■		■	■
0x67	StgProtEF#010/Operation delay	4	1	1	0	■	■		■	■
0x67	StgProtEF#012/Constant A	4	1	1	0	■	■		■	■
0x67	StgProtEF#013/Constant B	4	1	1	0	■	■		■	■
0x67	StgProtEF#014/Constant C	4	1	1	0	■	■		■	■
0x67	StgProtEF#015/Constant D	4	1	1	0	■	■		■	■
0x67	StgProtEF#016/Constant E	4	1	1	0	■	■		■	■
0x67	StgProtEF#017/Enable for Io>>	1	1	1	0	■	■		■	■
0x67	StgProtEF#018/Group	1	1	0	0	■	■		■	■
0x67	StgProtEF#019/Pick-up value	4	1	1	0	■	■		■	■
0x67	StgProtEF#020/Pick-up value	4	1	1	0	■	■		■	■
0x67	StgProtEF#021/Operation delay	4	1	1	0	■	■		■	■
0x67	StgProtEF#022/Operation delay	4	1	1	0	■	■		■	■
0x67	StgProtEF#023/Enable for Ioφ>	1	1	1	0	■			■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x67	StgProtEF#024/Group	1	1	0	0	■			■	■
0x67	StgProtEF#025/Direction mode	1	1	1	0	■			■	■
0x67	StgProtEF#026/Direction mode	1	1	1	0	■			■	■
0x67	StgProtEF#027/Char ctrl. in ResCap mode	1	1	1	0	■			■	■
0x67	StgProtEF#028/Char ctrl. in ResCap mode	1	1	1	0	■			■	■
0x67	StgProtEF#029/Pick-up value	4	1	1	0	■			■	■
0x67	StgProtEF#030/Pick-up value	4	1	1	0	■			■	■
0x67	StgProtEF#031/Uo setting for Ioφ> stage	4	1	1	0	■			■	■
0x67	StgProtEF#032/Uo setting for Ioφ> stage	4	1	1	0	■			■	■
0x67	StgProtEF#033/Angle offset	2	1	1	0	■			■	■
0x67	StgProtEF#034/Angle offset	2	1	1	0	■			■	■
0x67	StgProtEF#035/Pick up sector size	2	1	1	0	■			■	■
0x67	StgProtEF#036/Pick up sector size	2	1	1	0	■			■	■
0x67	StgProtEF#037/Delay curve family	1	1	1	0	■			■	■
0x67	StgProtEF#038/Delay curve family	1	1	1	0	■			■	■
0x67	StgProtEF#039/Delay type	1	1	1	0	■			■	■
0x67	StgProtEF#040/Delay type	1	1	1	0	■			■	■
0x67	StgProtEF#041/Operation delay	4	1	1	0	■			■	■
0x67	StgProtEF#042/Operation delay	4	1	1	0	■			■	■
0x67	StgProtEF#043/Constant A	4	1	1	0	■			■	■
0x67	StgProtEF#044/Constant B	4	1	1	0	■			■	■
0x67	StgProtEF#045/Constant C	4	1	1	0	■			■	■
0x67	StgProtEF#046/Constant D	4	1	1	0	■			■	■
0x67	StgProtEF#047/Constant E	4	1	1	0	■			■	■
0x67	StgProtEF#048/Enable for Ioφ>>	1	1	1	0	■			■	■
0x67	StgProtEF#049/Group	1	1	0	0	■			■	■
0x67	StgProtEF#050/Direction mode	1	1	1	0	■			■	■
0x67	StgProtEF#051/Direction mode	1	1	1	0	■			■	■
0x67	StgProtEF#052/Char ctrl. in ResCap mode	1	1	1	0	■			■	■
0x67	StgProtEF#053/Char ctrl. in ResCap mode	1	1	1	0	■			■	■
0x67	StgProtEF#054/Pick-up value	4	1	1	0	■			■	■
0x67	StgProtEF#055/Pick-up value	4	1	1	0	■			■	■
0x67	StgProtEF#056/Uo setting for Ioφ>> stage	4	1	1	0	■			■	■
0x67	StgProtEF#057/Uo setting for Ioφ>> stage	4	1	1	0	■			■	■
0x67	StgProtEF#058/Angle offset	2	1	1	0	■			■	■
0x67	StgProtEF#059/Angle offset	2	1	1	0	■			■	■
0x67	StgProtEF#060/Pick up sector size	2	1	1	0	■			■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x67	StgProtEF#061/Pick up sector size	2	1	1	0	■			■	■
0x67	StgProtEF#062/Delay curve family	1	1	1	0	■			■	■
0x67	StgProtEF#063/Delay curve family	1	1	1	0	■			■	■
0x67	StgProtEF#064/Delay type	1	1	1	0	■			■	■
0x67	StgProtEF#065/Delay type	1	1	1	0	■			■	■
0x67	StgProtEF#066/Operation delay	4	1	1	0	■			■	■
0x67	StgProtEF#067/Operation delay	4	1	1	0	■			■	■
0x67	StgProtEF#068/Constant A	4	1	1	0	■			■	■
0x67	StgProtEF#069/Constant B	4	1	1	0	■			■	■
0x67	StgProtEF#070/Constant C	4	1	1	0	■			■	■
0x67	StgProtEF#071/Constant D	4	1	1	0	■			■	■
0x67	StgProtEF#072/Constant E	4	1	1	0	■			■	■
0x67	StgProtEF#073/Enable for Io>>>	1	1	1	0	■	■		■	■
0x67	StgProtEF#074/Group	1	1	0	0	■	■		■	■
0x67	StgProtEF#075/Pick-up value	4	1	1	0	■	■		■	■
0x67	StgProtEF#076/Pick-up value	4	1	1	0	■	■		■	■
0x67	StgProtEF#077/Operation delay	4	1	1	0	■	■		■	■
0x67	StgProtEF#078/Operation delay	4	1	1	0	■	■		■	■
0x67	StgProtEF#079/Compensation mode	1	1	1	0		■		■	
0x67	StgProtEF#080/Compensation current	4	1	1	0		■		■	
0x67	StgProtEF#081/Save unbalance current	1	1	1	0		■		■	
0x67	StgProtEF#082/Saving unbal' event	1	1	1	0		■		■	
0x67	StgProtEF#083/Unbal saved' event	1	1	1	0		■		■	
0x67	StgProtEF#084/Enable for Io>>>>	1	1	1	0		■		■	■
0x67	StgProtEF#085/Group	1	1	0	0		■		■	■
0x67	StgProtEF#086/Pick-up value	4	1	1	0		■		■	■
0x67	StgProtEF#087/Pick-up value	4	1	1	0		■		■	■
0x67	StgProtEF#088/Operation delay	4	1	1	0		■		■	■
0x67	StgProtEF#089/Operation delay	4	1	1	0		■		■	■
0x67	StgProtEF#090/Compensation mode	1	1	1	0		■		■	
0x67	StgProtEF#091/Compensation current	4	1	1	0		■		■	
0x67	StgProtEF#092/Save unbalance current	1	1	1	0		■		■	
0x67	StgProtEF#093/Max allowed faults	2	1	1	0		■		■	
0x67	StgProtEF#094/Clear location counters	1	1	1	0		■		■	
0x67	StgProtEF#095/Saving unbal' event	1	1	1	0		■		■	
0x67	StgProtEF#096/Unbal saved' event	1	1	1	0		■		■	

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x67	StgProtEF#097/Enable for IoInt>	1	1	1	0				■	
0x67	StgProtEF#098/Group	1	1	0	0				■	
0x67	StgProtEF#099/Uo pick-up	4	1	1	0				■	
0x67	StgProtEF#100/Uo pick-up	4	1	1	0				■	
0x67	StgProtEF#101/Operation delay	4	1	1	0				■	
0x67	StgProtEF#102/Operation delay	4	1	1	0				■	
0x67	StgProtEF#103/Intermittent time	4	1	1	0				■	
0x67	StgProtEF#104/Enable for Uo>	1	1	1	0	■		■	■	■
0x67	StgProtEF#105/Group	1	1	0	0	■		■	■	■
0x67	StgProtEF#106/Pick-up value	4	1	1	0	■		■	■	■
0x67	StgProtEF#107/Pick-up value	4	1	1	0	■		■	■	■
0x67	StgProtEF#108/Operation delay	4	1	1	0	■		■	■	■
0x67	StgProtEF#109/Operation delay	4	1	1	0	■		■	■	■
0x67	StgProtEF#110/Enable for Uo>>	1	1	1	0	■		■	■	■
0x67	StgProtEF#111/Group	1	1	0	0	■		■	■	■
0x67	StgProtEF#112/Pick-up value	4	1	1	0	■		■	■	■
0x67	StgProtEF#113/Pick-up value	4	1	1	0	■		■	■	■
0x67	StgProtEF#114/Operation delay	4	1	1	0	■		■	■	■
0x67	StgProtEF#115/Operation delay	4	1	1	0	■		■	■	■
0x67	StgProtEF#116/Enable for ArcIo1>	1	1	1	0					
0x67	StgProtEF#117/Pick-up value	4	1	1	0					
0x67	StgProtEF#118/Arc inputs in use	1	1	1	0					
0x67	StgProtEF#119/Enable for ArcIo2>	1	1	1	0					
0x67	StgProtEF#120/Pick-up value	4	1	1	0					
0x67	StgProtEF#121/Arc inputs in use	1	1	1	0					
0x67	StgProtEF#122/Enable for Io>>>>>	1	1	1	0		■		■	■
0x67	StgProtEF#123/Group	1	1	0	0		■		■	■
0x67	StgProtEF#124/Pick-up value	4	1	1	0		■		■	■
0x67	StgProtEF#125/Pick-up value	4	1	1	0		■		■	■
0x67	StgProtEF#126/Operation delay	4	1	1	0		■		■	■
0x67	StgProtEF#127/Operation delay	4	1	1	0		■		■	■
0x67	StgProtEF#128/Enable for Ioφ>>>	1	1	1	0	■			■	■
0x67	StgProtEF#129/Group	1	1	0	0	■			■	■
0x67	StgProtEF#130/Direction mode	1	1	1	0	■			■	■
0x67	StgProtEF#131/Direction mode	1	1	1	0	■			■	■
0x67	StgProtEF#132/Char ctrl. in ResCap mode	1	1	1	0	■			■	■
0x67	StgProtEF#133/Char ctrl. in ResCap mode	1	1	1	0	■			■	■
0x67	StgProtEF#134/Pick-up value	4	1	1	0	■			■	■
0x67	StgProtEF#135/Pick-up value	4	1	1	0	■			■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x67	StgProtEF#136/Uo setting for Ioφ>>> stage	4	1	1	0	■			■	■
0x67	StgProtEF#137/Uo setting for Ioφ>>> stage	4	1	1	0	■			■	■
0x67	StgProtEF#138/Angle offset	2	1	1	0	■			■	■
0x67	StgProtEF#139/Angle offset	2	1	1	0	■			■	■
0x67	StgProtEF#140/Pick up sector size	2	1	1	0	■			■	■
0x67	StgProtEF#141/Pick up sector size	2	1	1	0	■			■	■
0x67	StgProtEF#142/Delay curve family	1	1	1	0	■			■	■
0x67	StgProtEF#143/Delay curve family	1	1	1	0	■			■	■
0x67	StgProtEF#144/Delay type	1	1	1	0	■			■	■
0x67	StgProtEF#145/Delay type	1	1	1	0	■			■	■
0x67	StgProtEF#146/Operation delay	4	1	1	0	■			■	■
0x67	StgProtEF#147/Operation delay	4	1	1	0	■			■	■
0x67	StgProtEF#148/Constant A	4	1	1	0	■			■	■
0x67	StgProtEF#149/Constant B	4	1	1	0	■			■	■
0x67	StgProtEF#150/Constant C	4	1	1	0	■			■	■
0x67	StgProtEF#151/Constant D	4	1	1	0	■			■	■
0x67	StgProtEF#152/Constant E	4	1	1	0	■			■	■
0x67	StgProtEF#153/Enable for Uo>>>	1	1	1	0	■		■	■	■
0x67	StgProtEF#154/Group	1	1	0	0	■		■	■	■
0x67	StgProtEF#155/Pick-up value	4	1	1	0	■		■	■	■
0x67	StgProtEF#156/Pick-up value	4	1	1	0	■		■	■	■
0x67	StgProtEF#157/Operation delay	4	1	1	0	■		■	■	■
0x67	StgProtEF#158/Operation delay	4	1	1	0	■		■	■	■
0x67	StgProtEF#159/Enable for Io'>	1	1	1	0		■		■	■
0x67	StgProtEF#160/Group	1	1	0	0		■		■	■
0x67	StgProtEF#161/Pick-up value	4	1	1	0		■		■	■
0x67	StgProtEF#162/Pick-up value	4	1	1	0		■		■	■
0x67	StgProtEF#163/Delay curve family	1	1	1	0		■		■	■
0x67	StgProtEF#164/Delay curve family	1	1	1	0		■		■	■
0x67	StgProtEF#165/Delay type	1	1	1	0		■		■	■
0x67	StgProtEF#166/Delay type	1	1	1	0		■		■	■
0x67	StgProtEF#167/Operation delay	4	1	1	0		■		■	■
0x67	StgProtEF#168/Operation delay	4	1	1	0		■		■	■
0x67	StgProtEF#169/Io' input	1	1	1	0		■		■	■
0x67	StgProtEF#171/Constant A	4	1	1	0		■		■	■
0x67	StgProtEF#172/Constant B	4	1	1	0		■		■	■
0x67	StgProtEF#173/Constant C	4	1	1	0		■		■	■
0x67	StgProtEF#174/Constant D	4	1	1	0		■		■	■
0x67	StgProtEF#175/Constant E	4	1	1	0		■		■	■
0x67	StgProtEF#176/Enable for Io'>>	1	1	1	0		■		■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x67	StgProtEF#177/Group	1	1	0	0		■		■	■
0x67	StgProtEF#178/Pick-up value	4	1	1	0		■		■	■
0x67	StgProtEF#179/Pick-up value	4	1	1	0		■		■	■
0x67	StgProtEF#180/Operation delay	4	1	1	0		■		■	■
0x67	StgProtEF#181/Operation delay	4	1	1	0		■		■	■
0x67	StgProtEF#182/Io input	1	1	1	0		■		■	■
0x67	StgProtEF#183/Enable for Io'>>>	1	1	1	0		■		■	■
0x67	StgProtEF#184/Group	1	1	0	0		■		■	■
0x67	StgProtEF#185/Pick-up value	4	1	1	0		■		■	■
0x67	StgProtEF#186/Pick-up value	4	1	1	0		■		■	■
0x67	StgProtEF#187/Operation delay	4	1	1	0		■		■	■
0x67	StgProtEF#188/Operation delay	4	1	1	0		■		■	■
0x67	StgProtEF#189/Io input	1	1	1	0		■		■	■
0x67	StgProtEF#190/Enable for IoUo>	1	1	1	0				■	■
0x67	StgProtEF#191/Group	1	1	0	0				■	■
0x67	StgProtEF#192/Pick-up value	4	1	1	0				■	■
0x67	StgProtEF#193/Pick-up value	4	1	1	0				■	■
0x67	StgProtEF#194/Io input	1	1	1	0				■	■
0x67	StgProtEF#195/Reset time	4	1	1	0				■	■
0x67	StgProtEF#196/Operation delay	4	1	1	0				■	■
0x67	StgProtEF#197/Operation delay	4	1	1	0				■	■
0x67	StgProtEF#198/Direction mode	1	1	1	0				■	■
0x67	StgProtEF#199/Direction mode	1	1	1	0				■	■
0x67	StgProtEF#200/Pick up sector size	2	1	1	0				■	■
0x67	StgProtEF#201/Pick up sector size	2	1	1	0				■	■
0x67	StgProtEF#202/Timer instant delay ctrl.	1	1	1	0				■	■
0x67	StgProtEF#203/Enable for IoUo>>	1	1	1	0				■	■
0x67	StgProtEF#204/Group	1	1	0	0				■	■
0x67	StgProtEF#205/Pick-up value	4	1	1	0				■	■
0x67	StgProtEF#206/Pick-up value	4	1	1	0				■	■
0x67	StgProtEF#207/Io input	1	1	1	0				■	■
0x67	StgProtEF#208/Reset time	4	1	1	0				■	■
0x67	StgProtEF#209/Operation delay	4	1	1	0				■	■
0x67	StgProtEF#210/Operation delay	4	1	1	0				■	■
0x67	StgProtEF#211/Direction mode	1	1	1	0				■	■
0x67	StgProtEF#212/Direction mode	1	1	1	0				■	■
0x67	StgProtEF#213/Pick up sector size	2	1	1	0				■	■
0x67	StgProtEF#214/Pick up sector size	2	1	1	0				■	■
0x67	StgProtEF#215/Timer instant delay ctrl.	1	1	1	0				■	■
0x67	StgProtEF#216/Enable for I2>	1	1	1	0	■	■		■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x67	StgProtEF#217/Group	1	1	0	0	■	■		■	■
0x67	StgProtEF#218/Pick-up value	4	1	1	0	■	■		■	■
0x67	StgProtEF#219/Pick-up value	4	1	1	0	■	■		■	■
0x67	StgProtEF#220/Delay curve family	1	1	1	0	■	■		■	■
0x67	StgProtEF#221/Delay curve family	1	1	1	0	■	■		■	■
0x67	StgProtEF#222/Delay type	1	1	1	0	■	■		■	■
0x67	StgProtEF#223/Delay type	1	1	1	0	■	■		■	■
0x67	StgProtEF#224/Operation delay	4	1	1	0	■	■		■	■
0x67	StgProtEF#225/Operation delay	4	1	1	0	■	■		■	■
0x67	StgProtEF#226/Enable for Arc I'>	1	1	1	0					
0x67	StgProtEF#227/Pick-up value	4	1	1	0					
0x67	StgProtEF#228/Arc inputs in use	1	1	1	0					
0x67	StgProtEF#229/Arc I state	1	1	0	0				■	■
0x67	StgProtEF#230/Arc Io state	1	1	0	0				■	■
0x67	StgProtEF#231/Arc stage 1	1	1	0	0				■	■
0x67	StgProtEF#232/Arc stage 2	1	1	0	0				■	■
0x67	StgProtEF#233/Arc stage 3	1	1	0	0				■	■
0x67	StgProtEF#234/Arc stage 4	1	1	0	0				■	■
0x67	StgProtEF#235/Arc stage 5	1	1	0	0				■	■
0x67	StgProtEF#236/Arc stage 6	1	1	0	0				■	■
0x67	StgProtEF#237/Arc stage 7	1	1	0	0				■	■
0x67	StgProtEF#238/Arc stage 8	1	1	0	0				■	■
0x67	StgProtEF#239/Temperature 1	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#240/Temperature 2	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#241/Temperature 3	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#242/Temperature 4	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#243/Temperature 5	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#244/Temperature 6	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#245/Temperature 7	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#246/Temperature 8	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#247/Temperature 9	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#248/Temperature 10	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#249/Temperature 11	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#250/Temperature 12	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#251/Temperature 13	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#252/Temperature 14	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#253/Temperature 15	2	1	0	0	■	■	■	■	■
0x67	StgProtEF#254/Temperature 16	2	1	0	0	■	■	■	■	■
0x68	StgProtOther#001/Enable for U>	1	1	1	0	■		■	■	■
0x68	StgProtOther#002/Group	1	1	0	0	■		■	■	■
0x68	StgProtOther#003/Pick-up value	4	1	1	0	■		■	■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x68	StgProtOther#004/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#005/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#006/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#007/Reset time	4	1	1	0	■		■	■	■
0x68	StgProtOther#008/Hysteresis	4	1	1	0	■		■	■	■
0x68	StgProtOther#009/Enable for U>>	1	1	1	0	■		■	■	■
0x68	StgProtOther#010/Group	1	1	0	0	■		■	■	■
0x68	StgProtOther#011/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#012/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#013/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#014/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#015/Hysteresis	4	1	1	0	■		■	■	■
0x68	StgProtOther#016/Enable for U>>>	1	1	1	0	■		■	■	■
0x68	StgProtOther#017/Group	1	1	0	0	■		■	■	■
0x68	StgProtOther#018/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#019/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#020/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#021/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#022/Hysteresis	4	1	1	0	■		■	■	■
0x68	StgProtOther#023/Enable for U<	1	1	1	0	■		■	■	■
0x68	StgProtOther#024/Group	1	1	0	0	■		■	■	■
0x68	StgProtOther#025/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#026/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#027/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#028/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#029/Low voltage blocking	4	1	0	0	■		■	■	■
0x68	StgProtOther#030/Low voltage blocking	4	1	0	0	■		■	■	■
0x68	StgProtOther#031/Reset time	4	1	1	0	■		■	■	■
0x68	StgProtOther#032/Hysteresis	4	1	1	0	■		■	■	■
0x68	StgProtOther#033/Enable for U<<	1	1	1	0	■		■	■	■
0x68	StgProtOther#034/Group	1	1	0	0	■		■	■	■
0x68	StgProtOther#035/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#036/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#037/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#038/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#039/Low voltage blocking	4	1	0	0	■		■	■	■
0x68	StgProtOther#040/Low voltage blocking	4	1	0	0	■		■	■	■
0x68	StgProtOther#041/Hysteresis	4	1	1	0	■		■	■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x68	StgProtOther#042/Enable for U<<<	1	1	1	0	■		■	■	■
0x68	StgProtOther#043/Group	1	1	0	0	■		■	■	■
0x68	StgProtOther#044/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#045/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#046/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#047/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#048/Low voltage blocking	4	1	0	0	■		■	■	■
0x68	StgProtOther#049/Low voltage blocking	4	1	0	0	■		■	■	■
0x68	StgProtOther#050/Hysteresis	4	1	1	0	■		■	■	■
0x68	StgProtOther#051/Enable for fX	1	1	1	0	■		■	■	■
0x68	StgProtOther#052/Group	1	1	0	0	■		■	■	■
0x68	StgProtOther#053/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#054/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#055/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#056/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#057/Low voltage blocking	4	1	1	0	■		■	■	■
0x68	StgProtOther#058/Enable for fXX	1	1	1	0	■		■	■	■
0x68	StgProtOther#059/Group	1	1	0	0	■		■	■	■
0x68	StgProtOther#060/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#061/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#062/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#063/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#064/Low voltage blocking	4	1	1	0	■		■	■	■
0x68	StgProtOther#065/Enable for f<	1	1	1	0	■		■	■	■
0x68	StgProtOther#066/Group	1	1	0	0	■		■	■	■
0x68	StgProtOther#067/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#068/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#069/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#070/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#071/Low voltage blocking	4	1	1	0	■		■	■	■
0x68	StgProtOther#072/Enable for f<<	1	1	1	0	■		■	■	■
0x68	StgProtOther#073/Group	1	1	0	0	■		■	■	■
0x68	StgProtOther#074/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#075/Pick-up value	4	1	1	0	■		■	■	■
0x68	StgProtOther#076/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#077/Operation delay	4	1	1	0	■		■	■	■
0x68	StgProtOther#078/Low voltage blocking	4	1	1	0	■		■	■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x68	StgProtOther#079/Enable for df/ dt>	1	1	1	0	■		■	■	
0x68	StgProtOther#080/Group	1	1	0	0	■		■	■	
0x68	StgProtOther#081/Pick-up value	4	1	1	0	■		■	■	
0x68	StgProtOther#082/Pick-up value	4	1	1	0	■		■	■	
0x68	StgProtOther#083/Operation delay	4	1	1	0	■		■	■	
0x68	StgProtOther#084/Operation delay	4	1	1	0	■		■	■	
0x68	StgProtOther#085/Minimum delay	4	1	1	0	■		■	■	
0x68	StgProtOther#086/Minimum delay	4	1	1	0	■		■	■	
0x68	StgProtOther#087/Enable for P<	1	1	1	0	■			■	■
0x68	StgProtOther#088/Group	1	1	0	0	■			■	■
0x68	StgProtOther#089/Pick-up value	4	1	1	0	■			■	■
0x68	StgProtOther#090/Pick-up value	4	1	1	0	■			■	■
0x68	StgProtOther#091/Operation delay	4	1	1	0	■			■	■
0x68	StgProtOther#092/Operation delay	4	1	1	0	■			■	■
0x68	StgProtOther#093/Enable for P<<	1	1	1	0	■			■	■
0x68	StgProtOther#094/Group	1	1	0	0	■			■	■
0x68	StgProtOther#095/Pick-up value	4	1	1	0	■			■	■
0x68	StgProtOther#096/Pick-up value	4	1	1	0	■			■	■
0x68	StgProtOther#097/Operation delay	4	1	1	0	■			■	■
0x68	StgProtOther#098/Operation delay	4	1	1	0	■			■	■
0x68	StgProtOther#099/Enable for feeder T>	1	1	1	0	■	■		■	
0x68	StgProtOther#100/Group	1	1	0	0	■	■		■	
0x68	StgProtOther#101/Maximum continuous current	4	1	1	0	■	■		■	
0x68	StgProtOther#102/Alarm setting	4	1	1	0	■	■		■	
0x68	StgProtOther#103/Time constant tau	2	1	1	0	■	■		■	
0x68	StgProtOther#104/Rel. cooling time constant	4	1	0	0	■	■		■	
0x68	StgProtOther#105/Max overload at +40°C	4	1	0	0	■	■		■	
0x68	StgProtOther#106/Max overload at +70°C	4	1	0	0	■	■		■	
0x68	StgProtOther#107/Ambient temperature	2	1	0	0	■	■		■	
0x68	StgProtOther#108/Ambient temp. sensor	1	1	0	0	■	■		■	
0x68	StgProtOther#109/Enable for CB fail	1	1	1	0	■	■	■	■	■
0x68	StgProtOther#110/Monitored Trip relay	1	1	1	0	■	■	■	■	■
0x68	StgProtOther#111/Timer1 Operation Delay	4	1	1	0	■	■	■	■	■
0x68	StgProtOther#112/Enable for SOTF	1	1	1	0	■	■		■	■
0x68	StgProtOther#113/Pick-up value	4	1	1	0	■	■		■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x68	StgProtOther#114/Pick-up value	4	1	1	0	■	■		■	■
0x68	StgProtOther#115/Cold load pickup	1	1	0	0	■	■		■	■
0x68	StgProtOther#116/Inrush detection	1	1	0	0	■	■		■	■
0x68	StgProtOther#117/Enable for df/dt>>	1	1	1	0	■		■	■	
0x68	StgProtOther#118/Group	1	1	0	0	■		■	■	
0x68	StgProtOther#119/Pick-up value	4	1	1	0	■		■	■	
0x68	StgProtOther#120/Pick-up value	4	1	1	0	■		■	■	
0x68	StgProtOther#121/Operation delay	4	1	1	0	■		■	■	
0x68	StgProtOther#122/Operation delay	4	1	1	0	■		■	■	
0x68	StgProtOther#123/Minimum delay	4	1	1	0	■		■	■	
0x68	StgProtOther#124/Minimum delay	4	1	1	0	■		■	■	
0x68	StgProtOther#125/Enable for Motor T>	1	1	1	0	■	■			■
0x69	StgGeneral#001/CT primary	4	1	1	0		■		■	■
0x69	StgGeneral#002/CT secondary	2	1	0	0		■		■	■
0x69	StgGeneral#003/Nominal input	2	1	0	0		■		■	■
0x69	StgGeneral#004/Earth CT primary	4	1	1	0		■	■	■	■
0x69	StgGeneral#005/Earth CT secondary	4	1	0	0		■	■	■	■
0x69	StgGeneral#006/Nominal Io1 input	4	1	0	0		■	■	■	■
0x69	StgGeneral#007/Earth CT' primary	4	1	1	0		■	■	■	■
0x69	StgGeneral#008/Earth CT' secondary	4	1	0	0		■	■	■	■
0x69	StgGeneral#009/Nominal Io' input	4	1	0	0		■	■	■	■
0x69	StgGeneral#010/VT primary	4	1	1	0			■	■	■
0x69	StgGeneral#011/VT secondary	2	1	1	0			■	■	■
0x69	StgGeneral#012/VTo secondary	4	1	1	0			■	■	■
0x69	StgGeneral#013/Motor nominal current	4	1	1	0					■
0x69	StgGeneral#021/Delay CT supervision	2	1	1	0	■	■		■	■
0x69	StgGeneral#022/VT supervisor	2	1	1	0	■		■	■	■
0x70	Analog2#001/Frequency	4	1	0	1	■	■	■	■	■
0x70	Analog2#002/Active power	4	1	0	1	■			■	■
0x70	Analog2#003/Reactive power	4	1	0	1	■			■	■
0x70	Analog2#004/Apparent power	4	1	0	1	■			■	■
0x70	Analog2#005/Phase-to-Phase voltage U12	4	1	0	1	■		■	■	■
0x70	Analog2#006/Phase-to-Phase voltage U23	4	1	0	1	■		■	■	■
0x70	Analog2#007/Phase-to-Phase voltage U31	4	1	0	1	■		■	■	■
0x70	Analog2#008/Power factor	4	1	0	1	■			■	■
0x70	Analog2#009/Phase-to-earth voltage VL1	4	1	0	1	■		■	■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x70	Analog2#010/Phase-to-earth voltage VL2	4	1	0	1	■		■	■	■
0x70	Analog2#011/Phase-to-earth voltage VL3	4	1	0	1	■		■	■	■
0x70	Analog2#012/Tangent φ	4	1	0	1	■			■	■
0x70	Analog2#013/Average Phase-Phase voltage	4	1	0	1	■		■	■	■
0x70	Analog2#014/Average Phase-Earth voltage	4	1	0	1	■		■	■	■
0x70	Analog2#015/Pos. sequence U1	4	1	0	1	■		■	■	■
0x70	Analog2#016/Negative sequence U2	4	1	0	1	■		■	■	■
0x70	Analog2#017/Min of Phase-Phase voltages	4	1	0	1	■		■	■	■
0x70	Analog2#018/Max of Phase-Phase voltages	4	1	0	1	■		■	■	■
0x70	Analog2#019/Min. of Phase-Earth voltages	4	1	0	1	■		■	■	■
0x70	Analog2#020/Max. of Phase-Earth voltages	4	1	0	1	■		■	■	■
0x70	Analog2#021/RMS voltage mean	4	1	0	1	■		■	■	■
0x70	Analog2#022/Phase-Earth voltage VL1RMS	4	1	0	1	■		■	■	■
0x70	Analog2#023/Phase-Earth voltage VL2RMS	4	1	0	1	■		■	■	■
0x70	Analog2#024/Phase-Earth voltage VL3RMS	4	1	0	1	■		■	■	■
0x70	Analog2#025/Phase-Phase U12demand	4	1	0	1	■		■	■	■
0x70	Analog2#026/Phase-Phase U23demand	4	1	0	1	■		■	■	■
0x70	Analog2#027/Phase-Phase U31demand	4	1	0	1	■		■	■	■
0x70	Analog2#028/Phase-Earth VL1demand	4	1	0	1	■		■	■	■
0x70	Analog2#029/Phase-Earth VL2demand	4	1	0	1	■		■	■	■
0x70	Analog2#030/Phase-Earth VL3demand	4	1	0	1	■		■	■	■
0x70	Analog2#031/Cosφ	4	1	0	1	■			■	■
0x70	Analog2#032/Cosφ of phase L1	4	1	0	1	■			■	■
0x70	Analog2#033/Cosφ of phase L2	4	1	0	1	■			■	■
0x70	Analog2#034/Cosφ of phase L3	4	1	0	1	■			■	■
0x70	Analog2#035/Phase L1 active power	4	1	0	1	■			■	■
0x70	Analog2#036/Phase L2 active power	4	1	0	1	■			■	■
0x70	Analog2#037/Phase L3 active power	4	1	0	1	■			■	■
0x70	Analog2#038/Phase L1 reactive power	4	1	0	1	■			■	■
0x70	Analog2#039/Phase L2 reactive power	4	1	0	1	■			■	■

Class	Name	Length	Read	Write	Cont. mode	P5U20 LPCT LPVT	P5U20	P5V20	P5F30	P5M30
0x70	Analog2#040/Phase L3 reactive power	4	1	0	1	■			■	■
0x70	Analog2#041/Phase L1 apparent power	4	1	0	1	■			■	■
0x70	Analog2#042/Phase L2 apparent power	4	1	0	1	■			■	■
0x70	Analog2#043/Phase L3 apparent power	4	1	0	1	■			■	■
0x70	Analog2#044/RMS active power	4	1	0	1	■			■	■
0x70	Analog2#045/RMS reactive power	4	1	0	1	■			■	■
0x70	Analog2#046/RMS apparent power	4	1	0	1	■			■	■
0x70	Analog2#047/Active power demand	4	1	0	1	■			■	■
0x70	Analog2#048/Reactive power demand	4	1	0	1	■			■	■
0x70	Analog2#049/Apparent power demand	4	1	0	1	■			■	■
0x70	Analog2#050/Power factor demand	4	1	0	1	■			■	■
0x70	Analog2#051/RMS active power demand	4	1	0	1	■			■	■
0x70	Analog2#052/RMS reactive power demand	4	1	0	1	■			■	■
0x70	Analog2#053/RMS apparent power demand	4	1	0	1	■			■	■
0x70	Analog2#054/Estimated time to trip	4	1	0	1	■	■		■	
0x70	Analog2#055/Phase current IL1	4	1	0	1	■	■		■	■
0x70	Analog2#056/Phase current IL2	4	1	0	1	■	■		■	■
0x70	Analog2#057/Phase current IL3	4	1	0	1	■	■		■	■
0x70	Analog2#058/Pos. sequence I1	4	1	0	1	■	■		■	■
0x70	Analog2#059/Negative sequence I2	4	1	0	1	■	■		■	■
0x70	Analog2#060/Current ratio I2/I1	4	1	0	1	■	■		■	■
0x70	Analog2#061/Voltage U2/U1	4	1	0	1	■		■	■	■
0x70	Analog2#063/Estimated time to trip	4	1	0	1	■	■			■

Redundancy protocols

There are three redundancy protocols available as options of Ethernet communication in Easergy P5 protection relays:

- PRP (Parallel Redundancy Protocol)
- HSR (High-availability Seamless Redundancy)
- RSTP (Rapid Spanning Tree Protocol)

Parallel Redundancy Protocol (PRP)

Introduction

The Parallel Redundancy Protocol used in the Easergy P5 protection relays is defined in Clause 4 of the IEC 62439-3 standard. The PRP is a “redundancy in the devices” method that provides bumpless switchover in case of network failure or reintegration. Furthermore, it provides the shortest Ethernet network reconfiguration time as network reconfiguration is seamless.

The Easergy P5 protection relay uses two independent Ethernet ports that operate in parallel on two independent networks. Each message is replicated and sent over both networks. The first network node that receives a message will process it, all later instances of the received message will be discarded. These details of replicating and discarding messages are controlled by the low-level PRP layer of the network architecture, so that the two networks are hidden from the higher level layers. Thus, PRP-based networks provide a high degree of robustness and resilience.

Easergy P5 protection relays support SNMP.

Essentially, a PRP network consists of a pair of similar Local Area Networks (LANs) which can be any topology (tree, ring or mesh). An example of a PRP network is shown in PRP redundancy network, page 190.

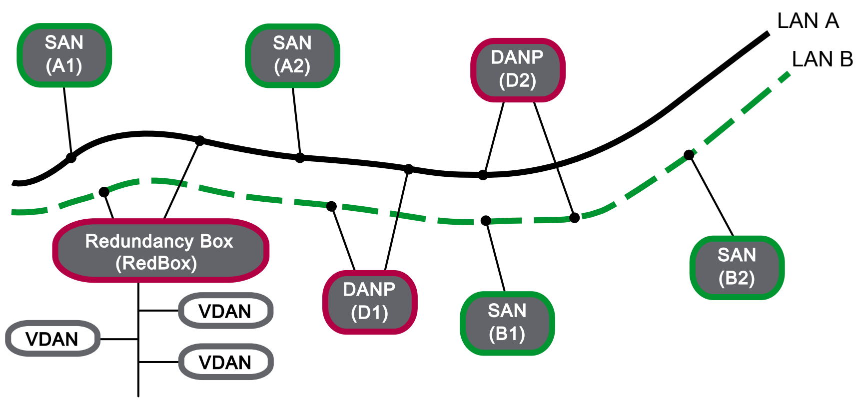
The key features of a PRP redundancy network include:

- Each of the two LANs can have one or more “Single Attached Nodes” (SANs). These are normally non-significant devices that are attached only to a single network. SANs can communicate with each other, but only if they are attached to the same LAN.
- Matched pairs of devices have an interface to each LAN, hence they are called “Dual Attached Nodes” (DANs). DANs having the PRP implemented are called “DANs with PRP implemented” (DANP).
- To make the network messages (also known as “frames”) be transferred correctly to each device in both LANs, each DANP has to be configured with the same Media Access Control (MAC) code and Internet Protocol (IP) address for both of its ports. As a result, TCP/IP traffic will automatically communicate with both of the paired devices, so it will be unaware of any layer 2 redundancy or frame duplication issues.
- A Redundancy Box is used when a single interface node has to be connected to both LANs. The RedBox can communicate with all other nodes. So far as other nodes are concerned, the RedBox behaves like a DAN, so an IED connected via a RedBox is also called a “Virtual DAN” (VDAN). The RedBox has its own unique IP address.
- The Easergy P5 protection relays have to be connected to the redundant Ethernet network as a Double Attached Node (DAN) using PRP (DAN using PRP is known as DANP).
- The redundant Ethernet interface can be made using an optical fibre connection with an LC connector type (Ethernet card dependent).
- The management of the PRP redundancy is transparent to the application data provided via the Ethernet interface.
- Disconnection of one of the LANs to the device does not cause any degradation to the application data over the Ethernet interface.
- Each supervision frame includes a sequence number as defined in the

IEC 62439-3 specification. This is incremented for each supervision message and the value starts from zero following a system restart.

- Received frames to provide supervision of the redundant network are not processed by Easergy P5 protection relays.

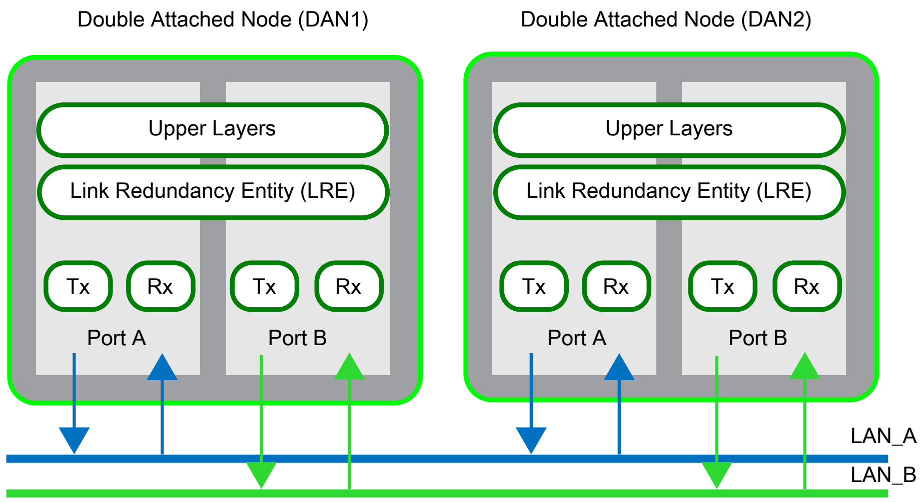
Figure 17 - PRP redundancy network



Structure of a DANP

Easergy P5 protection relays working in PRP mode work as a DANP each within the overall network topology. Each DANP has two ports that operate in parallel. They are attached to the upper layers of the communications stack through the Link Redundancy Entity (LRE).

Figure 18 - Communication between two DANPs



The LRE has two main tasks:

- Handling message frames
- Management of redundancy

When an upper layer sends a frame to the LRE, the LRE replicates the frame and sends it through both its ports at nearly the same time. The two frames move through the two LANs with slightly different delays, ideally arriving at the destination node within a small time window.

When receiving frames, the LRE forwards the first frame it received to its upper layers and then discards the duplicate.

As both DANP nodes have the same MAC and IP addresses, this makes redundancy transparent to the upper layers. This allows the Address Resolution Protocol (ARP) to work in the same way as with a SAN. Accordingly, to the upper layers of a DANP, the LRE layer shows the same interface as the network adapter of a non-redundant adapter.

To manage redundancy, the LRE:

- Adds a 32-bit Redundancy Check Tag (RCT) to each frame it sends
- Removes the RCT from each frame it receives

Communication between SANs and DANs

A SAN can be connected to any LAN and can communicate with any other SAN on the same LAN or any DAN. However, a SAN which connected to one LAN can not communicate directly to a SAN which is connected to the other LAN.

A DAN is connected to both LANs and can communicate with any Redundancy Box (RedBox) or any other DANs or any SANs on either network. For communication purposes, a DAN “views” a SAN connected through a RedBox as a VDAN.

When a SAN generates a basic frame, it sends the frame only onto the LAN to which it is connected.

Main characteristics

- One VLAN tag supported
- 128 publishers supported per receiver
- Up to 100Mbit/s full duplex Ethernet
- Dynamic frame memory allocation (page manager)
- Configurable duplicate detection
- Wishborne interface for configuration and status registers
- CPU port interface — Ethernet or Wishbone
- Support for link-local protocols - CPU may send to specific ports only - CPU knows receive port
- Configurable frame memory and queue length
- Duplicate detection with configurable size and aging time
- MAC address filtering (8 filter masks for interlink, 6 for CPU)
- Support for interfaces with or without Ethernet preamble

According to the IEC/IEEE 8802-3, the Maximum Transmission Unit (MTU) (Ethernet maximum packet size) is:

- 1518 bytes without VLAN and without PRP
- 1522 bytes with VLAN and without PRP
- 1524 bytes without VLAN and with PRP
- 1528 bytes with VLAN and with PRP

NOTE: Check that the LAN switches setting for the MTU is at least 1528 bytes.

PRP parameters

The redundant Ethernet standard (IEC 62439-3) defines several parameters for the PRP protocol; these being fixed according to the table below:

Table 56 - PRP parameter values

Parameter	Value	Description
Supervision Frame Multicast Address	01-15-4E-00-01-00	Target MAC Address for multicast supervision frame.
Life Check Interval	2 s +/- 100 ms	Period between transmission of supervision frames.
PRP Mode	Duplicate Discard	This is normal PRP mode, Duplicate address will not be supported.
Entry Forget Time	400 ms	Duration that the received message Sequence number will be held to discard a duplicate message.
Node Reboot Interval	500 ms	Duration following reboot for which no PRP frames will be transmitted.

High-availability Seamless Redundancy (HSR)

Introduction

The High-availability Seamless Redundancy Protocol used in the Easergy P5 protection relays is defined in Clause 5 of the IEC 62439-3 standard.

The HSR is a “redundancy in the devices” method that provides seamless switchover and recovery in case of a single communication failure or reintegration. HSR Ethernet redundancy method is independent of any industrial Ethernet protocol and typically used in a ring topology.

Easergy P5 protection relays provide two redundant Ethernet ports using HSR. The redundant Ethernet interface can be made using an optical fibre connection with an LC connector type. The management of the HSR redundancy is transparent to the application data provided via the Ethernet interface.

Disconnection of one of the Nodes to the device does not cause any degradation to the application data over the Ethernet interface.

Easergy P5 protection relays support SNMP.

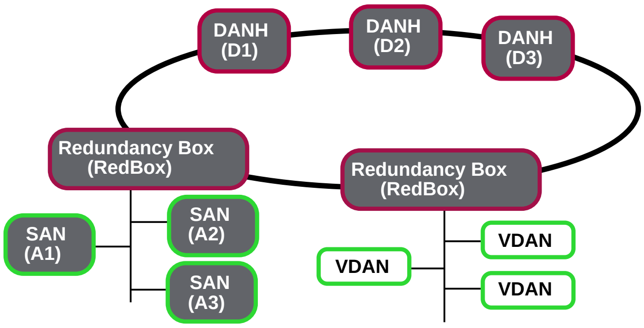
An example of a HSR network is shown in HSR redundancy network, page 193.

The key features of a HSR redundancy network include:

- Nodes within the ring are restricted to be HSR-capable bridging nodes, thus avoiding the use of dedicated bridges.
- Singly Attached Nodes (SANs) such as laptops or printers cannot be attached directly to the ring, but need attachment through a RedBox.
- A simple HSR network consists of doubly attached bridging nodes, each having two ports, interconnected by full-duplex links.
- A source DANH (Double Attached Node with HSR implemented) sends a frame passed from its upper layers, prefixes it by an HSR tag to identify frame duplicates and sends the frame over each port.
- A destination DANH receives, in the fault-free state, two identical frames from each port within a certain interval, if it is a multicast frame, it instantaneously forwards it on the ring, removes the HSR tag of the first frame before passing it to its upper layers and discards any duplicate.

  In particular, the node will not forward a frame that it injected into the ring. A destination node of a unicast frame does not forward a frame for which it is the only destination, except for testing.
- Easergy P5 protection relays have to be connected to the redundant Ethernet network as a Double Attached Node (DAN) using HSR (DANH).

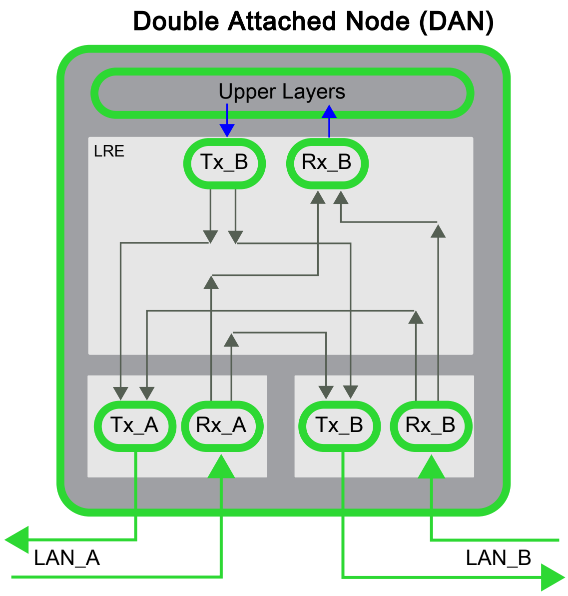
Figure 19 - HSR redundancy network



Structure of a DAN

Easergy P5 protection relays working in HSR Mode work as a DAN within the overall network topology. Each DAN has two ports that operate in parallel. The two HSR ports A and B are connected by the Link Redundancy Entity (LRE), which includes a switching matrix allowing to forward frames from one port to the other. The switching matrix allows cut-through bridging. The LRE presents to the higher layers the same interface as a standard Ethernet transceiver would do.

Figure 20 - Communication between two DANs (in HSR)



DAN node is operable in HSR-tagged forwarding mode, the DAN inserts the HSR tag on behalf of its host and forwards the ring traffic, except for frames sent by the node itself. Duplicate frames and frames where the node is the unicast destination are not forwarded.

Structure of a RedBox

The RedBox has a LRE that performs the duties of the HSR protocol, in particular:

- forwards the frames received from one HSR port to the other HSR port, unless the frame receives frames addressed to its own upper protocols
- prefixes the frames sent by its own upper layers with the corresponding HSR tag before sending two copies over its HSR ports

The switching logic is incorporated into the RedBox, so interlink becomes an internal connection.
A simple RedBox is present in every node, since the LRE makes a transition to a single non-HSR host. In addition, it is usual to have more than one host in a node, since a port for maintenance often exists.

A node does not send over a port a frame that is a duplicate of a frame previously sent over that port in that same direction.
For the purpose of Duplicate Discard, a frame is identified by:

- source MAC address
- sequence number

The Duplicate Discard method forgets an entry identified by <Source MAC Address><Sequence number> after a time EntryForgetTime.

Communication between SANs, DANs and RedBoxs

Singly Attached Nodes, for instance maintenance laptops or printers cannot be inserted directly into the ring since they have only one port and cannot interpret the HSR tag in the frames. SANs communicate with ring devices through a RedBox that acts as a proxy for the SANs attached to it.

A source DANH sends a frame passed from its upper layers, and prefixes it by an HSR tag to identify frame duplicates and sends the frame over both ports. Each supervision frame includes a sequence number as defined in the IEC 62439- 3 specification. This is incremented for each supervision message and the value starts from zero following a system restart.

A destination DANH receives, in the fault-free state, two identical frames from each port within a certain interval, if it is a multicast frame, it instantaneously forwards it on the ring, removes the HSR tag of the first frame before passing it to its upper layers (“D”- frame) and discards any duplicate.

Main characteristics

- One VLAN tag supported
- Up to 128 devices supported
- Up to 100Mbit/s full duplex Ethernet
- Dynamic frame memory allocation (page manager)
- Configurable duplicate detection
- Wishbone interface for configuration and status registers
- CPU port interface - Wishbone
- Support for link-local protocols - CPU may send to specific ports only - CPU knows receive port
- Support for interfaces with or without Ethernet preamble
- Configurable frame memory and queue length
- Duplicate detection with configurable size and aging time
- MAC address filtering (8 filter masks for interlink port, 6 for CPU port)
- Support for interfaces with or without Ethernet preamble

Limitations:

- Number of devices on a same ring at 100 Mbit/s:

  Each hop (devices or RedBox) not only carries its own messages but also all the other devices messages thus the bandwidth used is proportional to the number of device. The maximum number of hops is around 20 when the GOOSE messages are highly used or 40 if the number and importance of GOOSE messages is not high.
- When Precision Time Protocol, according IEEE1588/IEC 61588 standard, is used:

  As the GPS receiver inaccuracy is 200 ns and as each hop (devices or RedBox) can add a 50 ns inaccuracy, the maximum number of hops is 16 if 1 μs accuracy is required (PMU application or Process Bus).

HSR parameters

The redundant Ethernet standard (IEC 62439-3) defines several parameters for the HSR protocol; these being fixed according to the table below:

Table 57 - HSR parameter values

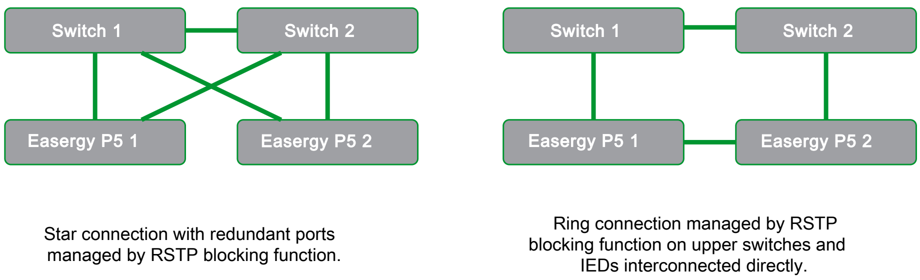
Parameter	Value	Description
Supervision Frame Multicast Address	01-15-4E-00-01-00	Target MAC Address for multicast supervision frame
Life Check Interval	2 s +/- 100 ms	Period between transmission of supervision frames
HSR Mode	Duplicate Discard	This is normal HSR mode, Duplicate address will not be supported.
Entry Forget Time	400 ms	Duration that the received message Sequence number will be held to discard a duplicate message.
Node Reboot Interval	500 ms	Duration following reboot for which no PRP frames will be transmitted.
MulticastFilterSize	8 Interlink and 6 Nios CPU	Number of multicast addresses to be filtered

Rapid Spanning Tree Protocol (RSTP)

Introduction

RSTP is a standard used to quickly reconnect a network failure by finding an alternative path, allowing loop-free network topology.

Figure 21 - A redundant Ethernet star or ring circuit



Although RSTP can recover network failures quickly, the recovery time depends on the number of devices and the topology. The recovery time also depends on the time taken by the devices to determine the root bridge and compute the port roles (discarding, learning, forwarding). The devices do this by exchanging Bridge Protocol Data Units (BPDUs) containing information about bridge devices and root path costs. See the IEEE 802.1w standard for further information.

The RSTP solution is based on open standards. It is therefore compatible with other manufacturers' IEDs that use the RSTP protocol. The typical RSTP recovery time is less than 50 ms for 10 IEDs in a network but it increases with the network size. Due to this recovery time it is not recommended to use RSTP in automation systems where a high availability of GOOSE is essential.

Easergy P5 protection relays provide two redundant Ethernet ports using RSTP. The redundant Ethernet interface can be made using RJ45 or optical fibre connections of LC connector type. The management of the RSTP is transparent to the application data provided via the Ethernet interface. One of the missed node connections to the device does not cause any degradation to the application data over the Ethernet interface.

Easergy P5 protection relays support SNMP.

RSTP parameters

Table 58 - RSTP parameter values

Parameter	Default Value	Range	Description
Enable for RSTP	Yes	Yes, No	Enable/disable the use of RSTP protocol on the Ethernet port. (RSTP on Slot L can be enabled or disabled, while RSTP on Slot M is always enabled.)
Bridge priority	32768	0...65535 (step is 4096)	Parameter used to define the RSTP root device for the network. If priorities of two or more devices are equal then the device with lowest MAC address is chosen as a root.
Hello Time	2 s	1...10 s	Setting defines how often RSTP frames (Hello BPDU) are sent.
Forward Delay	15 s	4...30 s	Time needed for the port to change its state from blocking to forwarding.
Max Age	20 s	6...40 s	The maximum age of the information transmitted by the Bridge when it is the Root Bridge.
Port1 Path Cost	200000	1...200000	Port Cost is related to transfer speed. This is determined according to RSTP specification.
Port1 Priority	128	0...255	When both Ethernet ports are set connected to the same network segment – in such a case the port with worse priority (higher value) is disabled as a backup path for that segment.
Port2 Path Cost	200000	1...200000	Port Cost is related to transfer speed. This is determined according to RSTP specification.
Port2 Priority	128	0...255	When both Ethernet ports are set connected to the same network segment – in such a case the port with worse priority (higher value) is disabled as a backup path for that segment.

The parameters for the RSTP protocol can be configured via:

- front panel
- Protocol configuration view of COMMUNICATION menu of eSetup Easergy Pro or Web HMI

Generic functions for all redundant Ethernet modules

- **Ethernet 100Base Fx/Tx**

  The fibre optic ports are full duplex 100 Mbps LC connectors.

- **Forwarding**

  The devices from the families Easergy P5 protection relays support store and forward mode. The switch forwards messages with known addresses to the appropriate port. The messages with unknown addresses, the broadcast messages and the multicast messages are forwarded out to all ports except the source port. Switches will not forward error packets, 802.3x pause frames or local packets.

  NOTE: Forwarding is active when HSR or RSTP protocol is selected.

- **Priority Tagging**

  802.1p priority tagging is enabled on all ports.

Precision Time Protocol (PTP)

Precision Time Protocol (PTP) communication uses the IEEE 802.3 protocol.

PTP communication is only available with PRP/HSR module. A Transparent Clock (TC) is supported on the HSR ring. PTP provides higher time accuracy (500 us).

Introduction to the PTP standards

A protocol is provided in this standard that enables precise synchronization of clocks in measurement and control systems implemented with technologies such as network communication, local computing, and distributed objects. The protocol is applicable to systems communicating via packet networks. Heterogeneous systems are enabled that include clocks of various inherent precision, resolution, and stability to synchronize. System wide synchronization accuracy and precision in the sub-microsecond range are supported with minimal network and local clock computing resources. Simple systems are installed and operated without requiring the management attention of users because the default behaviour of the protocol allows for it.

NOTE: Specific PTP compatible external equipment (switch, time synchronization source, etc.) are needed for Easergy P5 PTP protocols.

PTP implementation

PTP implementation is compliant with IEC 61850-9-3 and IEEE 1588v2/ IEC 61588. Peer-to-peer mode and Best Master Clock algorithm (BMCA) are supported.

Figure 22 - PTP configuration

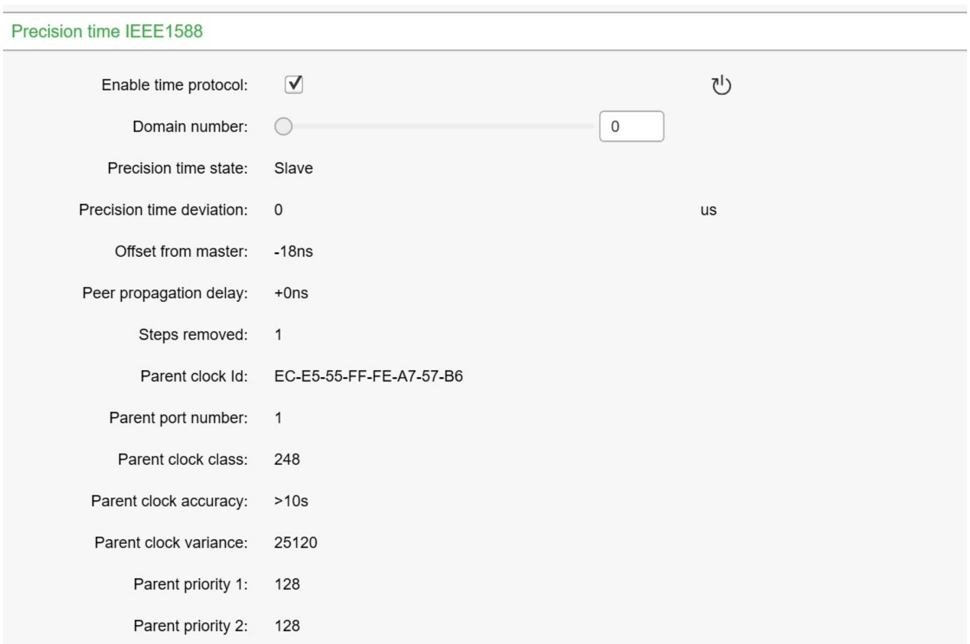


Table 59 - PTP parameter values

Parameter	Value	Description	Note
Enable time protocol	Yes, No	Enable/disable PTP protocol.	Set
Domain number	0...255	Define the permitted domain number of master clock. If the domainNumber in received PTP message header is different from the configuration parameter, the message will be rejected.	Set
Precision time state	Initial Faulty	The state of PTP.	

Table 59 - PTP parameter values (Continued)

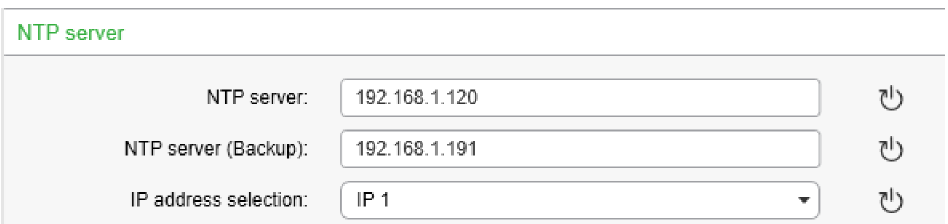
Parameter	Value	Description	Note
	Disabled Listening Pre_master Master Passive Uncalibrated Slave		
Precision time deviation	Unit: µs	The last time deviation for PTP in µs.	
Offset from master	Unit: ns, µs, ms or s	The time difference between a master and a slave computed by the slave.	
Peer propagation delay	Unit: ns, µs, ms or s	An estimate of the current one-way propagation delay on the link.	
Steps removed	0...255	The number of communication paths traversed between the local clock and the grandmaster clock.	
Parent clock Id	xx-xx-xx-FF-FE-xx-xx-xx	The parent clock id.	
Parent port number	0...255	The number of parent port.	
Parent clock class	0...255	Parent clock attribute defining a clock's TAI traceability.	
Parent clock accuracy	0...255	Parent clock attribute defining the accuracy of a clock.	
Parent clock variance	0...65535	Parent clock attribute defining the stability of a clock.	
Parent priority 1	0...255	The parent priority 1 used in the execution of the best master clock algorithm.	
Parent priority 2	0...255	The parent priority 2 used in the execution of the best master clock algorithm.	

Simple Network Time Protocol (SNTP)

Simple Network Time Protocol is supported by the Easergy P5 protection relay and the Redundant Ethernet switch. SNTP is used to synchronize the clocks of computer systems over packet-switched, variable-latency data networks. A jitter buffer is used to reduce the effects of variable latency introduced by queuing in packet switched networks, helping to ensure a continuous data stream over the network.

The Easergy P5 protection relays receive the synchronization from the NTP server. This is done using the IP address of the NTP server entered into the Easergy P5 protection relays from the eSetup Easergy Pro or Web HMI.

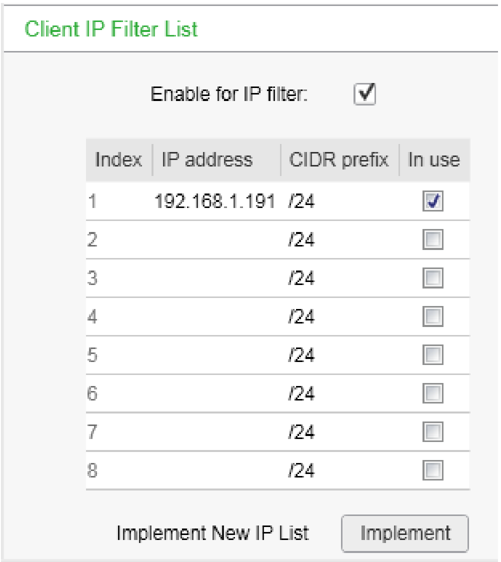
Figure 23 - Configuring the NTP server



Client IP address filter

The “Client IP Address List” is presented in the “Protocol configuration” section of the “COMMUNICATION” menu in eSetup Easergy Pro. When there is no Ethernet Card in slot L and slot M, this list is hidden. The Client IP address filter, when enabled, defines the exclusive list of IP addresses that are accepted by the Easergy P5 relay. Connections from IP addresses, not part of this list, are rejected.

Figure 24 - The Client IP address list view in the COMMUNICATION menu



The “Client IP Address List” is also listed in the general menu of the HMI.

Scope

The client IP address filter feature is only implemented for legacy protocols through TCP/IP.

- Modbus TCP/IP
- DNP3 TCP
- EtherNet/IP

Rules

- The feature can be enabled or disabled by clicking “Enable for IP filter”.
  - Enabled:

    The Easergy P5 protection relay filters the client IP address as configured in the table.
  - Disabled:

    Any client can connect to the Easergy P5 protection relay.
- This feature is common for the legacy protocols supported.
- CIDR (Classless Inter-Domain Routing) notation is used to define IP addresses range, e.g. 192.168.1.191/24, which means IP address 192.168.1.0 ~ 192.168.1.255 are all available.
- More than 8 IP addresses ranges are allowed/configured. But dynamically no more than 8 connections are active.

- Only the connection from these IP addresses which are configured in the “Client IP Address List” view can be accepted by the Easergy P5 protection relay.
- Any duplicated IP address is cleared and the “In use” flag is de-selected after clicking the “Implement New IP List” button. For example, if the 2nd and 5th IP address are both “192.168.1.191”, then, when clicking the “Implement” button the 5th IP address will be changed to empty, and “in use” is not selected.
- The CIDR IP address range is only active if the 'in use flag' is selected.
- When the number of connections is less than the max. allowed number, the connection from any permitted IP address is accepted.
- When there are already max. clients connected, the first connection is closed if there is new client coming from the same available IP address, otherwise the oldest connection is closed if there is new connection from available client IP.
- The parameter modified takes effect immediately after clicking the “Implement New IP List” button, the Easergy P5 protection relay is not required to reboot. The consequence of applying the IP Filer list (clicking the “Implement New IP List” button) is defined as:
  - Firmware reads all configuration parameters
  - Check for duplicated IP addresses
  - If “Enable for IP Filter” is not selected, all existing connections will be kept, and the communication will be running as usual.
  - If “Enable for IP Filter” is selected, the connection, whose IP address is allowed (defined in the IP address list), will be kept, and the communication will be running as usual. And all other connections, whose IP addresses are forbidden (not defined in the IP address list), will be closed.

Configuration parameters

Table 60 - Client IP filter configuration parameters

Parameter	Value	Description
Enable for IP filter	No/Yes	This flag indicates whether the client IP filter feature is supported or not.
IP address	Null or available IP address	Available IP address to be filtered.
CIDR prefix	/1 …. /32	n-bits of CIDR prefix
In use	False/True	This flag indicates whether this CIDR notation IP address is filtered.
Implement New IP List		Command to Implement New IP List

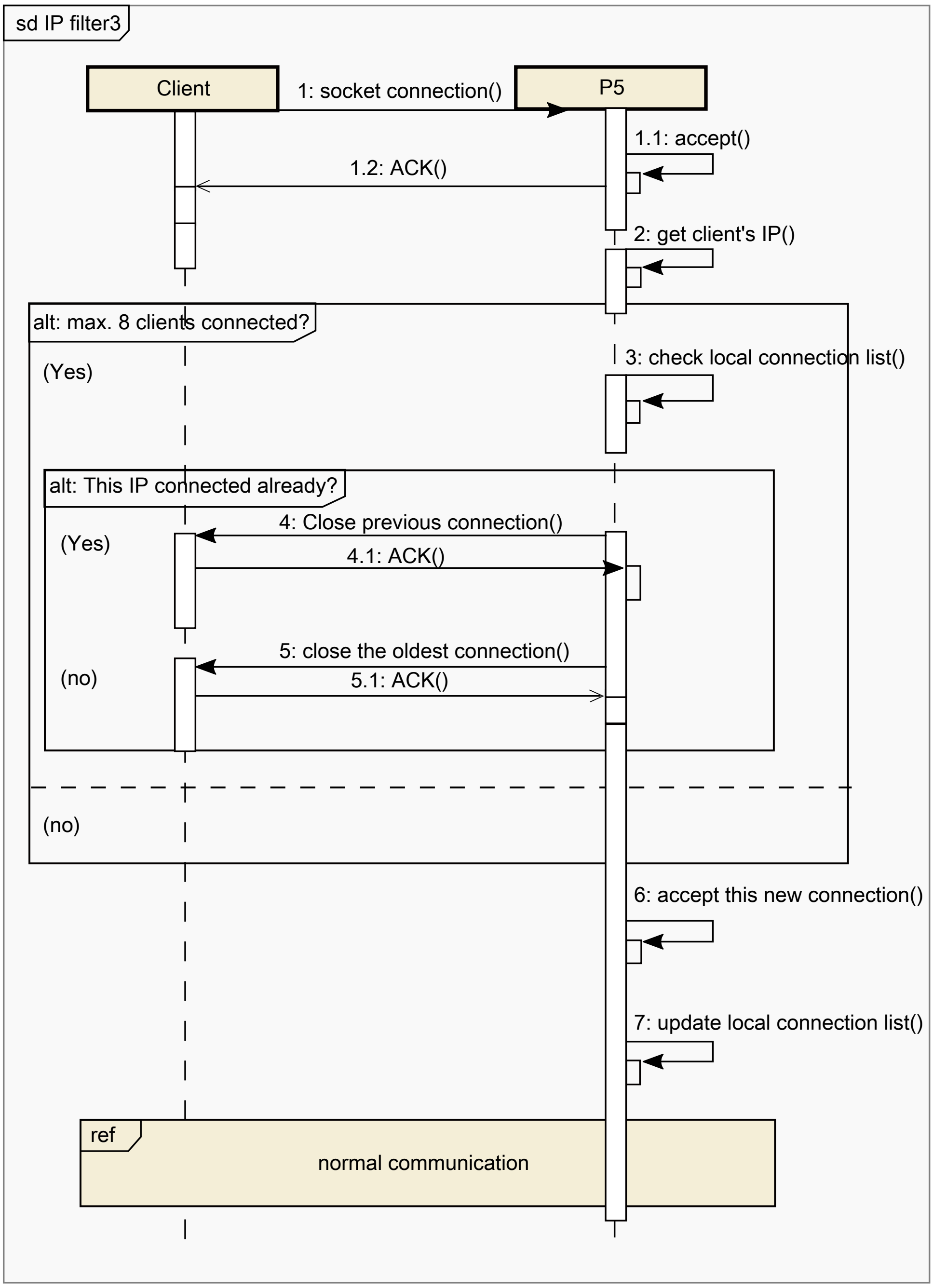
NOTE: There are 8 instances of “IP address”, “CIDR prefix” and “In use” parameters.

Process

The main sequence diagram is described as below for the condition that:

- The “Enable for IP filter” is Disable
- The “Enable for IP filter” is Enable and the client IP is configured in the filter list.

Figure 25 - Client IP filter



Secure communication with the eSetup Easergy Pro via the Ethernet interface

NOTE: The communication is done using port 22. Ensure this port is left unblocked on the network.

When Easergy P5 protection relays and eSetup Easergy Pro are connected via the Ethernet interface, they will communicate securely using SSH (Secure Shell).

The benefits of secure communication are:

- Help in the prevention of unwanted eavesdropping between eSetup Easergy Pro and the Easergy P5 protection relays.
- Help in the prevention of modification of data between eSetup Easergy Pro and the Easergy P5 protection relays.
- Ensure integrity of data.
- Help to prevent replay of data at a later date.

Revision history

Version number	Description		Release date
P5/EN M/11A	Original edition		2019-5
	Firmware version	V01	
	Release	001.029	
P5/EN M/22A	Firmware version	V01	2019-11
	Release	200.008	
	All protocols	Data point list updated	
	DNP3	File transfer function available	
	Modbus master	Modbus master chapter available	
	IEC 60870-5-103	Setting data configurable in IEC 60870-5-103 available	
	New feature	Client IP Address Filter chapter available	
	Conformance statement	Conformance statement for IEC 61850 Edition 1 and 2 updated	
P5/EN M/33A	Firmware version	V01	2020-07
	Release	300.103	
	PTP	Precision Time Protocol available	
	Modbus	Modbus read exception status (FC=7) and read device identification (FC=43/14) available	
	IEC 61850	File transfer and setting group available	
	All protocols	Data point list updated	
	Conformance statement	Conformance statement for IEC 61850 Edition 1 and 2 updated	

Appendix 1: Abbreviation

AP	Access Point
ARP	Address Resolution Protocol
ASDU	Application Service Data Unit
CID	The Configured IED Description (file) is a file used to have communication between an IED configuration tool to an IED. It can be considered as an SCD file stripped down to what the concerned IED need to know and contains a mandatory communication section of the addressed IED.
CIP	Common Industrial Protocol
COS	Change of State
DA	Data Attribute
DAN	Double Attached Nodes
DANP	Double Attached Nodes implementing PRP
DO	Data Object
DS	Dateset
FPGA	Field Programmable Gate Array
GoCB	GOOSE Control Block
GOOSE	Generic Object Oriented Substation Event
HTTPS	Secured Hypertext Transfer Protocol (HTTPS) is an extension of the Hypertext Transfer Protocol (HTTP) to help to secure communication over a computer network.
ICD	The IED Capability Description (file) completely defines the capabilities of an IED. This file needs to be supplied by each manufacturer to make the complete system configuration. The file contains a single IED section, an optional communication section and an optional substation part which denotes the physical entities corresponding to the IED.
IED	Intelligent Electronic Device – This is a term used to describe microprocessor-based controllers of power system equipment. Common types of IEDs include protective relaying devices, load tap changer controllers, circuit breaker controllers, capacitor bank switches, recloser controllers, voltage regulators, etc.
IID	The Instantiated IED Description (file) defines the configuration of one IED for a project and is used as data exchange format from the IED configurator to the system configurator. This file contains only the data for the IED being configured: one IED section, the communication section with the IED's communication parameters, the IED's data type templates, and, optionally, a substation section with the binding of functions (LNodes) to the single line diagram.
LAN	Local Area Network
LD	Logical Device
LN	Logical Node
LRE	Link Redundancy Entity
MAC	Media Access Control
MICS	Model Implementation Conformance Statement describes how the information model is implemented.
MTU	Maximum Transmission Unit
NI	Network Input
PICS	Protocol Implementation Conformance Statement describes choices made in protocol implementation.
PIXIT	Protocol Implementation Extra Information for Testing gives any additional implementation specific information not found in the previous standardized documents.
RCB	Report Control Block
RCT	Redundancy Check Tag
RedBox	Redundancy Box
SAN	Singly Attached Node

SCADA	Supervisory Control and Data Acquisition
SCD	The System (or Substation) Configuration Description is the file describing the complete power utility automation system details. It contains substation, communication, IED and Data type template sections. An SSD file and different ICD files contribute in making an SCD file.
SCL	The System Configuration description Language is the language and representation format specified by IEC 61850 for the configuration of electrical substation devices. This includes representation of modeled data and communication services specified by IEC 61850-7-X standard documents. The complete SCL representation and its details are specified in IEC 61850-6 standard document. It includes data representation for substation device entities; its associated functions represented as logical nodes, communication systems and capabilities. The complete representation of data as SCL enhances the different devices of a substation to exchange the SCL files and to have a complete interoperability.
sFTP	Secured File Transfer Protocol (sFTP) is a network protocol that provides file access, file transfer, and file management over any reliable data stream.
SNMP	Simple Network Management Protocol (SNMP) is an "Internetstandard protocol for managing devices on IP networks.
SNTP	Simple Network Time Protocol (SNTP) is a less complex implementation of NTP, using the same protocol but without requiring the storage of state over extended periods of time.
SSH	Secure Shell (SSH) is a cryptographic network protocol for operating network services securely over network communication.
TICS	Tissues Conformance Statement describes how the device behaves regarding identified technica lissues.
UCMM	UnConnected Message Manager
UDP	User Datagram Protocol
VDAN	Virtual Double Attached Nodes
XML	Extensible Markup Language

Appendix 2: IEC 61850 Edition 1 conformance statement

Introduction

Document purpose

The purpose of this document is to specify the communication features of the Easergy P5 protection relays embedded IEC 61850 server implementation mapped to IEC 61850 Edition 1 standards.

The model implementation in Easergy P5 protection relays varies with the functional scope provided by the different device models.

The information provided here may be still the subject of changes due to planned further extensions in the supported IEC 61850 functionality.

Terms and abbreviations

Terms / abbreviations	Definitions
ACSI	Abstract Communication Service Interfaces
BDA	Basic Data Attribute (not structured)
DA	Data Attributes
DO	DATA in IEC 61850-7-2, data object type or instance
FCD	Functionally Constrained Data
FCDA	Functionally Constrained Data Attribute
ID	Identifier
IED	Intelligent Electronic Device
LD	Logical Device
LN	Logical Node
MSV	Multicast Sampled Value
RCB	Report Control Block
GoCB	GOOSE Control Block or GSSE Control Block
SCL	Substation Configuration description Language
SCSM	Specific Communication Service Mapping
XML	Extensible Markup Language
GSSE	Generic Substation State Event
GOOSE	Generic Object Oriented Substation Event
SCD	Substation Configuration Description
ICD	IED Configuration Description
CID	Configured IED Description
PICS	Protocol Implementation Conformance Statement
MICS	Model Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
TICS	Tissue Implementation Conformance Statement

PICS details

The PICS is based upon UCAIug PICS Template version 2.3, UCA International Users Group Testing Sub Committee, October 08, 2019.

The following ACSI conformance statements are used to provide an overview and details about following devices: P5U20, P5V20, P5F30, P5M30, with firmware version V01.

- ASCI basic conformance statement
- ACSI models conformance statement
- ACSI service conformance statement

The statements specify the communication features mapped to IEC 61850-8-1 and IEC 61850-9-2, Edition 1.

ASCI basic conformance statement

The basic conformance statement is defined in the table below.

Table 61 - Basic conformance statement

		Client / Subscriber	Server / Publisher	Value / Comments
Client–Server roles				
B11	**Server** side (of TWO-PARTY-APPLICATION-ASSOCIATION)		Y	
B12	**Client** side (of TWO-PARTY-APPLICATION-ASSOCIATION)		–	
SCSMs supported				
B21	**SCSM**: IEC 61850-8-1 used		Y	
B22	**SCSM**: IEC 61850-9-1 used		N	
B23	**SCSM**: IEC 61850-9-2 used		N	
B24	**SCSM**: other		N	
Generic substation event model (GSE)				
B31	**Publisher** side		Y	
B32	**Subscriber** side	Y		
Transmission of sampled value model (SVC)				
B41	**Publisher** side		N	
B42	**Subscriber** side	N		
– = not applicable Y = supported N or empty = not supported				

ASCI models conformance statement

The ACSI models conformance statement is defined in the table below.

Table 62 - ASCI models conformance statement

		Client / Subscriber	Server / Publisher	Value / Comments
If **Server** side (B11) and/or **Client** side (B12) is supported				
M1	**Logical device**		Y	
M2	**Logical node**		Y	Only standard LN types defined in Part 7-4.
M3	**Data**		Y	Only standard object types defined in Part 7-3, 7-4. Mandatory objects and attributes, selected optional objects and attributes.
M4	**Data set**		Y	Supported pre-defined persistent data sets, configurable via SCL. Supported dynamically created data sets (persistent and non-persistent). Data set members selection restricted to FC such as ST and MX.
M5	**Substitution**		N	
M6	**Setting group control**		Y	
Reporting				
M7	**Buffered report control**		Y	
M7-1	sequence-number		Y	
M7-2	report-time-stamp		Y	
M7-3	reason-for-inclusion		Y	
M7-4	data-set-name		Y	
M7-5	data-reference		Y	
M7-6	buffer-overflow		Y	
M7-7	entryID		Y	
M7-8	BufTm		Y	
M7-9	IntgPd		Y	
M7-10	GI		Y	
M7-11	conf-revision		Y	
M8	**Unbuffered report control**		Y	
M8-1	sequence-number		Y	
M8-2	report-time-stamp		Y	
M8-3	reason-for-inclusion		Y	
M8-4	data-set-name		Y	
M8-5	data-reference		Y	
M8-6	BufTm		Y	
M8-7	IntgPd		Y	
M8-8	GI		Y	
M8-9	conf-revision		Y	
Logging				
M9	**Log control**		N	

Table 62 - ASCI models conformance statement (Continued)

		Client / Subscriber	Server / Publisher	Value / Comments
M9-1	IntgPd		N	
M10	**Log**		N	
Other				
M11	**Control**		Y	
M17	**File transfer**		Y	
M18	**Application association**		Y	
M19	**GOOSE Control Block**		Y	
M20	**Sampled Values Control Block**		N	
If GSE (B31/32) is supported				
M12	**GOOSE**		Y	
M13	**GSSE**		N	
If SVC (B41/B42) is supported				
M14	**Multicast SVC**		N	
M15	**Unicast SVC**		N	
For all IEDs				
M16	**Time**		Y	Performance class T2 (100μs accuracy)
Y = service is supported N or empty = service is not supported				

ASCI service conformance statement

The ACSI service conformance statement is defined in the table below (depending on the statements in ASCI basic conformance statement, page 207).

Table 63 - ASCI service conformance statement

	Ed	ASCI Service Conformance	AA: TP/MC	Client / Sub (C)	Server / Pub (S)	Comments
Server						
S1	1,2	GetServerDirectory (LOGICAL-DEVICE)	TP		Y	
Application association						
S2	1,2	Associate			Y	
S3	1,2	Abort			Y	
S4	1,2	Release			Y	
Logical device						
S5	1,2	LogicalDeviceDirectory	TP		Y	
Logical node						
S6	1,2	LogicalNodeDirectory	TP		Y	
S7	1,2	GetAllDataValues	TP		Y	
Data						
S8	1,2	GetDataValues	TP		Y	
S9	1,2	SetDataValues	TP		Y	
S10	1,2	GetDataDirectory	TP		Y	
S11	1,2	GetDataDefinition	TP		Y	
Data set						
S12	1,2	GetDataSetValues	TP		Y	
S13	1,2	SetDataSetValues	TP		N	
S14	1,2	CreateDataSet	TP		Y	
S15	1,2	DeleteDataSet	TP		Y	
S16	1,2	GetDataSetDirectory	TP		Y	
Substitution						
S17	1	SetDataValues	TP		N	
Setting group control						
S18	1,2	SelectActiveSG	TP		Y	
S19	1,2	SelectEditSG	TP		Y	
S20	1,2	SetSGValues	TP		Y	
S21	1,2	ConfirmEditSGValues	TP		Y	
S22	1,2	GetSGValues	TP		Y	
S23	1,2	GetSGCBValues	TP		Y	
Reporting						
Buffered report control block (BRCB)						
S24	1,2	Report	TP		Y	
S24-1	1,2	data-change (dchg)			Y	
S24-2	1,2	qchg-change (qchg)			Y	
S24-3	1,2	data-update (dupd)			Y	Accepted as TrgOpt, but not functionally supported by the IED

Table 63 - ASCI service conformance statement (Continued)

	Ed	ASCI Service Conformance	AA: TP/MC	Client / Sub (C)	Server / Pub (S)	Comments
S25	1,2	GetBRCBValues	TP		Y	
S26	1,2	SetBRCBValues	TP		Y	
Unbuffered report control block (URCB)						
S27	1,2	Report	TP		Y	
S27-1	1,2	data-change (dchg)			Y	
S27-2	1,2	qchg-change (qchg)			Y	
S27-3	1,2	data-update (dupd)			Y	Accepted as TrgOpt, but not functionally supported by the IED
S28	1,2	GetURCBValues	TP		Y	
S29	1,2	SetURCBValues	TP		Y	
Logging						
Log control block						
S30	1,2	GetLCBValues	TP		N	
S31	1,2	SetLCBValues	TP		N	
Log						
S32	1,2	QueryLogByTime	TP		N	
S33	1,2	QueryLogAfter	TP		N	
S34	1,2	GetLogStatusValues	TP		N	
Generic substation event model (GSE)						
S35	1,2	SendGOOSEMessage	MC		Y	
GOOSE Control Block						
S36	1,2	GetGoReference	TP		N	
S37	1,2	GetGOOSEElement-Number	TP		N	
S38	1,2	GetGoCBValues	TP		Y	
S39	1,2	SetGoCBValues	TP		Y	
GSSE (Ed2:61850-7-2 Annex C)						
S40	1	SendGSSEMessage	MC		N	
GSSE Control Block						
S41	1	GetGsReference	TP		N	
S42	1	GetGSSEElement-Number	TP		N	
S43	1	GetGsCBValues	TP		N	
S44	1	SetGsCBValues	TP		N	
Transmission of sampled value model (SVC)						
Multicast SV						
S45	1,2	SendMSVMessage	MC		N	Use for 9-2LE or IEC 61869-9
Multicast Sampled Values Control Block						
S46	1,2	GetMSVCBValues	TP		N	
S47	1,2	SetMSVCBValues	TP		N	
Unicast SV						

Table 63 - ASCI service conformance statement (Continued)

	Ed	ASCI Service Conformance	AA: TP/MC	Client / Sub (C)	Server / Pub (S)	Comments
S48	1,2	SendUSVMessage	TP		N	
Unicast Sampled Values Control Block						
S49	1,2	GetUSVCBValues	TP		N	
S50	1,2	SetUSVCBValues	TP		N	
Control						
S51	1,2	Select			Y	
S52	1,2	SelectWithValue	TP		Y	
S53	1,2	Cancel	TP		Y	
S54	1,2	Operate	TP		Y	
S55	1,2	CommandTermination	TP		Y	
S56	1,2	TimeActivatedOperate	TP		N	
File Transfer						
S57	1,2	GetFile	TP		Y	
S58	1,2	SetFile	TP		N	
S59	1,2	DeleteFile	TP		N	
S60	1,2	GetFileAttributeValues	TP		Y	
S61	1,2	GetServerDirectory (FILE-SYSTEM)	TP		Y	
Time						
T1	1,2	Time resolution of internal clock			14	14 for IEEE1588, 10 for IRIG-B, 7 for SNTP and protocols
T2	1,2	Time accuracy of internal clock			T2	Performance class T2 for IEEE1588, T1 for IRIG-B, T0 for SNTP and protocols
T3	1,2	Supported TimeStamp resolution	-		20	Nearest value of 2^{-n} in seconds (number 0 ... 24)

MICS details

The MICS is based upon UCAIug MICS Template version 1.2, UCA International Users Group Testing Sub Committee, August 13, 2019.

This model implementation conformance statement is applicable for P5U20, P5V20, P5F30 and P5M30, with firmware version V01.

This MICS document specifies the modeling extensions compared to IEC 61850 Edition 1.

Clause **Logical nodes list** contains the list of implemented logical nodes.

Clause **Logical node extensions** describes the new and extended logical nodes (if any).

Clause **Enum types extensions** describes the new and extended enum types (if any).

Logical nodes list

The following table contains the list of logical nodes implemented in the device:

Table 64 - Logical nodes implemented in the device

	P5U20	P5V20	P5F30	P5M30
L: System Logical Nodes				
LPHD (Physical device information)	x	x	x	x
LLN0 (Logical node zero)	x	x	x	x
P: Logical Nodes for protection functions				
PTRC (Protection trip conditioning)	x	x	x	x
PTOC (Time overcurrent)	x		x	x
PFRC (Rate of change frequency)	x	x	x	
PIOC (Instantaneous overcurrent)	x	x	x	x
PTOF (Over frequency)	x	x	x	x
PTOV (Overvoltage)	x	x	x	x
PDOP (Directional overpower)	x		x	x
PTUC (Undercurrent)	x			x
PTTR (Thermal overload)	x		x	x
PTUF (Under frequency)	x	x	x	x
PTUV (Under voltage)	x	x	x	x
PMRI (Motor restart inhibition)	x			x
PMSS (Motor starting time supervision)	x			x
PTEF (Transient earth fault)			x	
PADM (Admittance)			x	x
POVS (Motor overspeed)	x			x
PZSU (Motor underspeed)	x			x
PHAR (Harmonic restraint)	x		x	x
R: Logical nodes for protection related functions				
RREC (Auto reclosing)	x		x	
RDRE (Disturbance recorder)	x	x	x	x
RFLO (Fault locator)			x	

Table 64 - Logical nodes implemented in the device (Continued)

	P5U20	P5V20	P5F30	P5M30
RSYN (Synchronism-check)		x	x	
G: Logical Nodes for generic references				
GGIO (Generic process I/O)	x	x	x	x
GAPC (Generic automatic process control)	x	x	x	x
M: Logical Nodes for metering and measurement				
MMTR (Metering)	x		x	x
MMXU (Measurement)	x	x	x	x
MHAI (Harmonics)	x	x	x	x
C: Logical Nodes for control				
CSWI (Switch controller)	x	x	x	x
T: Logical nodes for instrument transformers and sensors				
TCTX (Current transformer)	x		x	x
TVTX (Voltage transformer)	x	x	x	x

Logical node extensions

The following table uses:

- M: Data is mandatory in the IEC 61850-7-4.
- O: Data is optional in the IEC 61850-7-4 and is used in the device.
- C: Data is conditional in the IEC 61850-7-4 and is used in the device.
- E: Data is an extension to the IEC 61850-7-4.

New logical nodes

Newly created logical nodes are listed in this clause, with lnNs attribute in the Name plate.

PADM Admittance
This LN shall be used for protection admittance E/F Io/Uo.

PADM class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5EFPADM1 P5EFPADM2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
YStr	ACD	YN start	E	
YOp	ACT	YN operate	E	
GStr	ACD	GN start	E	

PADM class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
GOp	ACT	GN operate	E	
BStr	ACD	BN start	E	
BOp	ACT	BN operate	E	
Settings				
FunEna	SPG	Whole function enable	E	
YFunEna	SPG	YN function enable	E	
GFunEna	SPG	GN function enable	E	
BFunEna	SPG	BN function enable	E	
UoStrVal	ASG	Uo pick-up value	E	
CorAng	ASG	Correction angle	E	
YStrVal	ASG	YN pick-up value	E	
YOpDlTms	ASG	YN operate delay time	E	
YRsDlTms	ASG	YN reset time	E	
YSolMod	SPG	YN SOL mode	E	
YSlOpDlTms	ASG	YN SOL operate delay time	E	
GStrVal	ASG	GN pick-up value	E	
GDirMod	ING	GN direction mode	E	
GOpDlTms	ASG	GN operate delay time	E	
GRsDlTms	ASG	GN reset time	E	
GSolMod	SPG	GN SOL mode	E	
GSlOpDlTms	ASG	GN SOL operate delay time	E	
BStrVal	ASG	BN pick-up value	E	
BDirMod	ING	BN direction mode	E	
BOpDlTms	ASG	BN operate delay time	E	
BRsDlTms	ASG	BN reset time	E	
BSolMod	SPG	BN SOL mode	E	
BSlOpDlTms	ASG	BN SOL operate delay time	E	

POVS Motor overspeed
This LN shall be used for protection motor overspeed.

POVS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5MOTPOVS1 P5MOTPOVS2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				

POVS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Str	ACD	Start	E	
Op	ACT	Operate	E	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	E	
OpDlTms	ASG	Operate delay time	E	

TCTX Current transformer
This LN shall be used for protection current transformer parameters.

TCTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5ITCTX1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Measured and metered values				
Settings				
FunEna	SPG	Function enable	E	
CTNum	ING	Number of connected phase CT	E	
OpDlTmms	ING	Operate delay time	E	
PriPhs	ASG	CT primary	E	
SecPhs	ASG	CT secondary	E	

TCTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5IOTCTX1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				

TCTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Measured and metered values				
Settings				
PriNeut1	ASG	Io CT primary	E	
PriNeut2	ASG	Io' CT primary	E	

TCTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5LPITCTX1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Measured and metered values				
ExtPri	MV	Rated ext. primary current In	E	
Settings				
FunEna	SPG	Function enable	E	
OpDlTmms	ING	Operate delay time	E	
NomPri	ASG	LPCT rated primary current	E	

TVTX Voltage transformer
This LN shall be used for protection voltage transformer parameters.

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5UTVTX1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Measured and Metered Values				

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Settings				
FunEna	SPG	Function enable	E	
ImbAMinLev	ASG	I2 min. setting	E	
ImbVMaxLev	ASG	U2 max. setting	E	
OpDlTmms	ING	Operate delay time	E	
PriPhs	ASG	VT primary	E	
SecNeut	ASG	VTo secondary	E	
SecPhs	ASG	VT secondary	E	

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5LPUTVTX1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Measured and Metered Values				
ExtPri	MV	Rated ext. primary current In	E	
Settings				
FunEna	SPG	Function enable	E	
PhAMagCor	ASG	VL1 magnitude correction	E	
PhBMagCor	ASG	VL2 magnitude correction	E	
PhCMagCor	ASG	VL3 magnitude correction	E	
PhAAngCor	ASG	VL1 Angle correction	E	
PhBAngCor	ASG	VL2 Angle correction	E	
PhCAngCor	ASG	VL3 Angle correction	E	
VL1yMagCor	ASG	VL1y magnitude correction	E	
VL1yAngCor	ASG	VL1y Angle correction	E	
VL2yMagCor	ASG	VL2y magnitude correction	E	
VL2yAngCor	ASG	VL2y Angle correction	E	
VtTyp	ING	Primary VT type	E	
VtSecAdpt	ASG	VT secondary rated voltage	E	
PhAMagAdpt	ASG	VL1 Adapt magnitude correction	E	
PhBMagAdpt	ASG	VL2 Adapt magnitude correction	E	
PhCMagAdpt	ASG	VL3 Adapt magnitude correction	E	

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
VlSecAdpt	ASG	VTy secondary rated voltage	E	
VL1yMagAdt	ASG	VL1y Adapt magnitude correction	E	

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5LPUTVTX2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Measured and Metered Values				
ExtPri	MV	Rated ext. primary current In	E	
Settings				
FunEna	SPG	Function enable	E	
NomPri	ASG	LPVT rated primary voltage	E	
PhAMagCor	ASG	VL1 magnitude correction	E	
PhBMagCor	ASG	VL2 magnitude correction	E	
PhCMagCor	ASG	VL3 magnitude correction	E	
PhAAngCor	ASG	VL1 Angle correction	E	
PhBAngCor	ASG	VL2 Angle correction	E	
PhCAngCor	ASG	VL3 Angle correction	E	
VL1yMagCor	ASG	VL1y magnitude correction	E	
VL1yAngCor	ASG	VL1y Angle correction	E	
VtTyp	ING	Primary VT type	E	
VtSecAdpt	ASG	VT secondary rated voltage	E	
PhAMagAdpt	ASG	VL1 Adapt magnitude correction	E	
PhBMagAdpt	ASG	VL2 Adapt magnitude correction	E	
PhCMagAdpt	ASG	VL3 Adapt magnitude correction	E	
VlSecAdpt	ASG	VTy secondary rated voltage	E	
VL1yMagAdt	ASG	VL1y Adapt magnitude correction	E	

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5LPUTVTX3		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Measured and Metered Values				
ExtPri	MV	Rated ext. primary current In	E	
Settings				
FunEna	SPG	Function enable	E	
NomPri	ASG	LPVT rated primary voltage	E	
PhAMagCor	ASG	VL1 magnitude correction	E	
PhBMagCor	ASG	VL2 magnitude correction	E	
PhCMagCor	ASG	VL3 magnitude correction	E	
PhAAngCor	ASG	VL1 Angle correction	E	
PhBAngCor	ASG	VL2 Angle correction	E	
PhCAngCor	ASG	VL3 Angle correction	E	
VtTyp	ING	Primary VT type	E	
VtSecAdpt	ASG	VT secondary rated voltage	E	
PhAMagAdpt	ASG	VL1 Adapt magnitude correction	E	
PhBMagAdpt	ASG	VL2 Adapt magnitude correction	E	
PhCMagAdpt	ASG	VL3 Adapt magnitude correction	E	
UoSecAdpt	ASG	Uo secondary rated voltage	E	
UoMagAdt	ASG	Uo Adapt magnitude correction	E	

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5LPUTVTX4		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Measured and Metered Values				
ExtPri	MV	Rated ext. primary current In	E	
Settings				

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
FunEna	SPG	Function enable	E	
NomPri	ASG	LPVT rated primary voltage	E	
PhAMagCor	ASG	VL1 magnitude correction	E	
PhBMagCor	ASG	VL2 magnitude correction	E	
PhCMagCor	ASG	VL3 magnitude correction	E	
PhAAngCor	ASG	VL1 Angle correction	E	
PhBAngCor	ASG	VL2 Angle correction	E	
PhCAngCor	ASG	VL3 Angle correction	E	
VtTyp	ING	Primary VT type	E	
VtSecAdpt	ASG	VT secondary rated voltage	E	
PhAMagAdpt	ASG	VL1 Adapt magnitude correction	E	
PhBMagAdpt	ASG	VL2 Adapt magnitude correction	E	
PhCMagAdpt	ASG	VL3 Adapt magnitude correction	E	

Standardized and extended DO of logical node type

The following table presents a summary of the standardized and extended DO of each Logical Node Type.

LN Type: SE_GAPC_PS_EasergyP5_V001
Description: Generic automatic process control
LN Class: GAPC

GAPC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5PSGAPC1...8		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	

LN Type: SE_GGIO_AR_EasergyP5FU_V001
Description: Generic process I/O
LN Class: GGIO

GGIO class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5ARGGIO1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Ind1	SPS	AR1 final trip	O	
Ind2	SPS	AR2 final trip	O	
Ind3	SPS	AR3 final trip	O	
Ind4	SPS	AR4 final trip	O	
Ind5	SPS	AR5 final trip	O	
Ind6	SPS	AR6 final trip	O	
Ind7	SPS	AR7 final trip	O	
Ind8	SPS	AR8 final trip	O	
Ind9	SPS	AR9 final trip	O	
Ind10	SPS	AR10 final trip	O	
Ind11	SPS	AR11 final trip	O	
Ind12	SPS	AR12 final trip	O	
Ind13	SPS	AR13 final trip	O	
Ind14	SPS	AR14 final trip	O	
Ind15	SPS	AR15 final trip	O	
Ind16	SPS	AR16 final trip	O	
Ind17	SPS	AR17 final trip	O	
Ind18	SPS	AR18 final trip	O	
Ind19	SPS	AR19 final trip	O	
Settings				
FunEna	SPG	Function enable	E	

LN Type: SE_GGIO_CBWA_EasergyP5FMU_V002
Description: Generic process I/O
LN Class: GGIO

GGIO class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5CBWAGGIO1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only

GGIO class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Ind1	SPS	General indication (binary input)	O	
Ind2	SPS	General indication (binary input)	O	
Alm1Phs1	INS	Alarm 1 of Phase 1	E	
Alm1Phs2	INS	Alarm 1 of Phase 2	E	
Alm1Phs3	INS	Alarm 1 of Phase 3	E	
Alm2Phs1	INS	Alarm 2 of Phase 1	E	
Alm2Phs2	INS	Alarm 2 of Phase 2	E	
Alm2Phs3	INS	Alarm 2 of Phase 3	E	
Settings				
FunEna	SPG	Function enable	E	
CBOpenCnt	ING	CB open counter	E	
RackOutCnt	ING	Rack out counter	E	
TripCnt	ING	Protection trip counter	E	
AlmLev1	ASG	Alarm level 1	E	
AlmLev2	ASG	Alarm level 2	E	
LimOpNum1	ASG	Limit for operate left 1	E	
LimOpNum2	ASG	Limit for operate left 2	E	

LN Type: SE_MMXU_VECA_EasergyP5FMU_VSI_V001
Description: Measurement
LN Class: MMXU

MMXU class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5VECAMMXU1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Measured values				
Hz	MV	Frequency	O	
A	WYE	Phase currents (IL1, IL2, IL3)	O	
Iovs	WYE	Residual current Io'	E	

LN Type: SE_PDOP_REVP_EasergyP5FM_V002
Description: Directional overpower
LN Class: PDOP

PDOP class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5REVPPDOP1 P5REVPPDOP2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PDOP_EF_EasergyP5FM_V002
Description: Directional overpower
LN Class: PDOP

PDOP class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5EFPDOP1 P5EFPDOP2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
DirMode	ING	Direction mode	E	
StrVal	ASG	Pick-up value	M	
UoStrVal	ASG	Uo setting	E	
SctrStrVal	ASG	Pick up sector size	E	
OpDlTms	ASG	Operate delay time	E	
SolMod	SPG	SOL Mode	E	
SolOpDlTms	ASG	SOL operate delay time	E	

PDOP class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
MemMod	ING	Memory Mode	E	
MmUoStrVal	ASG	Uo setting	E	
MemTms	ASG	Memory time	E	

LN Type: SE_PFRC_DFDT_EasergyP5FV_V002
SE_PFRC_DFDT_EasergyP5U_LPT_V002
Description: Rate of change of frequency
LN Class: PFRC

PFRC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5DFDTPFRC1 P5DFDTPFRC2 P5DFTLPFRC1 P5DFTLPFRC2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
DirChg	ING	Direction of change	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PIOC_CBFP_EasergyP5FMU_V002
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5CBFPPIOC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Str	ACD	Start	O	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
NeutStrVal	ASG	Undercurrent threshold for earth fault current	E	
PhsStrVal	ASG	Undercurrent threshold for phase current	E	
Tm1DlTms	ASG	Timer1 operate delay time	E	
Tm1Ena	SPG	Enable CBF timer1	E	
Tm2DlTms	ASG	Timer2 operate delay time	E	
Tm2Ena	SPG	Enable CBF timer2	E	

LN Type: SE_PIOC_CBFP_EasergyP5V_V002
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5CBFPPIOC2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	O	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
Tm1DlTms	ASG	Timer1 operate delay time	E	
Tm1Ena	SPG	Enable CBF timer1	E	
Tm2DlTms	ASG	Timer2 operate delay time	E	
Tm2Ena	SPG	Enable CBF timer2	E	

LN Type: SE_PIOC_CBFP_EasergyP5FMU_VSI_V001
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5CBFPPIOC3		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	O	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
NeutStrVal	ASG	Undercurrent threshold for earth fault current	E	
PhsStrVal	ASG	Undercurrent threshold for phase current	E	
IovsStrVal	ASG	Io'< current set	E	
Tm1DlTms	ASG	Timer1 operate delay time	E	
Tm1Ena	SPG	Enable CBF timer1	E	
Tm2DlTms	ASG	Timer2 operate delay time	E	
Tm2Ena	SPG	Enable CBF timer2	E	

LN Type: SE_PIOC_ARCM_EasergyP5FM_ARC_V001
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5ARCMPIOC1…8		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
MinOpTmms	ING	Min. hold time [x1ms]	E	

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
OpDlTmms	ING	Trip X delay [x1ms]	E	
OpMode	ING	Arc stage X Mode	E	

LN Type: SE_PIOC_CLP_EasergyP5FMU_V001
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5CLPPIOC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
Idl	ASG	Idle current	E	
StrVal	ASG	Pickup current	O	
DeadTms	ASG	CLPU dead time	E	
MaxTms	ASG	Maximum time	E	

LN Type: SE_PIOC_SOL_EasergyP5FMU_V001
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5SOLPIOC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Op	ACT	Operate	M	
Oprt2	ACT	2nd Operate	E	
Settings				

PIOC class				
Data object name	Common data class	Explanation	M/O/ C/E	Remarks
FunEna	SPG	Function enable	E	
SigNum	ING	SOL signal number	E	
CbClrTms	ASG	CB trip clearing time	E	

LN Type: SE_PIOC_SOTF_EasergyP5FMU_V001
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	Common data class	Explanation	M/O/ C/E	Remarks
P5SOTFPIOC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Enable for SOTF	E	
StrVal	ASG	Pick-up value	O	
DetDlTms	ASG	Dead line detection delay	E	
ActTmrTms	ASG	SOTF active Timer	E	

LN Type: SE_PMRI_MOTFST_EasergyP5MU_V003
Description: Motor restart inhibition
LN Class: PMRI

PMRI class				
Data object name	Common data class	Explanation	M/O/ C/E	Remarks
P5FSTPMRI1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Op	ACT	Operate	O	
StrInh	SPS	Restart inhibited	O	
Settings				

PMRI class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
MaxWrmStr	ING	Maximum warm starts, permissible number of warm starts	O	
MinStrTmm	ASG	Min time between motor starts	E	
HotSttsLmt	ASG	Hot Status Limit	E	
FunEna	SPG	Function enable	E	
MaxCldStr	ING	Max motor cold starts/hour	E	
RefPrdTmm	ASG	Reference period	E	

LN Type: SE_PMSS_STAL_EasergyP5MU_V001
Description: Motor starting time supervision
LN Class: PMSS

PMSS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5STALPMSS1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	O	
Op	ACT	Operate	O	
Settings				
SetA	ASG	Current setting for motor start-up	O	
SetTms	ING	Time setting for motor start-up	O	
MotStr	ASG	Motor startup (current pickup value of motor starting)	O	
FunEna	SPG	Function enable	E	
TmACrv	CURVE	Characteristics for Ist>	E	

LN Type: SE_PMSS_MSPD_EasergyP5MU_V001
Description: Motor starting time supervision
LN Class: PMSS

PMSS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5MSPDPMSS1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	

PMSS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
ZerSpdSt	SPS	Zero speed	E	
MotSpd	INS	Motor speed	E	
Settings				
FunEna	SPG	Function enable	E	
SpdIn	ING	Motor speed input DI	E	
RtdMotSpd	ASG	Rated motor speed	E	
PlsRot	ASG	Pulse per rotation	E	
ZerSpdTms	ASG	Zero speed delay	E	

LN Type: SE_PMSS_MABS_EasergyP5MU_V001
Description: Motor starting time supervision
LN Class: PMSS

PMSS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5MABSPMSS1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
AbsAlm	SPS	Anti-backspin Alarm	E	
Settings				
FunEna	SPG	Function enable	E	
MvMod	SPG	Measured Zero Speed Mode	E	
SwMod	SPG	Zero Speed Switch Mode	E	
AbsTms	ASG	Anti-backspin Delay	E	

LN Type: SE_PMSS_51LR_EasergyP5MU_V001
Description: Motor starting time supervision
LN Class: PMSS

PMSS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5LRPMSS1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				

PMSS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	O	
Op	ACT	Operate	O	
Settings				
SetA	ASG	Pick-up value	O	
FunEna	SPG	Function enable	E	
DlTyp	ING	Delay type	E	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTEF_IO_EasergyP5F_V002
Description: Transient earth fault
LN Class: PTEF

PTEF class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5IOIOPTEF1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	C	
Op	ACT	Operate	C	
Settings				
FunEna	SPG	Function enable	E	
DirMode	ING	Direction mode	E	
GndStr	ASG	Uo pick-up	O	
OpDlTms	ASG	Operate delay time	E	
MinPeak	ING	Min number of peaks	E	
RsDlTms	ASG	Reset delay	E	
Condition C: at least one of the two status information (Str, Op) shall be used.				

LN Type: SE_PTOC_STRVAL_EasergyP5FMU_V002
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5HAR5PTOC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
StrVal	ASG	Start value	O	
OpDlTmms	ING	Operate delay time	O	
FunEna	SPG	Function enable	E	

LN Type: SE_PTOC_UIBC_EasergyP5FMU_V002
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5UIBCPTOC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Start value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTOC_EasergyP5FMU_VSI_V002
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5EFVSPTOC1 P5EFVSPTOC2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
DlCrvFmly	ING	Delay curve family	E	
DlTyp	ING	Delay type	E	
OpDlTms	ASG	Operate delay time	E	
TmMult	ASG	Inv. time coefficient	O	
RsTyp	ING	Reset type	E	
RsDlTms	ASG	Reset time	E	
InrushStat	SPG	Inrush status	E	
SolStat	SPG	SOL status	E	
SolOpDTms	ASG	SOL operate delay time	E	
SolTmMult	ASG	SOL Inv. time coefficient	E	
ClpStat	SPG	CLP status	E	
ClpStrVal	ASG	CLP pick-up value	E	
ClpOpDTms	ASG	CLP operate delay time	E	
ClpTmMult	ASG	CLP Inv. time coefficient	E	
NetGrd	ING	Network grounding	E	

LN Type: SE_PTOC_NORMAL_EasergyP5FMU_V002
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5OCPTOC1 P5OCPTOC2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
DlCrvFmly	ING	Delay curve family	E	
DlTyp	ING	Delay type	E	
OpDlTms	ASG	Operate delay time	E	
TmMult	ASG	Inv. time coefficient	O	
RsTyp	ING	Reset type	E	
RsDlTms	ASG	Reset time	E	
InrushStat	SPG	Inrush status	E	
SolStat	SPG	SOL status	E	
SolOpDTms	ASG	SOL operate delay time	E	
SolTmMult	ASG	SOL Inv. time coefficient	E	
ClpStat	SPG	CLP status	E	
ClpStrVal	ASG	CLP pick-up value	E	
ClpOpDTms	ASG	CLP operate delay time	E	
ClpTmMult	ASG	CLP Inv. time coefficient	E	

LN Type: SE_PTOC_EasergyP5FM_V002
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5DEFPTOC1 P5DEFPTOC2 P5DEFPTOC3		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
DirMode	ING	Direction mode	E	

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
StrVal	ASG	Pick-up value	O	
UoStrVal	ASG	Uo setting	E	
AngOffset	ASG	Angle offset	E	
SctrStrVal	ASG	Pick up sector size	E	
DlCrvFmly	ING	Delay curve family	E	
DlTyp	ING	Delay type	E	
OpDlTms	ASG	Operate delay time	E	
TmMult	ASG	Inv. time coefficient	O	
RsTyp	ING	Reset type	E	
RsDlTms	ASG	Reset time	E	

LN Type: SE_PTOC_EasergyP5U_LPT_V002
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5DOCLPTOC1 P5DOCLPTOC2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
DirMode	ING	Direction mode	E	
AngOffset	ASG	Angle offset	E	
DlCrvFmly	ING	Delay curve family	E	
DlTyp	ING	Delay type	E	
OpDlTms	ASG	Operate delay time	E	
TmMult	ASG	Inv. time coefficient	O	
RsTyp	ING	Reset type	E	
RsDlTms	ASG	Reset time	E	
InrushStat	SPG	Inrush status	E	
SolStat	SPG	SOL status	E	
SolOpDTms	ASG	SOL operate delay time	E	

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
SolTmMult	ASG	SOL Inv. time coefficient	E	
ClpStat	SPG	CLP status	E	
ClpStrVal	ASG	CLP pick-up value	E	
ClpOpDTms	ASG	CLP operate delay time	E	
ClpTmMult	ASG	CLP Inv. time coefficient	E	

LN Type: SE_PTOC_DOC2_EasergyP5U_LPT_V001
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5DOCLPTOC3 P5DOCLPTOC4		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
DirMode	ING	Direction mode	E	
AngOffset	ASG	Angle offset	E	
OpDlTms	ASG	Operate delay time	E	
InrushStat	SPG	Inrush status	E	
SolStat	SPG	SOL status	E	
SolOpDTms	ASG	SOL operate delay time	E	
ClpStat	SPG	CLP status	E	
ClpStrVal	ASG	CLP pick-up value	E	
ClpOpDTms	ASG	CLP operate delay time	E	

LN Type: SE_PTOF_OFUF_EasergyP5FMV_V00V002/
SE_PTOF_OFUF_EasergyP5U_LPT_V002
Description: Overfrequency
LN Class: PTOF

PTOF class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5OFUFPTOF1 P5OFUFPTOF2 P5LPTPTOF1 P5LPTPTOF2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTOV_EasergyP5FMV_V002/
SE_PTOV_EasergyP5U_LPT_V001
Description: Overvoltage
LN Class: PTOV

PTOV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5OVPTOV1 P5OVPTOV2 P5OVPTOV3 P5OVLPTOV1 P5OVLPTOV2 P5OVLPTOV3		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	O	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTOV_UO_EasergyP5FMV_V001/
SE_PTOV_UO_EasergyP5U_LPT_V001
Description: Overvoltage

LN Class: PTOV

PTOV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5UOPTOV1 P5UOPTOV2 P5UOPTOV3 P5UOLPTOV1 P5UOLPTOV2 P5UOLPTOV3		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	O	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	
RsDlTms	ASG	Reset time	E	

LN Type: SE_PTOV_NEG_EasergyP5FMV_V001/
SE_PTOV_NEG_EasergyP5U_LPT_V001
Description: Overvoltage
LN Class: PTOV

PTOV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5NEGPTOV1 P5NEGPTOV2 P5NEGLPTOV1 P5NEGLPTOV2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	O	
Settings				
FunEna	SPG	Function enable	E	
OpMod	ING	Operate mode	E	
StrVal	ASG	Pick-up value	O	

PTOV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
DlTyp	ING	Delay type	E	
OpDlTms	ASG	Operate delay time	E	
RsDlTms	ASG	Reset time	E	

LN Type: SE_PTOV_CAP_EasergyP5F_V001
Description: Overvoltage
LN Class: PTOV

PTOV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5CAPPTOV1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	O	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
CapOfPhs	ASG	L-N capacitance of one phase	E	
RatUcLn	ASG	Rated L-N voltage UcLN	E	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTTR_THF_EasergyP5FU_V002
Description: Thermal overload
LN Class: PTTR

PTTR class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5THFPTTR1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				

PTTR class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Op	ACT	Operate	M	
AlmThm	SPS	Thermal alarm	O	
Settings				
TmpMax	ASG	Max object temperature	O	
AlmVal	ASG	Thermal alarm value	O	
FunEna	SPS	Function enable	E	
BasicCur	ASG	Basic current setting	E	
FactorK	ASG	Factor k	E	
HeaConsTmm	ASG	Heating time constant	O	
RsvVal	ASG	Reserve time thermal alarm	E	
TmpMod	ING	Temperature based mode	E	
TmpNom	ASG	Nominal ambient temp	E	
TmpAlrm	ASG	Alarm temperature	E	
TmpAmbMin	ASG	Min ambient temperature	E	
TmpAmbDft	ASG	Default ambient temperature	E	

LN Type: SE_PTTR_THM_EasergyP5MU_V002
Description: Thermal overload
LN Class: PTTR

PTTR class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5THMPTTR1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Op	ACT	Operate	M	
AlmThm	SPS	Thermal alarm	O	
Settings				
TmpMax	ASG	Max object temperature	O	
AlmVal	ASG	Thermal alarm value	O	
FunEna	SPS	Function enable	E	
BasicCur	ASG	Basic current setting	E	
FactorK	ASG	Factor k	E	
HeaConsTmm	ASG	Heating time constant	E	
ConsTmm	ASG	Time constant for motor starting	E	
CooConsTmm	ASG	Cooling time constant	E	
UnblFctr	ASG	Unbalance factor	E	

PTTR class				
Data object name	Common data class	Explanation	M/O/C/E	Remarks
RsvVal	ASG	Reserve time thermal alarm	E	
TmpMod	ING	Temperature based mode	E	
TmpNom	ASG	Nominal ambient temp	E	
TmpAlrm	ASG	Alarm temperature	E	
TmpAmbMin	ASG	Min ambient temperature	E	
TmpAmbDft	ASG	Default ambient temperature	E	

LN Type: SE_PTUC_UC_EasergyP5MU_V002
Description: Undercurrent
LN Class: PTUC

PTUC class				
Data object name	Common data class	Explanation	M/O/C/E	Remarks
P5UCPTUC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTUF_UF_EasergyP5FMV_V002/SE_PTUF_UF_EasergyP5U_LPT_V002
Description: Underfrequency
LN Class: PTUF

PTUF class				
Data object name	Common data class	Explanation	M/O/C/E	Remarks
P5UFPTUF1 P5UFPTUF2 P5UFLPTUF1 P5UFLPTUF2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	

PTUF class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTUV_UV_EasergyP5FMV_V002/ SE_PTUV_UV_EasergyP5U_LPT_V002
Description: Undervoltage
LN Class: PTUV

PTUV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5UVPTUV1 P5UVPTUV2 P5UVPTUV3 P5UVLPTUV1 P5UVLPTUV2 P5UVLPTUV3		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTUV_UVPS_EasergyP5MV_V002
Description: Undervoltage
LN Class: PTUV

PTUV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5UVPSPTUV1 P5UVPSPTUV2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only

PTUV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PZSU_EasergyP5MU_V001
Description: Motor underspeed
LN Class: PZSU

PZSU class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5MOTPZSU1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PHAR_ID_EasergyP5FMU_V001
Description: Harmonic restraint
LN Class: PHAR

PHAR class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5IDPHAR1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	INC	Mode	M	Status-only

PHAR class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Beh	INS	Behaviour	M	
Health	INS	Health	M	
NamPlt	LPL	Name plate	M	
Status Information				
Str	ACD	Start (active when restraint is needed)	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pickup for 2nd harmonic	E	
CurBlkVal	ASG	Max inrush current	E	

Enum types extensions

New Enum types

Enum type ARCOpMode is one of new added types defined as below.

Value	Description	Remarks
0	Light	
1	Light and current	

Enum type DefDirMode is one of new added types defined as below.

Value	Description	Remarks
0	ResCap	
1	Sector	
2	Undir	

Enum type DocDirMode is one of new added types defined as below.

Value	Description	Remarks
0	Dir_Backup	
1	Undir	
2	Dir	

Enum type DlCrvFamily is one of new added types defined as below.

Value	Description	Remarks
0	DT	
1	IEC	
2	IEEE	
3	IEEE2	
4	Others	
5	Prg1	
6	Prg2	
7	Prg3	

Enum type RsTyp is one of new added types defined as below.

Value	Description	Remarks
0	DT	
1	IDMT	

Enum type DIType is one of new added types defined as below.

Value	Description	Remarks
0	DT	
1	NI	
2	VI	
3	EI	
4	LTI	
5	LTEI	
6	LTVI	
7	MI	
8	STI	
9	STEI	
10	CO8	
11	RI	
12	RXIDG	
13	—	

Enum type NetGrd is one of new added types defined as below.

Value	Description	Remarks
0	Res	
1	Cap	

Enum type NegOPMod is one of new added type defined as below.

Value	Description	Remarks
0	No_Action	
1	Blocking	

Enum type NegDITyp is one of new added type defined as below.

Value	Description	Remarks
0	DT	
1	INV	

Enum type StrMod is one of new added type defined as below.

Value	Description	Remarks
0	Negative	
1	Positive	
2	Either	

Enum type MemoryMode is one of new added types defined as below.

Value	Description	Remarks
0	None	
1	Voltage	

2	Time	
3	Both	

Enum type EfDirModeKind is one of new added type defined as below.

Value	Description	Remarks
0	Forward	
1	Reverse	

Enum type SlotDISelect is one of new added type defined as below.

Value	Description	Remarks
0	Slot_C_DI1	
1	Slot_D_DI1	
2	Slot_E_DI1	

Enum type VTTypeKind is one of new added type defined as below.

Value	Description	Remarks
0	VT	
1	LPVT	

Enum type TempModKind is one of new added type defined as below.

Value	Description	Remarks
0	Current	
1	Ambient	

Enum type PadmDirMod is one of new added type defined as below.

Value	Description	Remarks
0	Undir	
1	Forward	
2	Reverse	

Enum type SignalNum is one of new added type defined as below.

Value	Description	Remarks
0	1	
1	2	

Extended Enum types

Enum type SIUnitKind is extended by the following enumerations.

Value	Quantity	Unit name	Symbol
-1	Rate of change of frequency	hertz per second	Hz/s
-2	Number of characters	characters	char
-3	Baud	characters per second	Char/s
-4	Turbine inertia	kg square meter	kgm^2
-5	Sound pressure level	decibel	dB
-6	Numerical tagging method	per unit	pu

Value	Quantity	Unit name	Symbol
-7	Percent	percent	%
-8	Relative temperature	degree Fahrenheit	°F
-9	Electric resistance	ohm (V/A)	V/A
-10	Rotational speed	Revolutions per minute	rmp
-11	Pulse per rotation	Pulse per rotation	/R
-12	time	minute	min

Enum type AutoRecST is extended by the following enumerations.

Value	Symbol
-1	Reclaim
-2	Ready_Ext
-3	WaitOpen
-4	WaitClose
-5	Discrim
-6	Locked
-7	FinalTr
-8	CBFail
-9	Inhibit
-10	Blocked
-11	ExtOpen
-12	ExClose
-13	WaitSync

PIXIT details

Introduction

This PIXIT is based upon UCAIug PIXIT Template version 15, UCA International Users Group Testing Sub Committee, October 22, 2019.

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in P5U20, P5V20, P5F30 and P5M30, with firmware version V01.

Together with the PICS and MICS documents, the PIXIT document forms the basis for a conformance test according to IEC 61850-10. The PIXIT entries contain information which is not available in the PICS, MICS, TICS documents or SCL file.

Each chapter specifies the PIXIT for applicable ACSI service model as structured in IEC 61850-10. The “Ed” column indicates if the entry is applicable for IEC 61850 Edition 1 and/or Edition 2.

PIXIT for association model

The extra information for testing is given in the table below.

Table 65 - Protocol implementation extra information for testing

ID	Ed	Description	Value / Clarification
As1	1	Maximum number of clients that can set-up an association simultaneously	8
As2	1,2	TCP_KEEPALIVE value. The recommended range is 0…20s	Configurable: from 0 to 20s
As3	1,2	Lost connection detection time	TCP_KEEPALIVE + 2s *10 Maximum 140s (2s is retransmission interval of TCP Keep-alive message, 10 retransmissions) (0 means 120s)
As4	-	Authentication is not supported yet	
As5	1,2	What association parameters are necessary for successful association	Transport selector Calling: N Called: Y Session selector Calling: N Called: Y Presentation selector Calling: N Called: Y AP title Calling: N Called: N AE qualifier Calling: N Called: N
As6	1,2	If association parameters are necessary for association, describe the correct values. Association parameters are configurable, default values are	Transport selector 1 Session selector 1 Presentation selector 1 AP title 1,1,1,999,1 AE qualifier 12
As7	1,2	What is the maximum and minimum MMS PDU size	Max: 65535 bytes Min: In initiate request 1024 bytes

Table 65 - Protocol implementation extra information for testing (Continued)

ID	Ed	Description	Value / Clarification
As8	1,2	What is the maximum start up time after a power supply interrupt	P5 relay start-up time including the server function is at average 180s; it depends on the configuration size (number and types of logical nodes)
As9	1,2	Does this device function only as test equipment? (test equipment need not have a non-volatile configuration; but it cannot be part of the substation automation system)	N

PIXIT for server model

ID	Ed	Description	Value / Clarification
Sr1	1,2	Which analogue value (MX) quality bits are supported (can be set by server)	Validity: Y Good, N Invalid, N Reserved, N Questionable N Overflow N OutofRange N BadReference N Oscillatory N Failure N OldData N Inconsistent N Inaccurate Source: Y Process N Substituted Y Test N OperatorBlocked
Sr2	1,2	Which status value (ST) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, Y Questionable N BadReference N Oscillatory N Failure N OldData N Inconsistent N Inaccurate Source: Y Process N Substituted Y Test N OperatorBlocked
Sr3	-	What is the maximum number of data object references in one GetDataValues request	Deprecated
Sr4	-	What is the maximum number of data object references in one SetDataValues request	Deprecated
Sr5	1	Which Mode values are supported	On Y [On-]Blocked N Test Y Test/Blocked Y Off N

PIXIT for data set model

ID	Ed	Description	Details
Ds1	1	What is the maximum number of data elements in one data set (compare ICD setting)	500
Ds2	1	How many persistent data sets can be created by one or more clients (this number includes predefined datasets)	50
Ds3	1	How many non-persistent data sets can be created by one or more clients	50

NOTE: Arrays are not supported in dataset.

PIXIT for setting group control model

ID	Ed	Description	Value / Clarification
Sg1	1	What is the number of supported setting groups for each logical device	4
Sg2	1,2	What is the effect of when and how the non-volatile storage is updated (compare IEC 61850-8-1 $16.2.4)	When: CnfEdit set to TRUE successfully. How: the setting value in edit buffer will be copied to the selected setting group, and then the new value will be updated to non-volatile storage by setting engine.
Sg3	1	Can multiple clients edit the same setting group	N
Sg4	1	What happens if the association is lost while editing a setting group	The SE values changes are lost, the EditSG value will not change.
Sg5	1	Is EditSG value 0 allowed?	Y Write a value of 0 to EditSG will cancel all the setting values in the Edit buffer.
Sg6	2	When ResvTms is not present how long is an edit setting group locked	Reserved forever except Cancel, Confirm or Disconnection.

PIXIT for reporting model

ID	Ed	Description	Details	
Rp1	1	The supported trigger conditions (compare PICS)	integrity	Y
			data change	Y
			quality change	Y
			data update	Y
			general interrogation	Y
Rp2	1	The supported optional fields are	sequence-number	Y
			report-time-stamp	Y
			reason-for-inclusion	Y
			data-set-name	Y

ID	Ed	Description	Details	
			data-reference	Y
			buffer-overflow (not applicable to URCB)	Y
			entryID (not applicable to URCB)	Y
			conf-rev	Y
			segmentation	Y
Rp3	1,2	Can the server send segmented reports? (when not supported the device shall refuse an association request with a smaller than minimum PDU size)	Y	
Rp4	1,2	Mechanism on second internal data change notification of the same analogue data value within buffer period (compare IEC 61850-7-2 $14.2.2.9)	Send report immediately	
Rp5	1	Multi client URCB approach (compare IEC 61850-7-2 $14.2.1)	Each URCB is visible to all clients	
Rp6	-	What is the format of EntryID	Deprecated	
Rp7	1,2	What is the buffer size for each BRCB or how many reports can be buffered	100k bytes per report control block	
Rp8	-	Pre-configured RCB attributes that are dynamic, compare SCL report settings	Deprecated	
Rp9	1	May the reported data set contain: - structured data objects? - data attributes?	 Y Y	
Rp10	1,2	What is the scan cycle for binary events? Is this fixed, configurable or event-driven	5 milliseconds Fixed	
Rp11	1	Does the device support to pre-assign a RCB to a specific client in the SCL	N	
Rp12	2	After restart of the server is the value of ConfRev restored from the original configuration or retained prior to restart	Fom the original configuration	
Rp13	1,2	Does the server accept any client to configure / enable a BRCB with ResvTms=-1? What fields are used to do the identification?	N	
Rp14	1,2	What is default value for BRCB. ResvTms if client does not write or ResvTms not exposed in the control block (must be >= 0)	Not support ResvTms.	

PIXIT for GOOSE publish model

ID	Ed	Description	Value / Clarification
Gp1	1,2	Can the test (Ed1) / simulation (Ed2) flag in the published GOOSE be set	N
Gp2	1	What is the behavior when the GOOSE publish configuration is incorrect	NdsCom=T DUT keeps GoEna=F
Gp3	1,2	Published FCD supported common data classes / data types are	Common data classes: SPS, DPC, CMV, MV Data types as single attributes: BOOLEAN, CODED ENUM, FLOAT32, QUALITY Arrays are not supported.
Gp4	1,2	What is the maximum value of TAL (maxTime)? Is it fixed or configurable?	Maximum TAL = 120000 ms (double of maximum configurable slowest retransmission cycle 60000 ms) Configurable by configuration tool
Gp5	1,2	What is the fastest retransmission time? Is it fixed or configurable?	4 ms Retransmission scheme: First message upon data change, followed by 4, 10, 20, 40, 80, 160, 320, 640, 1280, 2500, 5000, 10000, 20000, 40000, 60000 and finally reaching the configured slow retransmission time). TAL is set to value 2 times bigger than interval. Fixed
Gp6	-	Can the GOOSE publish be turned on / off by using SetGoCBValues(GoEna)	Deprecated
Gp7	1,2	What is initial GOOSE sqNum after restart of the device	1
Gp8	1	May the GOOSE data set contain: - structured data objects (FCD) - timestamp data attributes	 Y Y
Gp9	1,2	Does Server or ICT refuse GOOSE payload dataset length greater than SCSM supports?	Y

PIXIT for GOOSE subscribe model

ID	Ed	Description	Value / Clarification
Gs1	1,2	What elements of a subscribed GOOSE message are checked to decide the message is valid and the allData values are accepted? If yes, describe the conditions. Notes: • the VLAN tag may be removed by a ethernet switch and shall not be checked • the simulation flag shall always be checked (Ed2) • the ndsCom shall always be checked (Ed2)	Y destination MAC address (equal to configured) Y APPID (equal to configured) N gocbRef N timeAllowedtoLive (see Remarks) N datSet Y goID (equal to configured, checking can be set off) N t Y stNum (see Remarks) N sqNum (see Remarks) Y simulation/test (if true, values not passed to application, the application data will keep last received value when simulation/test was false, but status of the network input stays valid) Y confRev (equal to configured) Y ndsCom (if true, values not passed to application, the application data will keep last received value , and network inputs status is set to invalid as if message was never received) Y numDatSetEntries (see Remarks) N out-of-order dataset members
Gs2	1,2	When is a subscribed GOOSE marked as lost? (TAL = time allowed to live value from the last received GOOSE message)	Message does not arrive by TAL+1s Internally in the relay there is a status indication to the application about GOOSE problem (data is marked as OLD if the message does not arrive prior to TAL+1s if TAL>1s or prior to 1s if TAL<1s).
Gs3	1,2	What is the behavior when one or more subscribed GOOSE messages isn't received or syntactically incorrect (missing GOOSE)	The subsequently received GOOSE message is accepted even if the new state number is not equal to the incremented value of the previously received state number (it is enough that it is not equal to the last received state number).
Gs4	1,2	What is the behavior when a subscribed GOOSE message is out-of-order	Message is treated as normal (it is assumed that previous messages have been lost).
Gs5	1,2	What is the behavior when a subscribed GOOSE message is duplicated	Duplicated message is ignored
Gs6	1	Does the device subscribe to GOOSE messages with/without the VLAN tag?	Y with the VLAN tag Y without the VLAN tag
Gs7	1	May the GOOSE data set contain: - structured data objects? - data attributes?	Y Y
Gs8	1,2	Subscribed FCD supported common data classes / data types are	Data classes: SPS, SPC, DPS, DPC, INS, INC, ENS, ENC, CMV, MV Data types as single attributes: BOOLEAN, INT8, INT16, INT32, INT8U, INT16U, INT32U, ENUM, CODED ENUM, BITSTRING, FLOAT32 Arrays are not supported

ID	Ed	Description	Value / Clarification
Gs9	1,2	Are subscribed GOOSE with test=T (Ed1) / simulation=T (Ed2) accepted in test/ simulation mode	N - Test mode is not supported by the device
Gs10	1,2	Max number of dataset members	Unlimited
Gs11	1	Is Fixed-length encoded GOOSE supported	Yes

TAL = Time Allowed to Live

Remarks:

A GOOSE message will be accepted and processed by the subscriber in DUT:

- Even if it is received after expiration of the time allowed to live sent in the previous message,
- Even if the new state number is not equal to the incremented value of the previously received state number - it is enough that it is not equal to the last received state number,
- If the state number differs from the previously received state number, the sequence number is accepted with any value (if the state number is equal to the previously received state number, the message is treated as retransmission),
- Even if the received message contains a dataset of the size different than the size of the previously received dataset.

A GOOSE message will NOT be accepted by the subscriber in DUT if:

- Destination MAC address is not equal to configured one
- Protocol ID is not equal to 0x88B8
- APPID is not equal to configured one for any of the network inputs
- ConfRev is not equal to configured one for any of the network inputs
- goID is not equal to configured one for any of the network inputs
- state number is the same as in the previous message (is treated as retransmission)
- ndsCom bit is set to true in received message

Note for sGosN6h (out of order dataset)

Value from GOOSE message will be accepted even if the type is different than in previous message given that:

- Type is compatible with network input type i.e. for binary network inputs accepted types are: BOOLEAN, INTEGER and BITSTRIG, ENUM, CODED ENUM for analog network inputs accepted types are FLOAT32 and INTEGER
- In case of binary network input and types other than BOOLEAN as a value for processing bit selected in configuration will be taken from the received data in the message (by default it is bit 0)
- Value will not be accepted if data from the message is not containing configured bit (for example if bit 5 is configured and received data contains only 2 bits like stVal from DPC type)

Every network input can be associated via internal logic with one of 16 validity indications. If given network input is not received due to one of the reasons mentioned above this indication is activated. Validity flag for the network input will be activated also if next message with the value will not be received within the time indicated in **time to live** field contained in the previous message.

The value of numDatSetEntries from the header determines how many data entries from the message are processed. With numDatSetEntries = 0 no data entries are processed from the received message. If numDatSetEntries is lower than expected (source information for some network inputs is not processed or missing) those missing network inputs will be marked as invalid.

During device startup there can be more than one state transition of the GOOSE publisher dataset, since different parts of the relay application will start after GOOSE publisher.

When checking GoID, the APPID must not be the same as the APPID of other GOOSE.

PIXIT for GOOSE performance

ID	Ed	Description	Value / Clarification
Gf1	1,2	Performance class	N/A
Gf2	1,2	GOOSE ping-pong processing method	Scan cycle based
Gf3	1,2	Application logic scan cycle (ms)	Max. 3 ms for SPS, 10 ms for DPS Min. 0 ms for SPS, 0 ms for DPS
Gf4	1	Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes)	500

PIXIT for control model

ID	Ed	Description	Value / Clarification
Ct1	-	What control models are supported (compare PICS)	DOns: Y SBOns: Y DOes: Y SBOes: Y
Ct2	1,2	Is the control model fixed, configurable and/or dynamic?	Configurable for CSWI class: All controllable objects Obj1 … Obj6 under CSWI class are configured to use **one and the same** chosen control model. Objects Obj7 … Obj8 under CSWI class have fixed control model status-only. Fixed for GGIO: All controllable objects under GGIO class the control model is fixed: direct-with-normal-security.
Ct3	-	Is TimeActivatedOperate supported (compare PICS or SCL)	Deprecated
Ct4	-	Is “operate-many” supported (compare sboClass)	N
Ct5	1	Will the DUT activate the control output when the test attribute is set in the SelectWithValue and/or Operate request (when N test procedure Ctl2 is applicable)	N
Ct6	-	What are the conditions for the time (T) attribute in the SelectWithValue and/or Operate request	Deprecated
Ct7	-	Is pulse configuration supported (compare pulseConfig)	Deprecated
Ct8	1	What is the behavior of the DUT when the check conditions are set Is this behavior fixed, configurable, online changeable?	N synchrocheck N interlock-check DUT ignores the check value and the command is executed as usual

ID	Ed	Description	Value / Clarification
			Fixed
Ct9	1,2	Which additional cause diagnosis are supported	N Unknown Y Not-supported Y Blocked-by-switching-hierarchy N Select-failed Y Invalid-position Y Position-reached N Step-limit Y Blocked-by-Mode N Blocked-by-process N Blocked-by-interlocking N Blocked-by-synchrocheck Y Command-already-in-execution N Blocked-by-health N 1-of-n-control N Abortion-by-cancel Y Time-limit-over N Abortion-by-trip Y Object-not-selected Y Parameter-change-in-execution
Ct10	1,2	How to force a “test-not-ok” respond with SelectWithValue request?	Put device into local mode
Ct11	1,2	How to force a “test-not-ok” respond with Select request?	Put device into local mode
Ct12	1,2	How to force a “test-not-ok” respond with Operate request?	DOns: Operate with orCat out of range SBOns: Operate without Select DOes: Operate with orCat out of range SBOes: Operate without Select
Ct13	1,2	Which origin categories are supported/accepted?	Y bay-control Y station-control Y remote-control Y automatic-bay Y automatic-station Y automatic-remote Y maintenance Y process
Ct14	1,2	What happens if the orCat is not supported or invalid	DOns: Negative response SBOns: Negative response DOes: Negative response (with additional cause diagnosis code value Not-supported) SBOes: Negative response (with additional cause diagnosis code value Not-supported)
Ct15	1,2	Does the IED accept a SelectWithValue/Operate with the same control value as the current status value?	DOns: N SBOns: N

ID	Ed	Description	Value / Clarification
		Is this behavior configurable?	DOes: N Addcause: Position-reached SBOes: N Addcause: Position-reached Configurable: N
Ct16	1	Does the IED accept a select/operate on the same control object from 2 different clients at the same time?	DOns: Y (see Remarks) SBOns: N DOes: N SBOes: N
Ct17	1	Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (tissue 334)	SBOns: N SBOes: N
Ct18	1	Is for SBOes the internal validation performed during the SelectWithValue and/or Operate step?	Y During SelectWithValue and during Operate
Ct19	-	Can a control operation be blocked by Mod=Off or [On-] Blocked (compare PIXIT Sr5)	Deprecated
Ct20	1,2	Does the IED support local / remote operation?	Y
Ct21	1,2	Does the IED send an InformationReport with LastApplError as part of the Operate response- for control with normal security?	SBOns: N DOns: N
Ct22	2	How to force a "parameter-change-in-execution"	SBOns: N/A SBOes: N/A
Ct23	1,2	How many SBOns/SBOes control objects can be selected at the same time?	SBOns: 1 SBOes: 1
Ct24	1,2	Does the DUT support any operate timeout > 0	N
Ct25	1,2	When CDC=DPC is supported, is it possible to have DPC (Controllable Double Point) go to the intermediate state? (00)	Y
Ct26	1,2	Name an enhanced security point (if any) with a finite operate timeout specify the timeout (in milliseconds)	Relay/Obj1CSWI1.Pos Operate timeout can be configured by setting Configuration Tool, the range is 0.02 ... 600 s. For example: DOes: 10000 ms SBOes: 10000 ms
Ct27	2	Does the IED support control objects with external signals?	DOns: Y SBOns: Y DOes: Y SBOes: Y
Ct_ex1		SBO Timeout	60 seconds

Remarks:

In DOns model: When two clients send Operate request within a very short interval (under 100 ms) then for processing the second command the object position is still unchanged due to the first command, thus both clients receive positive Operate response.

PIXIT for time synchronization

ID	Ed	Description	Value / Clarification
Tm1	1	What time quality bits are supported (may be set by the IED) Ed.2 requires all 3 bits	Y LeapSecondsKnown Y ClockFailure Y ClockNotSynchronized
Tm2	1,2	Describe the behaviour when the time server(s) ceases to respond What is the time server lost detection time	Time is taken from internal RTC The latency depends on measured drift of the internal clock. Usually it can take 400 seconds
Tm3	1,2	How long does it take to take over the new time from time server	Depends on time difference between internal and time server. Max. 400 s is the waiting time to see Timestamp Quality transition to ClockNotSynchronised.
Tm4	1,2	When is the time quality bit "Clock failure" set?	The time quality bit “Clock failure” is set to “one” when the P5 IED restarts from power up, or when the connection to time server is lost; the bit is reset to “zero” when the clock becomes synchronized. All available time synchronization sources will affect the “Clock failure” bit. These time sources include SNTP and where applicable, IRIG-B.
Tm5	1	When is the time quality bit "Clock not synchronized” set? Note: For Ed2 and up, CNS is set according to PIXIT Tm2	The time quality bit “Clock not synchronized” is set to “one” when the P5 IED starts from power up, or when the connection to time server is lost; the bit is reset to “zero” when the clock becomes synchronized. All available time synchronization sources will affect the “Clock not synchronized” bit. These time sources include SNTP and where applicable, IRIG-B.
Tm6	-	Is the timestamp of a binary event adjusted to the configured scan cycle?	Deprecated
Tm7	1	Does the device support time zone and daylight saving?	Y
Tm8	1,2	Which attributes of the SNTP response packet are validated?	N Leap indicator not equal to 3 N Mode is equal to SERVER Y OriginateTimestamp is equal to value sent by the SNTP client as Transmit Timestamp Y RX/TX timestamp fields are checked for reasonableness Y SNTP version 3 or 4 N other
Tm9	1,2	Do the COMTRADE files have local time or UTC time Is this configurable	Local N

PIXIT for file transfer model

ID	Ed	Description	Value / Clarification
Ft1	1	What is structure of files and directories Where are the COMTRADE files stored Are comtrade files zipped and what files are included in each zip file	Directory structure - COMTRADE - DR - TREND COMTRADE files stored in folder / COMTRADE /DR Zipped; Each COMTRADE record includes 2 files: .cfg and .dat
Ft2	1,2	Directory names are separated from the file name by	Separated by '/'
Ft3	1	The maximum file name size including path (recommended 64 chars)	255 Below are all the maximum sizes: - Full file name (including the directory path, suffix and separation characters): 255 - File name: 64 - File directory name: 32 - File name suffix: 3
Ft4	1,2	Are directory/file name case sensitive	Case sensitive
Ft5	1,2	Maximum file size for SetFile	SetFile is not supported.
Ft6	1	Is the requested file path included in the MMS fileDirectory respond file name	Y
Ft7	1	Is the wild char supported MMS fileDirectory request	Y
Ft8	1,2	Is it allowed that 2 clients get a file at the same time	N
Ft9	1,2	Which files can be deleted	None

TICS details

Introduction

The TICS is based upon UCAIug TICS Template version 2.1, UCA International Users Group Testing Sub Committee, April 23, 2019.

This Tissues implementation conformance statement is applicable for Easergy P5U20, P5V20, P5F30, P5M30, with firmware version V01.

Implemented Tissues

During the October 2006 meeting IEC TC57 working group 10 decided that:

- green Tissues with the category “IntOp” are mandatory for IEC 61850 Edition 1
- Tissues with the category “Ed.2” Tissues should not be implemented

The below tables give an overview of the applicable mandatory Tissues.

Table 66 - Tissues implementation conformance statement

Part	Tissue	Description	Implemented by server	Supported by client
8-1	116	GetNameList with empty response?	Y	na
	165	Improper Error Response for GetDataSetValues	Y	na
	183	GetNameList error handling	Y	na
	246	Control negative response (SBOns) with LastApplError	na	na *
	545	Skip file directories with no files	na	ni
7-4	252	AlmThm should have CDC SPS	Y	na
7-3	28	Definition of APC	na	na
	54	Point def xVal, not cVal	na	na
	55	Ineut = Ires ?	Y	ni
	63	mag in CDC CMV	Y	na
	65	Deadband calculation of a Vector and trigger option	na	na
	219	operTm in ACT	na	na
	270	WYE and DEL rms values	Y	ni
	1199	BCR	Y	na
7-2	30	control parameter T	Y	na *
	31	Typo	na	na *
	32	Typo in syntax	na	na*
	35	Typo Syntax Control time	na	na *
	36	Syntax parameter DSet-Ref missing	na	na
	37	Syntax GOOSE "T" type	Y	na
	39	Add DstAddr to GoCB	Y	na
	40	GOOSE Message “AppID” to “GoID”	Y	na
	41	GsCB “AppID” to “GsID”	na	na
	42	SV timestamp: “EntryTime” to “TimeStamp"	na	na
	43	Control "T" semantic	na	na
	44	AddCause - Object not sel	Y	na

Table 66 - Tissues implementation conformance statement (Continued)

Part	Tissue	Description	Implemented by server	Supported by client
	45	Missing AddCauses	na	na
	46	Synchro check cancel	na	na
	47	"." in LD Name?	Y	na
	49	BRCB TimeOfEntry (part of #453)	-	na *
	50	LNName start with number?	Y	na
	51	ARRAY [0..num] missing	Y	na *
	52	Ambiguity GOOSE SqNum	Y	na
	53	Add DstAddr to GsCB, SV	na	na
	151	Name constraint for control blocks etc.	Y	na
	166	DataRef attribute in Log	na	na *
	185	Logging - Integrity period	na	na *
	189	SV Format	na	na
	190	BRCB: EntryId and TimeOfEntry (part of #453)	-	na *
	191	BRCB: Integrity and buffering reports (part of #453)	-	na *
	278	EntryId not valid for a server (part of #453)	-	na *
	297	Sequence number	Y	na *
	298	Type of SqNum	na	na *
	305	Reporting with BufTm=0	na	na *
	322	Write Configuration attribute of BRCBs	na	na *
	329	Reporting and BufOvl	na	na *
	333	Enabling of an incomplete GoCB	na	na
	335	Clearing of Bufovfl	na	na *
	348	URCB class and report	na	na *
	349	BRCB TimeOfEntry has two definitions	na	na *
	453	Reporting & Logging model revision	Y	na *
	1281	Default for TrgPos.GI is TRUE	na	na *
6	1	Syntax	na	na
	5	tExtensionAttributeNameEnum is restricted	Y	ni
	8	SIUnit enumeration for W	Y	na
	10	Base type for bitstring usage	Y	na
	17	DAI/SDI elements syntax	Y	na
	169	Ordering of enum differs from 7-3	na	na
	245	Attribute RptId in SCL	Y	na *
	529	Replace sev - Unknown by unknown	na	na

NOTE: Tissue 49, 190, 191, 275 and 278 are part of tissue #453, all other technical tissues in the table are mandatory if applicable.

NOTE: Editorial tissues are marked as “na”.

For detailed information on the individual Tissues, connect to the TISSUE database: www.tissues.iec61850.com

Appendix 3: IEC 61850 Edition 2 conformance statement

Introduction

Document purpose

The purpose of this document is to specify the communication features of the Easergy P5 protection relays embedded IEC 61850 server implementation mapped to IEC 61850 Edition 2 standards.

The model implementation in Easergy P5 protection relays varies with the functional scope provided by the different device models.

The information provided here may be still the subject of changes due to planned further extensions in the supported IEC 61850 functionality.

Terms and abbreviations

Terms / abbreviations	Definitions
ACSI	Abstract Communication Service Interfaces
BDA	Basic Data Attribute (not structured)
DA	Data Attributes
DO	DATA in IEC 61850-7-2, data object type or instance
FCD	Functionally Constrained Data
FCDA	Functionally Constrained Data Attribute
ID	Identifier
IED	Intelligent Electronic Device
LD	Logical Device
LN	Logical Node
MSV	Multicast Sampled Value
RCB	Report Control Block
GoCB	GOOSE Control Block or GSSE Control Block
SCL	System Configuration description Language
SCSM	Specific Communication Service Mapping
XML	Extensible Markup Language
GSSE	Generic Substation State Event
GOOSE	Generic Object Oriented Substation Event
SCD	Substation Configuration Description
ICD	IED Configuration Description
CID	Configured IED Description
PICS	Protocol Implementation Conformance Statement
MICS	Model Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
TICS	Tissue Implementation Conformance Statement

PICS details

The PICS is based upon UCAIug PICS Template version 2.3, UCA International Users Group Testing Sub Committee, October 08, 2019.

The following ACSI conformance statements are used to provide an overview and details about following devices: P5U20, P5V20, P5F30, P5M30, with firmware version V01.

- ASCI basic conformance statement,
- ACSI models conformance statement,
- ACSI service conformance statement

The statements specify the communication features mapped to IEC 61850-8-1 and IEC 61850-9-2, Edition 2.

ASCI basic conformance statement

The basic conformance statement is defined in the table below.

Table 67 - Basic conformance statement

		Client / Subscriber	Server / Publisher	Value / Comments
Client–Server roles				
B11	**Server** side (of TWO-PARTY-APPLICATION-ASSOCIATION)		Y	
B12	**Client** side (of TWO-PARTY-APPLICATION-ASSOCIATION)		–	
SCSMs supported				
B21	**SCSM**: IEC 61850-8-1 used		Y	
B22	**SCSM**: IEC 61850-9-1 used			Deprecated in Ed.2
B23	**SCSM**: IEC 61850-9-2 used		N	
B24	**SCSM**: other		N	
Generic substation event model (GSE)				
B31	**Publisher** side		Y	
B32	**Subscriber** side	Y		
Transmission of sampled value model (SVC)				
B41	**Publisher** side		N	
B42	**Subscriber** side	N		
– = not applicable Y = supported N or empty = not supported				

ASCI models conformance statement

The ACSI models conformance statement is defined in the table below.

Table 68 - ASCI models conformance statement

		Client / Subscrib-er	Server / Publisher	Value / Comments
If **Server** side (B11) and/or **Client** side (B12) supported				
M1	**Logical device**		Y	
M2	**Logical node**		Y	Only standard LN types defined in Part 7-4.
M3	**Data**		Y	Only standard object types defined in Part 7-3, 7-4. Mandatory objects and attributes, selected optional objects and attributes.
M4	**Data set**		Y	Supported pre-defined persistent data sets, configurable via SCL. Supported dynamically created data sets (persistent and non-persistent). Data set members selection restricted to FC such as ST and MX.
M5	**Substitution**		N	
M6	**Setting group control**		Y	
Reporting				
M7	**Buffered report control**		Y	
M7-1	sequence-number		Y	
M7-2	report-time-stamp		Y	
M7-3	reason-for-inclusion		Y	
M7-4	data-set-name		Y	
M7-5	data-reference		Y	
M7-6	buffer-overflow		Y	
M7-7	entryID		Y	
M7-8	BufTm		Y	
M7-9	IntgPd		Y	
M7-10	GI		Y	
M7-11	conf-revision		Y	
M8	**Unbuffered report control**		Y	
M8-1	sequence-number		Y	
M8-2	report-time-stamp		Y	
M8-3	reason-for-inclusion		Y	
M8-4	data-set-name		Y	
M8-5	data-reference		Y	
M8-6	BufTm		Y	
M8-7	IntgPd		Y	
M8-8	GI		Y	
M8-9	conf-revision		Y	

Table 68 - ASCI models conformance statement (Continued)

		Client / Subscrib-er	Server / Publisher	Value / Comments
Logging				
M9	**Log control**		N	
M9-1	IntgPd		N	
M10	**Log**		N	
Other				
M11	**Control**		Y	
M17	**File transfer**		Y	
M18	**Application association**		Y	
M19	**GOOSE Control Block**		Y	
M20	**Sampled Values Control Block**		N	
If GSE (B31/32) is supported				
M12	**GOOSE**		Y	
M13	**GSSE**		N	Deprecated in Ed.2
If SVC (B41/B42) is supported				
M14	**Multicast SVC**		N	
M15	**Unicast SVC**		N	
For all IEDs				
M16	**Time**		Y	Performance class T2 (100μs accuracy)
Y = service is supported N or empty = service is not supported				

ASCI service conformance statement

The ACSI service conformance statement is defined in the table below (depending on the statements in ASCI basic conformance statement, page 264).

Table 69 - ASCI service conformance statement

	Ed	ASCI Service Conformance	AA: TP/MC	Client / Sub (C)	Server / Pub (S)	Comments
Server						
S1	1,2	GetServerDirectory (LOGICAL-DEVICE)	TP		Y	
Application association						
S2	1,2	Associate			Y	
S3	1,2	Abort			Y	
S4	1,2	Release			Y	
Logical device						
S5	1,2	LogicalDeviceDirectory	TP		Y	
Logical node						
S6	1,2	LogicalNodeDirectory	TP		Y	
S7	1,2	GetAllDataValues	TP		Y	
Data						
S8	1,2	GetDataValues	TP		Y	
S9	1,2	SetDataValues	TP		Y	
S10	1,2	GetDataDirectory	TP		Y	
S11	1,2	GetDataDefinition	TP		Y	
Data set						
S12	1,2	GetDataSetValues	TP		Y	
S13	1,2	SetDataSetValues	TP		N	Deprecated in Ed.2
S14	1,2	CreateDataSet	TP		Y	
S15	1,2	DeleteDataSet	TP		Y	
S16	1,2	GetDataSetDirectory	TP		Y	
Substitution						
S17	1	SetDataValues	TP		N	
Setting group control						
S18	1,2	SelectActiveSG	TP		Y	
S19	1,2	SelectEditSG	TP		Y	
S20	1,2	SetEditSGValue	TP		Y	
S21	1,2	ConfirmEditSGValues	TP		Y	
S22	1,2	GetEditSGValue	TP		Y	
S23	1,2	GetSGCBValues	TP		Y	
Reporting						
Buffered report control block (BRCB)						
S24	1,2	Report	TP		Y	
S24-1	1,2	data-change (dchg)			Y	
S24-2	1,2	qchg-change (qchg)			Y	
S24-3	1,2	data-update (dupd)			Y	Accepted as TrgOpt, but not functionally

Table 69 - ASCI service conformance statement (Continued)

	Ed	ASCI Service Conformance	AA: TP/MC	Client / Sub (C)	Server / Pub (S)	Comments
						supported by the IED
S25	1,2	GetBRCBValues	TP		Y	
S26	1,2	SetBRCBValues	TP		Y	
Unbuffered report control block (URCB)						
S27	1,2	Report	TP		Y	
S27-1	1,2	data-change (dchg)			Y	
S27-2	1,2	qchg-change (qchg)			Y	
S27-3	1,2	data-update (dupd)			Y	Accepted as TrgOpt, but not functionally supported by the IED
S28	1,2	GetURCBValues	TP		Y	
S29	1,2	SetURCBValues	TP		Y	
Logging						
Log control block						
S30	1,2	GetLCBValues	TP		N	
S31	1,2	SetLCBValues	TP		N	
Log						
S32	1,2	QueryLogByTime	TP		N	
S33	1,2	QueryLogAfter	TP		N	
S34	1,2	GetLogStatusValues	TP		N	
Generic substation event model (GSE)						
S35	1,2	SendGOOSEMessage	MC		Y	
GOOSE Control Block						
S36	1,2	GetGoReference	TP		N	
S37	1,2	GetGOOSEElement-Number	TP		N	
S38	1,2	GetGoCBValues	TP		Y	
S39	1,2	SetGoCBValues	TP		Y	
GSSE (Ed2:61850-7-2 Annex C)						
S40	1	SendGSSEMessage	MC		N	Deprecated in Ed.2
GSSE Control Block						
S41	1	GetGsReference	TP		N	Deprecated in Ed.2
S42	1	GetGSSEElementNum-ber	TP		N	Deprecated in Ed.2
S43	1	GetGsCBValues	TP		N	Deprecated in Ed.2
S44	1	SetGsCBValues	TP		N	Deprecated in Ed.2
Transmission of sampled value model (SVC)						
Multicast SV						
S45	1,2	SendMSVMessage	MC		N	Use for 9-2LE or IEC 61869-9
Multicast Sampled Values Control Block						
S46	1,2	GetMSVCBValues	TP		N	

Table 69 - ASCI service conformance statement (Continued)

	Ed	ASCI Service Conformance	AA: TP/MC	Client / Sub (C)	Server / Pub (S)	Comments
S47	1,2	SetMSVCBValues	TP		N	
Unicast SV						
S48	1,2	SendUSVMessage	TP		N	
Unicast Sampled Values Control Block						
S49	1,2	GetUSVCBValues	TP		N	
S50	1,2	SetUSVCBValues	TP		N	
Control						
S51	1,2	Select			Y	
S52	1,2	SelectWithValue	TP		Y	
S53	1,2	Cancel	TP		Y	
S54	1,2	Operate	TP		Y	
S55	1,2	CommandTermination	TP		Y	
S56	1,2	TimeActivatedOperate	TP		N	
File Transfer						
S57	1,2	GetFile	TP		Y	
S58	1,2	SetFile	TP		N	
S59	1,2	DeleteFile	TP		N	
S60	1,2	GetFileAttributeValues	TP		Y	
S61	1,2	GetServerDirectory (FILE-SYSTEM)	TP		Y	
Time						
T1	1,2	Time resolution of internal clock			14	14 for IEEE1588, 10 for IRIG-B, 7 for SNTP and protocols
T2	1,2	Time accuracy of internal clock			T2	Performance class T2 for IEEE1588, T1 for IRIG-B, T0 for SNTP and protocols
T3	1,2	Supported TimeStamp resolution	-		20	Nearest value of 2^{-n} in seconds (number 0 ... 24)

MICS details

The MICS is based upon UCAIug MICS Template version 1.2, UCA International Users Group Testing Sub Committee, August 13, 2019.

This model implementation conformance statement is applicable for P5U20, P5V20, P5F30, P5M30, with firmware version V01.

This MICS document specifies the modeling extensions compared to IEC 61850 Edition 2.

Clause **Logical nodes list** contains the list of implemented logical nodes.

Clause **Logical node extensions** describes the new and extended logical nodes (if any).

Clause **Enum types extensions** describes the new and extended enum types (if any).

Logical nodes list

The following table contains the list of logical nodes implemented in the device:

Table 70 - Logical nodes implemented in the device

	P5U20	P5V20	P5F30	P5M30
L: System Logical Nodes				
LPHD (Physical device information)	x	x	x	x
LLN0 (Logical node zero)	x	x	x	x
P: Logical Nodes for protection functions				
PTRC (Protection trip conditioning)	x	x	x	x
PTOC (Time overcurrent)	x		x	x
PFRC (Rate of change frequency)	x	x	x	
PIOC (Instantaneous overcurrent)	x	x	x	x
PTOF (Over frequency)	x	x	x	x
PTOV (Overvoltage)	x	x	x	x
PDOP (Directional overpower)	x		x	x
PTUC (Undercurrent)	x			x
PTTR (Thermal overload)	x		x	x
PTUF (Under frequency)	x	x	x	x
PTUV (Under voltage)	x	x	x	x
PMRI (Motor restart inhibition)	x			x
PMSS (Motor starting time supervision)	x			x
PTEF (Transient earth fault)			x	
PADM (Admittance)			x	x
POVS (Motor overspeed)	x			x
PZSU (Motor underspeed)	x			x
PHAR (Harmonic restraint)	x		x	x
R: Logical nodes for protection related functions				
RREC (Auto reclosing)	x		x	
RDRE (Disturbance recorder)	x	x	x	x
RFLO (Fault locator)			x	

Table 70 - Logical nodes implemented in the device (Continued)

	P5U20	P5V20	P5F30	P5M30
RSYN (Synchronism-check)		x	x	
G: Logical Nodes for generic references				
GGIO (Generic process I/O)	x	x	x	x
GAPC (Generic automatic process control)	x	x	x	x
M: Logical Nodes for metering and measurement				
MMTR (Metering)	x		x	x
MMXU (Measurement)	x	x	x	x
MHAI (Harmonics)	x	x	x	x
C: Logical Nodes for control				
CSWI (Switch controller)	x	x	x	x
T: Logical nodes for instrument transformers and sensors				
TCTX (Current transformer)	x		x	x
TVTX (Voltage transformer)	x	x	x	x

Logical node extensions

The following table uses:

- M: Data is mandatory in the IEC 61850-7-4.
- O: Data is optional in the IEC 61850-7-4 and is used in the device.
- C: Data is conditional in the IEC 61850-7-4 and is used in the device.
- E: Data is an extension to the IEC 61850-7-4.

The condition below is available for all logical nodes in this chapter.
Condition C1: Mod, Health and NamPlt shall be inherited by LLN0 of the root LD of a hierarchy as mandatory and by all other LN as optional.

New logical nodes

Newly created logical nodes are listed in this clause, with InNs attribute in the Name plate.

PADM Admittance
This LN shall be used for protection admittance E/F Io/Uo.

PADM class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5EFPADM1 P5EFPADM2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
YStr	ACD	YN start	E	

PADM class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
YOp	ACT	YN operate	E	
GStr	ACD	GN start	E	
GOp	ACT	GN operate	E	
BStr	ACD	BN start	E	
BOp	ACT	BN operate	E	
Settings				
FunEna	SPG	Whole function enable	E	
YFunEna	SPG	YN function enable	E	
GFunEna	SPG	GN function enable	E	
BFunEna	SPG	BN function enable	E	
UoStrVal	ASG	Uo pick-up value	E	
CorAng	ASG	Correction angle	E	
YStrVal	ASG	YN pick-up value	E	
YOpDlTms	ASG	YN operate delay time	E	
YRsDlTms	ASG	YN reset time	E	
YSolMod	SPG	YN SOL mode	E	
YSlOpDlTms	ASG	YN SOL operate delay time	E	
GStrVal	ASG	GN pick-up value	E	
GDirMod	ENG	GN direction mode	E	
GOpDlTms	ASG	GN operate delay time	E	
GRsDlTms	ASG	GN reset time	E	
GSolMod	SPG	GN SOL mode	E	
GSlOpDlTms	ASG	GN SOL operate delay time	E	
BStrVal	ASG	BN pick-up value	E	
BDirMod	ENG	BN direction mode	E	
BOpDlTms	ASG	BN operate delay time	E	
BRsDlTms	ASG	BN reset time	E	
BSolMod	SPG	BN SOL mode	E	
BSlOpDlTms	ASG	BN SOL operate delay time	E	

POVS Motor overspeed
This LN shall be used for protection motor overspeed.

POVS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5MOTPOVS1 P5MOTPOVS2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	

POVS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	E	
Op	ACT	Operate	E	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	E	
OpDlTms	ASG	Operate delay time	E	

TCTX Current transformer
This LN shall be used for protection current transformer parameters.

TCTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5ITCTX1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Measured and metered values				
Settings				
FunEna	SPG	Function enable	E	
CTNum	ING	Number of connected phase CT	E	
OpDlTmms	ING	Operate delay time	O	
PriPhs	ASG	CT primary	E	
SecPhs	ASG	CT secondary	E	

TCTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5IOTCTX1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	

TCTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
NamPlt	LPL	Name plate	C1	
Status Information				
Measured and metered values				
Settings				
PriNeut1	ASG	Io CT primary	E	
PriNeut2	ASG	Io' CT primary	E	

TCTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5LPITCTX1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Measured and metered values				
ExtPri	MV	Rated ext. primary current In	E	
Settings				
FunEna	SPG	Function enable	E	
OpDlTmms	ING	Operate delay time	E	
NomPri	ASG	LPCT rated primary current	E	

TVTX Voltage transformer
This LN shall be used for protection voltage transformer parameters.

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5UTVTX1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Measured and Metered Values				
Settings				
FunEna	SPG	Function enable	E	
ImbAMinLev	ASG	I2 min. setting	E	
ImbVMaxLev	ASG	U2 max. setting	E	
OpDlTmms	ING	Operate delay time	E	
PriPhs	ASG	VT primary	E	
SecNeut	ASG	VTo secondary	E	
SecPhs	ASG	VT secondary	E	

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5LPUTVTX1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Measured and Metered Values				
ExtPri	MV	Rated ext. primary current In	E	
Settings				
FunEna	SPG	Function enable	E	
PhAMagCor	ASG	VL1 magnitude correction	E	
PhBMagCor	ASG	VL2 magnitude correction	E	
PhCMagCor	ASG	VL3 magnitude correction	E	
PhAAngCor	ASG	VL1 Angle correction	E	
PhBAngCor	ASG	VL2 Angle correction	E	
PhCAngCor	ASG	VL3 Angle correction	E	
VL1yMagCor	ASG	VL1y magnitude correction	E	
VL1yAngCor	ASG	VL1y Angle correction	E	
VL2yMagCor	ASG	VL2y magnitude correction	E	
VL2yAngCor	ASG	VL2y Angle correction	E	
VtTyp	ING	Primary VT type	E	
VtSecAdpt	ASG	VT secondary rated voltage	E	
PhAMagAdpt	ASG	VL1 Adapt magnitude correction	E	

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
PhBMagAdpt	ASG	VL2 Adapt magnitude correction	E	
PhCMagAdpt	ASG	VL3 Adapt magnitude correction	E	
VlSecAdpt	ASG	VTy secondary rated voltage	E	
VL1yMagAdt	ASG	VL1y Adapt magnitude correction	E	

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5LPUTVTX2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	EINS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Measured and Metered Values				
ExtPri	MV	Rated ext. primary current In	E	
Settings				
FunEna	SPG	Function enable	E	
NomPri	ASG	LPVT rated primary voltage	E	
PhAMagCor	ASG	VL1 magnitude correction	E	
PhBMagCor	ASG	VL2 magnitude correction	E	
PhCMagCor	ASG	VL3 magnitude correction	E	
PhAAngCor	ASG	VL1 Angle correction	E	
PhBAngCor	ASG	VL2 Angle correction	E	
PhCAngCor	ASG	VL3 Angle correction	E	
VL1yMagCor	ASG	VL1y magnitude correction	E	
VL1yAngCor	ASG	VL1y Angle correction	E	
VtTyp	ING	Primary VT type	E	
VtSecAdpt	ASG	VT secondary rated voltage	E	
PhAMagAdpt	ASG	VL1 Adapt magnitude correction	E	
PhBMagAdpt	ASG	VL2 Adapt magnitude correction	E	
PhCMagAdpt	ASG	VL3 Adapt magnitude correction	E	
VlSecAdpt	ASG	VTy secondary rated voltage	E	
VL1yMagAdt	ASG	VL1y Adapt magnitude correction	E	

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5LPUTVTX3		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Measured and Metered Values				
ExtPri	MV	Rated ext. primary current In	E	
Settings				
FunEna	SPG	Function enable	E	
NomPri	ASG	LPVT rated primary voltage	E	
PhAMagCor	ASG	VL1 magnitude correction	E	
PhBMagCor	ASG	VL2 magnitude correction	E	
PhCMagCor	ASG	VL3 magnitude correction	E	
PhAAngCor	ASG	VL1 Angle correction	E	
PhBAngCor	ASG	VL2 Angle correction	E	
PhCAngCor	ASG	VL3 Angle correction	E	
VtTyp	ING	Primary VT type	E	
VtSecAdpt	ASG	VT secondary rated voltage	E	
PhAMagAdpt	ASG	VL1 Adapt magnitude correction	E	
PhBMagAdpt	ASG	VL2 Adapt magnitude correction	E	
PhCMagAdpt	ASG	VL3 Adapt magnitude correction	E	
UoSecAdpt	ASG	Uo secondary rated voltage	E	
UoMagAdt	ASG	Uo Adapt magnitude correction	E	

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5LPUTVTX4		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	E	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				

TVTX class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Measured and Metered Values				
ExtPri	MV	Rated ext. primary current In	E	
Settings				
FunEna	SPG	Function enable	E	
NomPri	ASG	LPVT rated primary voltage	E	
PhAMagCor	ASG	VL1 magnitude correction	E	
PhBMagCor	ASG	VL2 magnitude correction	E	
PhCMagCor	ASG	VL3 magnitude correction	E	
PhAAngCor	ASG	VL1 Angle correction	E	
PhBAngCor	ASG	VL2 Angle correction	E	
PhCAngCor	ASG	VL3 Angle correction	E	
VtTyp	ING	Primary VT type	E	
VtSecAdpt	ASG	VT secondary rated voltage	E	
PhAMagAdpt	ASG	VL1 Adapt magnitude correction	E	
PhBMagAdpt	ASG	VL2 Adapt magnitude correction	E	
PhCMagAdpt	ASG	VL3 Adapt magnitude correction	E	

Standardized and extended DO of logical node type

The following table presents a summary of the standardized and extended DO of each Logical Node Type.

LN Type: SE_GAPC_PS_EasergyP5_V001
Description: Generic automatic process control
LN Class: GAPC

GAPC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5PSGAPC1...8		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	O	
Op	ACT	Operate	O	
Settings				
FunEna	SPG	Function enable	E	

LN Type: SE_GGIO_AR_EasergyP5FU_V001
Description: Generic process I/O

LN Class: GGIO

GGIO class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
P5ARGGIO1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Ind1	SPS	AR1 final trip	O	
Ind2	SPS	AR2 final trip	O	
Ind3	SPS	AR3 final trip	O	
Ind4	SPS	AR4 final trip	O	
Ind5	SPS	AR5 final trip	O	
Ind6	SPS	AR6 final trip	O	
Ind7	SPS	AR7 final trip	O	
Ind8	SPS	AR8 final trip	O	
Ind9	SPS	AR9 final trip	O	
Ind10	SPS	AR10 final trip	O	
Ind11	SPS	AR11 final trip	O	
Ind12	SPS	AR12 final trip	O	
Ind13	SPS	AR13 final trip	O	
Ind14	SPS	AR14 final trip	O	
Ind15	SPS	AR15 final trip	O	
Ind16	SPS	AR16 final trip	O	
Ind17	SPS	AR17 final trip	O	
Ind18	SPS	AR18 final trip	O	
Ind19	SPS	AR19 final trip	O	
Settings				
FunEna	SPG	Function enable	E	

LN Type: SE_GGIO_CBWA_EasergyP5FMU_V002
Description: Generic process I/O
LN Class: GGIO

GGIO class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
P5CBWAGGIO1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				

GGIO class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Ind1	SPS	General indication (binary input)	O	
Ind2	SPS	General indication (binary input)	O	
Alm1Phs1	INS	Alarm 1 of Phase 1	E	
Alm1Phs2	INS	Alarm 1 of Phase 2	E	
Alm1Phs3	INS	Alarm 1 of Phase 3	E	
Alm2Phs1	INS	Alarm 2 of Phase 1	E	
Alm2Phs2	INS	Alarm 2 of Phase 2	E	
Alm2Phs3	INS	Alarm 2 of Phase 3	E	
Settings				
FunEna	SPG	Function enable	E	
CBOpenCnt	ING	CB open counter	E	
RackOutCnt	ING	Rack out counter	E	
TripCnt	ING	Protection trip counter	E	
AlmLev1	ASG	Alarm level 1	E	
AlmLev2	ASG	Alarm level 2	E	
LimOpNum1	ASG	Limit for operate left 1	E	
LimOpNum2	ASG	Limit for operate left 2	E	

LN Type: SE_MMXU_VECA_EasergyP5FMU_VSI_V001
Description: Measurement
LN Class: MMXU

MMXU class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5VECAMMXU1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Measured values				
Hz	MV	Frequency	O	
A	WYE	Phase currents (IL1, IL2, IL3)	O	
Iovs	WYE	Residual current Io'	E	

LN Type: SE_PDOP_REVP_EasergyP5FM_V002
Description: Directional overpower
LN Class: PDOP

PDOP class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5REVPPDOP1 P5REVPPDOP2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PDOP_EF_EasergyP5FM_V002
Description: Directional overpower
LN Class: PDOP

PDOP class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5EFPDOP1 P5EFPDOP2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
DirMode	ENG	Direction mode	E	
StrVal	ASG	Pick-up value	M	
UoStrVal	ASG	Uo setting	E	
SctrStrVal	ASG	Pick up sector size	E	
OpDlTms	ASG	Operate delay time	E	
SolMod	SPG	SOL Mode	E	
SolOpDlTms	ASG	SOL operate delay time	E	

PDOP class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
MemMod	ENG	Memory Mode	E	
MmUoStrVal	ASG	Uo setting	E	
MemTms	ASG	Memory time	E	

LN Type: SE_PFRC_DFDT_EasergyP5FV_V002
SE_PFRC_DFDT_EasergyP5U_LPT_V002
Description: Rate of change of frequency
LN Class: PFRC

PFRC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5DFDTPFRC1 P5DFDTPFRC2 P5DFTLPFRC1 P5DFTLPFRC2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
DirChg	ENG	Direction of change	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PIOC_CBFP_EasergyP5FMU_V002
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5CBFPPIOC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Str	ACD	Start	O	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
NeutStrVal	ASG	Undercurrent threshold for earth fault current	E	
PhsStrVal	ASG	Undercurrent threshold for phase current	E	
Tm1DlTms	ASG	Timer1 operate delay time	E	
Tm1Ena	SPG	Enable CBF timer1	E	
Tm2DlTms	ASG	Timer2 operate delay time	E	
Tm2Ena	SPG	Enable CBF timer2	E	

LN Type: SE_PIOC_CBFP_EasergyP5V_V002
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5CBFPPIOC2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	O	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
Tm1DlTms	ASG	Timer1 operate delay time	E	
Tm1Ena	SPG	Enable CBF timer1	E	
Tm2DlTms	ASG	Timer2 operate delay time	E	
Tm2Ena	SPG	Enable CBF timer2	E	

LN Type: SE_PIOC_CBFP_EasergyP5FMU_VSI_V001
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5CBFPPIOC3		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	O	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
NeutStrVal	ASG	Undercurrent threshold for earth fault current	E	
PhsStrVal	ASG	Undercurrent threshold for phase current	E	
IovsStrVal	ASG	Io'< current set	E	
Tm1DlTms	ASG	Timer1 operate delay time	E	
Tm1Ena	SPG	Enable CBF timer1	E	
Tm2DlTms	ASG	Timer2 operate delay time	E	
Tm2Ena	SPG	Enable CBF timer2	E	

LN Type: SE_PIOC_ARCM_EasergyP5FM_ARC_V001
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5ARCMPIOC1…8		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
MinOpTmms	ING	Min. hold time [x1ms]	E	

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
OpDlTmms	ING	Trip X delay [x1ms]	E	
OpMode	ENG	Arc stage X Mode	E	

LN Type: SE_PIOC_CLP_EasergyP5FMU_V001
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5CLPPIOC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
Idl	ASG	Idle current	E	
StrVal	ASG	Pickup current	O	
DeadTms	ASG	CLPU dead time	E	
MaxTms	ASG	Maximum time	E	

LN Type: SE_PIOC_SOL_EasergyP5FMU_V001
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5SOLPIOC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Op	ACT	Operate	M	
Oprt2	ACT	2nd Operate	E	
Settings				

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
FunEna	SPG	Function enable	E	
SigNum	ENG	SOL signal number	E	
CbClrTms	ASG	CB trip clearing time	E	

LN Type: SE_PIOC_SOTF_EasergyP5FMU_V001
Description: Instantaneous overcurrent
LN Class: PIOC

PIOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5SOTFPIOC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Enable for SOTF	E	
StrVal	ASG	Pick-up value	O	
DetDlTms	ASG	Dead line detection delay	E	
ActTmrTms	ASG	SOTF active Timer	E	

LN Type: SE_PMRI_MOTFST_EasergyP5MU_V003
Description: Motor restart inhibition
LN Class: PMRI

PMRI class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5FSTPMRI1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Op	ACT	Operate	O	
StrInh	SPS	Restart inhibited	O	
Settings				

PMRI class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
MaxWrmStr	ING	Maximum warm starts, permissible number of warm starts	O	
MinStrTmm	ASG	Min time between motor starts	E	
HotSttsLmt	ASG	Hot Status Limit	E	
FunEna	SPG	Function enable	E	
MaxCldStr	ING	Max motor cold starts/hour	E	
RefPrdTmm	ASG	Reference period	E	

LN Type: SE_PMSS_STAL_EasergyP5MU_V001
Description: Motor starting time supervision
LN Class: PMSS

PMSS class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
P5STALPMSS1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	O	
Op	ACT	Operate	O	
Settings				
SetA	ASG	Current setting for motor start-up	O	
SetTms	ING	Time setting for motor start-up	O	
MotStr	ASG	Motor startup (current pickup value of motor starting)	O	
FunEna	SPG	Function enable	E	
TmACrv	CURVE	Characteristics for Ist>	E	

LN Type: SE_PMSS_MSPD_EasergyP5MU_V001
Description: Motor starting time supervision
LN Class: PMSS

PMSS class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
P5MSPDPMSS1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	

PMSS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
ZerSpdSt	SPS	Zero speed	E	
MotSpd	INS	Motor speed	E	
Settings				
FunEna	SPG	Function enable	E	
SpdIn	ENG	Motor speed input DI	E	
RtdMotSpd	ASG	Rated motor speed	E	
PlsRot	ASG	Pulse per rotation	E	
ZerSpdTms	ASG	Zero speed delay	E	

LN Type: SE_PMSS_MABS_EasergyP5MU_V001
Description: Motor starting time supervision
LN Class: PMSS

PMSS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5MABSPMSS1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
AbsAlm	SPS	Anti-backspin Alarm	E	
Settings				
FunEna	SPG	Function enable	E	
MvMod	SPG	Measured Zero Speed Mode	E	
SwMod	SPG	Zero Speed Switch Mode	E	
AbsTms	ASG	Anti-backspin Delay	E	

LN Type: SE_PMSS_51LR_EasergyP5MU_V001
Description: Motor starting time supervision
LN Class: PMSS

PMSS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5LRPMSS1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				

PMSS class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	O	
Op	ACT	Operate	O	
Settings				
SetA	ASG	Pick-up value	O	
FunEna	SPG	Function enable	E	
DlTyp	ENG	Delay type	E	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTEF_IO_EasergyP5F_V002
Description: Transient earth fault
LN Class: PTEF

PTEF class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5IOIOPTEF1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	C	
Op	ACT	Operate	C	
Settings				
FunEna	SPG	Function enable	E	
DirMode	ENG	Direction mode	E	
GndStr	ASG	Uo pick-up	O	
OpDlTms	ASG	Operate delay time	E	
MinPeak	ING	Min number of peaks	E	
RsDlTms	ASG	Reset delay	E	
Condition C: at least one of the two status information (Str, Op) shall be used.				

LN Type: SE_PTOC_STRVAL_EasergyP5FMU_V002
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5HAR5PTOC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
StrVal	ASG	Start value	O	
OpDlTmms	ING	Operate delay time	O	
FunEna	SPG	Function enable	E	

LN Type: SE_PTOC_UIBC_EasergyP5FMU_V002
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5UIBCPTOC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Start value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTOC_EasergyP5FMU_VSI_V002
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5EFVSPTOC1 P5EFVSPTOC2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
DlCrvFmly	ENG	Delay curve family	E	
DlTyp	ENG	Delay type	E	
OpDlTms	ASG	Operate delay time	E	
TmMult	ASG	Inv. time coefficient	O	
RsTyp	ENG	Reset type	E	
RsDlTms	ASG	Reset time	E	
InrushStat	SPG	Inrush status	E	
SolStat	SPG	SOL status	E	
SolOpDTms	ASG	SOL operate delay time	E	
SolTmMult	ASG	SOL Inv. time coefficient	E	
ClpStat	SPG	CLP status	E	
ClpStrVal	ASG	CLP pick-up value	E	
ClpOpDTms	ASG	CLP operate delay time	E	
ClpTmMult	ASG	CLP Inv. time coefficient	E	
NetGrd	ENG	Network grounding	E	

LN Type: SE_PTOC_NORMAL_EasergyP5FMU_V002
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5OCPTOC1 P5OCPTOC2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
DlCrvFmly	ENG	Delay curve family	E	
DlTyp	ENG	Delay type	E	
OpDlTms	ASG	Operate delay time	E	
TmMult	ASG	Inv. time coefficient	O	
RsTyp	ENG	Reset type	E	
RsDlTms	ASG	Reset time	E	
InrushStat	SPG	Inrush status	E	
SolStat	SPG	SOL status	E	
SolOpDTms	ASG	SOL operate delay time	E	
SolTmMult	ASG	SOL Inv. time coefficient	E	
ClpStat	SPG	CLP status	E	
ClpStrVal	ASG	CLP pick-up value	E	
ClpOpDTms	ASG	CLP operate delay time	E	
ClpTmMult	ASG	CLP Inv. time coefficient	E	

LN Type: SE_PTOC_EasergyP5FM_V002
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5DEFPTOC1 P5DEFPTOC2 P5DEFPTOC3		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
DirMode	ENG	Direction mode	E	

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
StrVal	ASG	Pick-up value	O	
UoStrVal	ASG	Uo setting	E	
AngOffset	ASG	Angle offset	E	
SctrStrVal	ASG	Pick up sector size	E	
DlCrvFmly	ENG	Delay curve family	E	
DlTyp	ENG	Delay type	E	
OpDlTms	ASG	Operate delay time	E	
TmMult	ASG	Inv. time coefficient	O	
RsTyp	ENG	Reset type	E	
RsDlTms	ASG	Reset time	E	

LN Type: SE_PTOC_EasergyP5U_LPT_V002
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5DOCLPTOC1 P5DOCLPTOC2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
DirMode	ENG	Direction mode	E	
AngOffset	ASG	Angle offset	E	
DlCrvFmly	ENG	Delay curve family	E	
DlTyp	ENG	Delay type	E	
OpDlTms	ASG	Operate delay time	E	
TmMult	ASG	Inv. time coefficient	O	
RsTyp	ENG	Reset type	E	
RsDlTms	ASG	Reset time	E	
InrushStat	SPG	Inrush status	E	
SolStat	SPG	SOL status	E	
SolOpDTms	ASG	SOL operate delay time	E	

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
SolTmMult	ASG	SOL Inv. time coefficient	E	
ClpStat	SPG	CLP status	E	
ClpStrVal	ASG	CLP pick-up value	E	
ClpOpDTms	ASG	CLP operate delay time	E	
ClpTmMult	ASG	CLP Inv. time coefficient	E	

LN Type: SE_PTOC_DOC2_EasergyP5U_LPT_V001
Description: Time overcurrent
LN Class: PTOC

PTOC class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5DOCLPTOC3 P5DOCLPTOC4		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
DirMode	ENG	Direction mode	E	
AngOffset	ASG	Angle offset	E	
OpDlTms	ASG	Operate delay time	E	
InrushStat	SPG	Inrush status	E	
SolStat	SPG	SOL status	E	
SolOpDTms	ASG	SOL operate delay time	E	
ClpStat	SPG	CLP status	E	
ClpStrVal	ASG	CLP pick-up value	E	
ClpOpDTms	ASG	CLP operate delay time	E	

LN Type: SE_PTOF_OFUF_EasergyP5FMV_V00V002/
SE_PTOF_OFUF_EasergyP5U_LPT_V002
Description: Overfrequency
LN Class: PTOF

PTOF class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5OFUFPTOF1 P5OFUFPTOF2 P5LPTPTOF1 P5LPTPTOF2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTOV_EasergyP5FMV_V002/
SE_PTOV_EasergyP5U_LPT_V001
Description: Overvoltage
LN Class: PTOV

PTOV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5OVPTOV1 P5OVPTOV2 P5OVPTOV3 P5OVLPTOV1 P5OVLPTOV2 P5OVLPTOV3		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	O	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTOV_UO_EasergyP5FMV_V001/
SE_PTOV_UO_EasergyP5U_LPT_V001
Description: Overvoltage

LN Class: PTOV

PTOV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5UOPTOV1 P5UOPTOV2 P5UOPTOV3 P5UOLPTOV1 P5UOLPTOV2 P5UOLPTOV3		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	O	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	
RsDlTms	ASG	Reset time	E	

LN Type: SE_PTOV_NEG_EasergyP5FMV_V001/ SE_PTOV_NEG_EasergyP5U_LPT_V001
Description: Overvoltage
LN Class: PTOV

PTOV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5NEGPTOV1 P5NEGPTOV2 P5NEGLPTOV1 P5NEGLPTOV2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	O	
Settings				
FunEna	SPG	Function enable	E	
OpMod	ENG	Operate mode	E	
StrVal	ASG	Pick-up value	O	

PTOV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
DlTyp	ENG	Delay type	E	
OpDlTms	ASG	Operate delay time	E	
RsDlTms	ASG	Reset time	E	

LN Type: SE_PTOV_CAP_EasergyP5F_V001
Description: Overvoltage
LN Class: PTOV

PTOV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5CAPPTOV1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	O	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
CapOfPhs	ASG	L-N capacitance of one phase	E	
RatUcLn	ASG	Rated L-N voltage UcLN	E	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTTR_THF_EasergyP5FU_V002
Description: Thermal overload
LN Class: PTTR

PTTR class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5THFPTTR1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				

PTTR class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Op	ACT	Operate	M	
AlmThm	SPS	Thermal alarm	O	
Settings				
TmpMax	ASG	Max object temperature	O	
AlmVal	ASG	Thermal alarm value	O	
FunEna	SPS	Function enable	E	
BasicCur	ASG	Basic current setting	E	
FactorK	ASG	Factor k	E	
HeaConsTmm	ASG	Heating time constant	O	
RsvVal	ASG	Reserve time thermal alarm	E	
TmpMod	ENG	Temperature based mode	E	
TmpNom	ASG	Nominal ambient temp	E	
TmpAlrm	ASG	Alarm temperature	E	
TmpAmbMin	ASG	Min ambient temperature	E	
TmpAmbDft	ASG	Default ambient temperature	E	

LN Type: SE_PTTR_THM_EasergyP5MU_V002
Description: Thermal overload
LN Class: PTTR

PTTR class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5THMPTTR1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Op	ACT	Operate	M	
AlmThm	SPS	Thermal alarm	O	
Settings				
TmpMax	ASG	Max object temperature	O	
AlmVal	ASG	Thermal alarm value	O	
FunEna	SPS	Function enable	E	
BasicCur	ASG	Basic current setting	E	
FactorK	ASG	Factor k	E	
HeaConsTmm	ASG	Heating time constant	E	
ConsTmm	ASG	Time constant for motor starting	E	
CooConsTmm	ASG	Cooling time constant	E	
UnblFctr	ASG	Unbalance factor	E	

PTTR class				
Data object name	Common data class	Explanation	M/O/ C/E	Remarks
RsvVal	ASG	Reserve time thermal alarm	E	
TmpMod	ENG	Temperature based mode	E	
TmpNom	ASG	Nominal ambient temp	E	
TmpAlrm	ASG	Alarm temperature	E	
TmpAmbMin	ASG	Min ambient temperature	E	
TmpAmbDft	ASG	Default ambient temperature	E	

LN Type: SE_PTUC_UC_EasergyP5MU_V002
Description: Undercurrent
LN Class: PTUC

PTUC class				
Data object name	Common data class	Explanation	M/O/ C/E	Remarks
P5UCPTUC1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTUF_UF_EasergyP5FMV_V002/SE_PTUF_UF_EasergyP5U_LPT_V002
Description: Underfrequency
LN Class: PTUF

PTUF class				
Data object name	Common data class	Explanation	M/O/ C/E	Remarks
P5UFPTUF1 P5UFPTUF2 P5UFLPTUF1 P5UFLPTUF2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	

PTUF class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTUV_UV_EasergyP5FMV_V002/ SE_PTUV_UV_EasergyP5U_LPT_V002
Description: Undervoltage
LN Class: PTUV

PTUV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5UVPTUV1 P5UVPTUV2 P5UVPTUV3 P5UVLPTUV1 P5UVLPTUV2 P5UVLPTUV3		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PTUV_UVPS_EasergyP5MV_V002
Description: Undervoltage
LN Class: PTUV

PTUV class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
P5UVPSPTUV1 P5UVPSPTUV2		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only

PTUV class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PZSU_EasergyP5MU_V001
Description: Motor underspeed
LN Class: PZSU

PZSU class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
P5MOTPZSU1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start	M	
Op	ACT	Operate	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pick-up value	O	
OpDlTms	ASG	Operate delay time	E	

LN Type: SE_PHAR_ID_EasergyP5FMU_V001
Description: Harmonic restraint
LN Class: PHAR

PHAR class				
Data object name	**Common data class**	**Explanation**	**M/O/C/E**	**Remarks**
P5IDPHAR1		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.	M	
Data Objects				
Common Logical Node Information				
Mod	ENC	Mode	C1	Status-only

PHAR class				
Data object name	**Common data class**	**Explanation**	**M/O/ C/E**	**Remarks**
Beh	ENS	Behaviour	M	
Health	ENS	Health	C1	
NamPlt	LPL	Name plate	C1	
Status Information				
Str	ACD	Start (active when restraint is needed)	M	
Settings				
FunEna	SPG	Function enable	E	
StrVal	ASG	Pickup for 2nd harmonic	E	
CurBlkVal	ASG	Max inrush current	E	

Enum types extensions

New Enum types

Enum type ARCOpMode is one of new added types defined as below.

Value	Description	Remarks
0	Light	
1	Light and current	

Enum type DefDirMode is one of new added types defined as below.

Value	Description	Remarks
0	ResCap	
1	Sector	
2	Undir	

Enum type DocDirMode is one of new added types defined as below.

Value	Description	Remarks
0	Dir_Backup	
1	Undir	
2	Dir	

Enum type DICrvFamily is one of new added types defined as below.

Value	Description	Remarks
0	DT	
1	IEC	
2	IEEE	
3	IEEE2	
4	Others	
5	Prg1	
6	Prg2	
7	Prg3	

Enum type RsTyp is one of new added types defined as below.

Value	Description	Remarks
0	DT	
1	IDMT	

Enum type DIType is one of new added types defined as below.

Value	Description	Remarks
0	DT	
1	NI	
2	VI	
3	EI	
4	LTI	
5	LTEI	
6	LTVI	
7	MI	
8	STI	
9	STEI	
10	CO8	
11	RI	
12	RXIDG	
13	—	

Enum type NetGrd is one of new added types defined as below.

Value	Description	Remarks
0	Res	
1	Cap	

Enum type NegOPMod is one of new added type defined as below.

Value	Description	Remarks
0	No_Action	
1	Blocking	

Enum type NegDITyp is one of new added type defined as below.

Value	Description	Remarks
0	DT	
1	INV	

Enum type StrMod is one of new added type defined as below.

Value	Description	Remarks
0	Negative	
1	Positive	
2	Either	

Enum type MemoryMode is one of new added types defined as below.

Value	Description	Remarks
0	None	
1	Voltage	

2	Time	
3	Both	

Enum type EfDirModeKind is one of new added type defined as below.

Value	Description	Remarks
0	Forward	
1	Reverse	

Enum type SlotDISelect is one of new added type defined as below.

Value	Description	Remarks
0	Slot_C_DI1	
1	Slot_D_DI1	
2	Slot_E_DI1	

Enum type VTTypeKind is one of new added type defined as below.

Value	Description	Remarks
0	VT	
1	LPVT	

Enum type TempModKind is one of new added type defined as below.

Value	Description	Remarks
0	Current	
1	Ambient	

Enum type PadmDirMod is one of new added type defined as below.

Value	Description	Remarks
0	Undir	
1	Forward	
2	Reverse	

Enum type SignalNum is one of new added type defined as below.

Value	Description	Remarks
0	1	
1	2	

Extended Enum types

Enum type SIUnitKind is extended by the following enumerations.

Value	Quantity	Unit name	Symbol
-6	Numerical tagging method	per unit	pu
-7	Percent	percent	%
-8	Relative temperature	degree Fahrenheit	°F
-9	Electric resistance	ohm (V/A)	V/A
-10	Rotational speed	Revolutions per minute	rmp
-11	Pulse per rotation	Pulse per rotation	/R

Enum type AutoReclosingKind is extended by the following enumerations.

Value	Symbol
-1	Reclaim
-2	Ready_Ext
-3	WaitOpen
-4	WaitClose
-5	Discrim
-6	Locked
-7	FinalTr
-8	CBFail
-9	Inhibit
-10	Blocked
-11	ExtOpen
-12	ExClose
-13	WaitSync

PIXIT details

Introduction

This PIXIT is based upon UCAIug PIXIT Template version 15, UCA International Users Group Testing Sub Committee, October 22, 2019.

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in P5U20, P5V20, P5F30, P5M30, with firmware version V01.

Together with the PICS and the MICS the PIXIT document forms the basis for a conformance test according to IEC 61850-10. The PIXIT entries contain information which is not available in the PICS, MICS, TICS documents or SCL file.

Each chapter specifies the PIXIT for applicable ACSI service model as structured in IEC 61850-10. The “Ed” column indicates if the entry is applicable for IEC 61850 Edition 1 and/or Edition 2.

PIXIT for documentation

ID	Ed	Description	Value / Clarification
Do1	2	How to expose required firmware versions not present in the data model	Information included in the ICD file and in the data model (LLN0.NamePlt.swRev)

PIXIT for association model

The extra information for testing is given in the table below.

Table 71 - Protocol implementation extra information for testing

ID	Ed	Description	Value / Clarification
As1	1	Maximum number of clients that can set-up an association simultaneously	8
As2	1,2	TCP_KEEPALIVE value. The recommended range is 0…20s	Configurable: from 0 to 20s
As3	1,2	Lost connection detection time	TCP_KEEPALIVE + 2s *10 Maximum 140s (2s is retransmission interval of TCP Keep-alive message, 10 retransmissions) (0 means 120s)
As4	-	Authentication is not supported yet	
As5	1,2	What association parameters are necessary for successful association	Transport selector Calling: N Called: Y Session selector Calling: N Called: Y Presentation selector Calling: N Called: Y AP title Calling: N Called: N AE qualifier Calling: N Called: N
As6	1,2	If association parameters are necessary for association, describe the correct values. Association parameters are configurable, default values are	Transport selector 1 Session selector 1 Presentation selector 1 AP title 1,1,1,999,1

Table 71 - Protocol implementation extra information for testing (Continued)

ID	Ed	Description	Value / Clarification
			AE qualifier 12
As7	1,2	What is the maximum and minimum MMS PDU size	Max: 65535 bytes Min: In initiate request 1024 bytes
As8	1,2	What is the maximum start up time after a power supply interrupt	P5 relay start-up time including the server function is at average 180s; it depends on the configuration size (number and types of logical nodes)
As9	1,2	Does this device function only as test equipment? (test equipment need not have a non-volatile configuration; but it cannot be part of the substation automation system)	N

PIXIT for server model

ID	Ed	Description	Value / Clarification
Sr1	1,2	Which analogue value (MX) quality bits are supported (can be set by server)	Validity: Y Good, N Invalid, N Reserved, N Questionable N Overflow N OutofRange N BadReference N Oscillatory N Failure N OldData N Inconsistent N Inaccurate Source: Y Process N Substituted Y Test N OperatorBlocked
Sr2	1,2	Which status value (ST) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, Y Questionable N BadReference N Oscillatory N Failure Y OldData N Inconsistent N Inaccurate Source: Y Process N Substituted Y Test N OperatorBlocked
Sr3	-	What is the maximum number of data object references in one GetDataValues request	Deprecated
Sr4	-	What is the maximum number of data object references in one SetDataValues request	Deprecated
Sr5	1	Which Mode values are supported	On Y [On-]Blocked N Test Y Test/Blocked Y Off N

PIXIT for data set model

ID	Ed	Description	Details
Ds1	1	What is the maximum number of data elements in one data set (compare ICD setting)	500
Ds2	1	How many persistent data sets can be created by one or more clients (this number includes predefined data sets)	50
Ds3	1	How many non-persistent data sets can be created by one or more clients	50

NOTE: Arrays are not supported in dataset.

PIXIT for setting group control model

ID	Ed	Description	Value / Clarification
Sg1	1	What is the number of supported setting groups for each logical device	4
Sg2	1,2	What is the effect of when and how the non-volatile storage is updated (compare IEC 61850-8-1 $16.2.4)	When: CnfEdit set to TRUE successfully. How: the setting value in edit buffer will be copied to the selected setting group, and then the new value will be updated to non-volatile storage by setting engine.
Sg3	1	Can multiple clients edit the same setting group	N
Sg4	1	What happens if the association is lost while editing a setting group	The SE values changes are lost, the EditSG value will not change.
Sg5	1	Is EditSG value 0 allowed	Y Write a value of 0 to EditSG will cancel all the setting values in the Edit buffer.
Sg6	2	When ResvTms is not present how long is an edit setting group locked	Reserved forever except Cancel, Confirm or Disconnection.

PIXIT for reporting model

ID	Ed	Description	Details	
Rp1	1	The supported trigger conditions (compare PICS)	integrity	Y
			data change	Y
			quality change	Y
			data update	Y
			general interrogation	Y
Rp2	1	The supported optional fields are	sequence-number	Y
			report-time-stamp	Y
			reason-for-inclusion	Y
			data-set-name	Y
			data-reference	Y
			buffer-overflow (not applicable to URCB)	Y

ID	Ed	Description	Details	
			entryID (not applicable to URCB)	Y
			conf-rev	Y
			segmentation	Y
Rp3	1,2	Can the server send segmented reports? (when not supported the device shall refuse an association request with a smaller than minimum PDU size)	Y	
Rp4	1,2	Mechanism on second internal data change notification of the same analogue data value within buffer period (compare IEC 61850-7-2 $14.2.2.9)	Send report immediately	
Rp5	1	Multi client URCB approach (compare IEC 61850-7-2 $14.2.1)	Each URCB is visible to all clients	
Rp6	-	What is the format of EntryID	Deprecated	
Rp7	1,2	What is the buffer size for each BRCB or how many reports can be buffered	100k bytes per report control block	
Rp8	-	Pre-configured RCB attributes that are dynamic, compare SCL report settings	Deprecated	
Rp9	1	May the reported data set contain: - structured data objects? - data attributes?	Y Y	
Rp10	1,2	What is the scan cycle for binary events? Is this fixed, configurable or event-driven	5 milliseconds Fixed	
Rp11	1	Does the device support to pre-assign a RCB to a specific client in the SCL	N	
Rp12	2	After restart of the server is the value of ConfRev restored from the original configuration or retained prior to restart	from the original configuration	
Rp13	1,2	Does the server accept any client to configure / enable a BRCB with ResvTms=-1? What fields are used to do the identification?	N	
Rp14	2	When BRCB.ResvTms is exposed, what is default value for BRCB.ResvTms if client does not write (must be > 0) or When BRCB.ResvTms is not exposed, what is the internal reservation time (must be >= 0)	1s 1s	

PIXIT for GOOSE publish model

ID	Ed	Description	Value / Clarification
Gp1	1,2	Can the test (Ed1) / simulation (Ed2) flag in the published GOOSE be set	N
Gp2	1	What is the behavior when the GOOSE publish configuration is incorrect	NdsCom=T DUT keeps GoEna=F
Gp3	1,2	Published FCD supported common data classes / data types are	Common data classes: SPS, DPC, CMV, MV Data types as single attributes: BOOLEAN, CODED ENUM, FLOAT32, QUALITY Arrays are not supported.
Gp4	1,2	What is the maximum value of TAL (maxTime) Is it fixed or configurable	Maximum TAL = 120000 ms (double of maximum configurable slowest retransmission cycle 60000 ms) Configurable by configuration tool
Gp5	1,2	What is the fastest retransmission time Is it fixed or configurable	4 ms Retransmission scheme: First message upon data change, followed by 4, 10, 20, 40, 80, 160, 320, 640, 1280, 2500, 5000, 10000, 20000, 40000, 60000 and finally reaching the configured slow retransmission time). TAL is set to value 2 times bigger than interval. Fixed
Gp6	-	Can the GOOSE publish be turned on / off by using SetGoCBValues(GoEna)	Deprecated
Gp7	1,2	What is initial GOOSE sqNum after restart of the device	1
Gp8	1	May the GOOSE data set contain: - structured data objects (FCD) - timestamp data attributes	 Y Y
Gp9	1,2	Does Server or ICT check GOOSE payload data set length	Y

PIXIT for GOOSE subscribe model

ID	Ed	Description	Value / Clarification
Gs1	1,2	What elements of a subscribed GOOSE message are checked to decide the message is valid and the allData values are accepted? If yes, describe the conditions. Notes: • the VLAN tag may be removed by a ethernet switch and shall not be checked • the simulation flag shall always be checked (Ed2)	Y destination MAC address (equal to configured) Y APPID (equal to configured) N gocbRef N timeAllowedtoLive (see Remarks) N datSet Y goID (equal to configured, checking can be set off) N t Y stNum (see Remarks) N sqNum (see Remarks) Y simulation/test (if true, values not passed to application, the application data will keep last received value when simulation/test was false, but status of the network input stays valid) Y confRev (equal to configured) Y ndsCom (if true, values not passed to application, the application data will keep last received value , and network inputs status is set to invalid as if message was never received) Y numDatSetEntries (see Remarks) N out-of-order dataset members
Gs2	1,2	When is a subscribed GOOSE marked as lost (TAL = time allowed to live value from the last received GOOSE message)	Message does not arrive by TAL+1s Internally in the relay there is a status indication to the application about GOOSE problem (data is marked as OLD if the message does not arrive prior to TAL+1s if TAL>1s or prior to 1s if TAL<1s).
Gs3	1,2	What is the behavior when one or more subscribed GOOSE messages isn't received or syntactically incorrect (missing GOOSE)	The subsequently received GOOSE message is accepted even if the new state number is not equal to the incremented value of the previously received state number (it is enough that it is not equal to the last received state number).
Gs4	1,2	What is the behavior when a subscribed GOOSE message is out-of-order	Message is treated as normal (it is assumed that previous messages have been lost).
Gs5	1,2	What is the behavior when a subscribed GOOSE message is duplicated	Duplicated message is ignored
Gs6	1	Does the device subscribe to GOOSE messages with/without the VLAN tag	Y with the VLAN tag Y without the VLAN tag
Gs7	1	May the GOOSE data set contain: - structured data objects - data attributes	Y Y
Gs8	1,2	Subscribed FCD supported common data classes / data types are	Data classes: SPS, SPC, DPS, DPC, INS, INC, ENS, ENC, CMV, MV Data types as single attributes: BOOLEAN, INT8, INT16, INT32, INT8U, INT16U, INT32U, ENUM, CODED ENUM, BITSTRING, FLOAT32 Arrays are not supported
Gs9	1,2	Are subscribed GOOSE with test=T (Ed1) /	N - Simulation mode is not supported by the device

ID	Ed	Description	Value / Clarification
		simulation=T (Ed2) accepted in test/ simulation mode	
Gs10	1,2	Max number of dataset members	Unlimited
Gs11	1	Is Fixed-length encoded GOOSE supported	Y

TAL = Time Allowed to Live

Remarks:

A GOOSE message will be accepted and processed by the subscriber in DUT:

- Even if it is received after expiration of the time allowed to live sent in the previous message,
- Even if the new state number is not equal to the incremented value of the previously received state number - it is enough that it is not equal to the last received state number,
- If the state number differs from the previously received state number, the sequence number is accepted with any value (if the state number is equal to the previously received state number, the message is treated as retransmission),
- Even if the received message contains a dataset of the size different than the size of the previously received dataset.

A GOOSE message will NOT be accepted by the subscriber in DUT if:

- Destination MAC address is not equal to configured one
- Protocol ID is not equal to 0x88B8
- APPID is not equal to configured one for any of the network inputs
- ConfRev is not equal to configured one for any of the network inputs
- goID is not equal to configured one for any of the network inputs
- state number is the same as in the previous message (is treated as retransmission)
- ndsCom bit is set to true in received message

Note for sGosN6h (out of order dataset):

Value from GOOSE message will be accepted even if the type is different than in previous message given that:

- Type is compatible with network input type i.e. for binary network inputs accepted types are: BOOLEAN, INTEGER and BITSTRIG, ENUM, CODED ENUM for analog network inputs accepted types are FLOAT32 and INTEGER
- In case of binary network input and types other than BOOLEAN as a value for processing bit selected in configuration will be taken from the received data in the message (by default it is bit 0)
- Value will not be accepted if data from the message is not containing configured bit (for example if bit 5 is configured and received data contains only 2 bits like stVal from DPC type)

Every network input can be associated via internal logic with one of 16 validity indications. If given network input is not received due to one of the reasons mentioned above this indication is activated. Validity flag for the network input will be activated also if next message with the value will not be received within the time indicated in **time to live** field contained in the previous message.

The value of numDatSetEntries from the header determines how many data entries from the message are processed. With numDatSetEntries = 0 no data entries are processed from the received message. If numDatSetEntries is lower than expected (source information for some network inputs is not processed or missing) those missing network inputs will be marked as invalid.

During device startup there can be more than one state transition of the GOOSE publisher dataset, since different parts of the relay application will start after GOOSE publisher.

When checking GoID, the APPID must not be the same as the APPID of other GOOSE.

PIXIT for GOOSE performance

ID	Ed	Description	Value / Clarification	
Gf1	1,2	Performance class	P2	
Gf2	1,2	GOOSE ping-pong processing method	Scan cycle based	
Gf3	1,2	Application logic scan cycle (ms)	Max.	3 ms for SPS, 10 ms for DPS
			Min.	0 ms for SPS, 0 ms for DPS
Gf4	1	Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes)	500	

PIXIT for control model

ID	Ed	Description	Value / Clarification
Ct1	1	What control models are supported (compare PICS)	DOns: Y SBOns: Y DOes: Y SBOes: Y
Ct2	1,2	Is the control model fixed, configurable and/ or dynamic?	Configurable for CSWI class: All controllable objects Obj1 … Obj6 under CSWI class are configured to use **one and the same** chosen control model. Objects Obj7 … Obj8 under CSWI class have fixed control model status-only. Fixed for GGIO: All controllable objects under GGIO class the control model is fixed: direct-with-normal-security.
Ct3	-	Is TimeActivatedOperate supported (compare PICS or SCL)	Deprecated
Ct4	-	Is “operate-many” supported (compare sboClass)	Deprecated
Ct5	1	Will the DUT activate the control output when the test attribute is set in the SelectWithValue and/or Operate request (when N test procedure Ctl2 is applicable)	N
Ct6	-	What are the conditions for the time (T) attribute in the SelectWithValue and/or Operate request	Deprecated
Ct7	-	Is pulse configuration supported (compare pulseConfig)	Deprecated
Ct8	1	What is the behavior of the DUT when the check conditions are set	N synchrocheck N interlock-check DUT ignores the check value and the command is executed as usual

ID	Ed	Description	Value / Clarification
		Is this behavior fixed, configurable, online changeable?	Fixed
Ct9	1,2	Which additional cause diagnosis are supported	N Unknown Y Not-supported Y Blocked-by-switching-hierarchy N Select-failed Y Invalid-position Y Position-reached N Step-limit Y Blocked-by-Mode N Blocked-by-process N Blocked-by-interlocking N Blocked-by-synchrocheck Y Command-already-in-execution N Blocked-by-health N 1-of-n-control N Abortion-by-cancel Y Time-limit-over N Abortion-by-trip Y Object-not-selected Y Object-already-selected N No-access-authority N Ended-with-overshoot N Abortion-due-to-deviation N Abortion-by-communication-loss N Blocked-by-command N None Y Inconsistent-parameters Y Locked-by-other-client N Parameter-change-in-execution
Ct10	1,2	How to force a “test-not-ok” respond with SelectWithValue request?	Put device into local mode
Ct11	1,2	How to force a “test-not-ok” respond with Select request?	Put device into local mode
Ct12	1,2	How to force a “test-not-ok” respond with Operate request?	DOns: Operate with orCat out of range SBOns: Operate without Select DOes: Operate with orCat out of range SBOes: Operate without Select
Ct13	1,2	Which origin categories are supported/accepted?	Y bay-control Y station-control Y remote-control Y automatic-bay

ID	Ed	Description	Value / Clarification
			Y automatic-station Y automatic-remote Y maintenance Y process
Ct14	1,2	What happens if the orCat is not supported or invalid	DOns: Negative response SBOns: Negative response DOes: Negative response (with additional cause diagnosis code value Not-supported) SBOes: Negative response (with additional cause diagnosis code value Not-supported)
Ct15	1,2	Does the IED accept a SelectWithValue/ Operate with the same control value as the current status value? Is this behavior configurable?	DOns: N SBOns: N DOes: N Addcause: Position-reached SBOes: N Addcause: Position-reached Configurable: N
Ct16	1	Does the IED accept a select/operate on the same control object from 2 different clients at the same time?	DOns: Y (see Remarks) SBOns: N DOes: N SBOes: N
Ct17	1	Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (tissue 334)	SBOns: N SBOes: N
Ct18	1	Is for SBOes the internal validation performed during the SelectWithValue and/or Operate step?	Y During SelectWithValue and during Operate
Ct19	-	Can a control operation be blocked by Mod=Off or [On-]Blocked (compare PIXIT Sr5)	Deprecated
Ct20	1,2	Does the IED support local / remote operation?	Y
Ct21	1,2	Does the IED send an InformationReport with LastApplError as part of the Operate response-for control with normal security?	SBOns: N DOns: N
Ct22	2	How to force a “parameter-change-in-execution”	SBOns: N/A SBOes: N/A
Ct23	1,2	How many SBOns/ SBOes control objects can be selected at the same time?	SBOns: 1 SBOes: 1
Ct24	1,2	Can a controllable object be forced to keep its old state e.g. Internal Controllable Objects may not be accessible to force this, whereas a switch like Circuit Breaker outside the DUT can?	Y

ID	Ed	Description	Value / Clarification
Ct25	1,2	When CDC=DPC is supported, is it possible to have DPC (Controllable Double Point) go to the intermediate state? (00)	Y
Ct26	1,2	Name a DOes point (if any) with a finite operate timeout and specify the timeout (in milliseconds)	Relay/Obj1CSWI1.Pos Operate timeout can be configured by setting Configuration Tool, the range is 0.02 ... 600 s. For example: DOes: 10000 ms SBOes: 10000 ms
Ct27	2	Does the IED support control objects with external signals?	DOns: Y SBOns: Y DOes: Y SBOes: Y
Ct_ex1		SBO Timeout	60 seconds

NOTE: In DOns model: When two clients send Operate request within a very short interval (under 100 ms) then for processing the second command the object position is still unchanged due to the first command, thus both clients receive positive Operate response.

PIXIT for time synchronization

ID	Ed	Description	Value / Clarification
Tm1	1	What time quality bits are supported (may be set by the IED) Ed.2 requires all 3 bits	Y LeapSecondsKnown Y ClockFailure Y ClockNotSynchronized
Tm2	1,2	Describe the behaviour when the time server(s) ceases to respond What is the time server lost detection time	Time is taken from internal RTC The latency depends on measured drift of the internal clock. Usually it can take 400 seconds
Tm3	1,2	How long does it take to take over the new time from time server	Depends on time difference between internal and time server. Max. 400 s is the waiting time to see Timestamp Quality transition to ClockNotSynchronised.
Tm4	1,2	When is the time quality bit "Clock failure" set?	The time quality bit “Clock failure” is set to “one” when the P5 IED restarts from power up, or when the connection to time server is lost; the bit is reset to “zero” when the clock becomes synchronized. All available time synchronization sources will affect the “Clock failure” bit. These time sources include SNTP and where applicable, IRIG-B.
Tm5	1	When is the time quality bit "Clock not synchronized” set? Note: For Ed2 and up, CNS is set according to PIXIT Tm2	The time quality bit “Clock not synchronized” is set to “one” when the P5 IED starts from power up, or when the connection to time server is lost; the bit is reset to “zero” when the clock becomes synchronized. All available time synchronization sources will affect the “Clock not synchronized” bit. These time sources include SNTP and where applicable, IRIG-B.
Tm6	-	Is the timestamp of a binary event adjusted to the configured scan cycle?	Deprecated

ID	Ed	Description	Value / Clarification
Tm7	1	Does the device support time zone and daylight saving?	Y
Tm8	1,2	Which attributes of the SNTP response packet are validated?	N Leap indicator not equal to 3 N Mode is equal to SERVER Y OriginateTimestamp is equal to value sent by the SNTP client as Transmit Timestamp Y RX/TX timestamp fields are checked for reasonableness Y SNTP version 3 or 4 N other
Tm9	1,2	Do the COMTRADE files have local time or UTC time Is this configurable	Local N

PIXIT for file transfer model

ID	Ed	Description	Value / Clarification
Ft1	1	What is structure of files and directories Where are the COMTRADE files stored Are comtrade files zipped and what files are included in each zip file	Directory structure - COMTRADE - DR - TREND COMTRADE files stored in folder / COMTRADE /DR Zipped; Each COMTRADE record includes 2 files: .cfg and .dat
Ft2	1,2	Directory names are separated from the file name by	Separated by '/'
Ft3	1	The maximum file name size including path (recommended 64 chars)	255 Below are all the maximum sizes: - Full file name (including the directory path, suffix and separation characters): 255 - File name: 64 - File directory name: 32 - File name suffix: 3
Ft4	1,2	Are directory/file name case sensitive	Case sensitive
Ft5	1,2	Maximum file size for SetFile	SetFile is not supported.
Ft6	1	Is the requested file path included in the MMS fileDirectory respond file name	Y
Ft7	1	Is the wild char supported MMS fileDirectory request	Y
Ft8	1,2	Is it allowed that 2 clients get a file at the same time	N
Ft9	1,2	Which files can be deleted	None

TICS details

Introduction

The TICS is based upon UCAIug TICS Template version 2.1, UCA International Users Group Testing Sub Committee, April 23, 2019.

This document is applicable for P5U20, P5V20, P5F30 and P5M30, with firmware version V01.

Mandatory Edition 2 Tissues

The below tables give an overview of the applicable mandatory Tissues.

The original TISSUE should be consulted for details of changes.

Implemented by server:

Y: means that the server has implemented the respective tissue

ni: no impact on testing

na: not applicable if the server does not support the corresponding ACSI service(s)

Supported by client:

Y: means that the client supports servers that have implemented the respective tissue

ni: no impact on testing

na: not applicable if the client does not support the corresponding ACSI service(s)

Table 72 - Tissues implementation conformance statement

Part 6 Tissue	Description	Implemented Y/na
658	Tracking related features	na
663	FCDA element cannot be a "functionally constrained logical node"	Y
668	Autotransformer modeling	na
687	SGCB ResvTms	na
719	ConfDataSet - maxAttributes definition is confusing	Y
721	Log element name	na
768	bType VisString65 is missing	na
779	Object references	na
788	SICS S56 from optional to mandatory	na
789	ConfLdName as services applies to both server and client	na
804	valKind and IED versus System configuration	na
806	Max length of log name inconsistent between IEC 61850-6 and IEC 61850-7-2	na
807	Need a way to indicate if "Owner" present in RCB	Y
823	ValKind for structured data attributes	na
824	Short addresses on structured data attributes	na
825	Floating point value	na
845	SGCB ResvTms	na
853	SBO and ProtNs	Y
855	Recursive SubFunction	na

Table 72 - Tissues implementation conformance statement (Continued)

Part 6 Tissue	Description	Implemented Y/na
856	VoltageLevel frequency and phases	na
857	Function/SubFunction for ConductingEquipment	na
886	Missing IEC 61850-8-1 P-types	na
901	tServices as AP or as IED element	Y
936	SupSubscription parameter usage is difficult	na
1147	tServices - FileHandling not consistent with IEC 61850-7-2	Y
1185	Valkind value Conf for EX FC data valKind=Conf is allowed for dataNs	na
1284	SCSM mapping may require a communication section in an ICD file	Y
1328	Limitation on the size of data type templates identifiers	Y
1395	Client LN attributes	na
1402	ExtRef during engineering	na
1415	SICS-S110 IID import mandatory for Edition2	na
1419	Support of ldName on other IEDs SICS I212 is now mandatory	Y
1444	Need to support fixed and SCT controlled datasets	na
1445	ConfReportControl and a fixed ReportSettings	na
1450	OriginalSclXxx computation rules	Y
1485	Need to supercede Tissue 1398 to clarify SCT behavior	na

Part 7-1 Tissue	Description	Implemented Y/na
828	Data model namespace revision IEC 61850-7-4:2007[A]	Y
948	Enumeration (string) values format	na
1151	Simulated GOOSE disappears after 1st appearance when LPHD.Sim = TRUE	na
1396	The use and configuration flow of LGOS and LSVS is unclear	na
1447	Restriction on ENUMtypes in SCL	na
1457	Multiple DOI nodes with the same name	na
1468	Re-use DO from other LN	Y
1491	CmdBlk blocks itself	na
1495	GetVariableAccessAttributes error code	Y

Part 7-2 Tissue	Description	Implemented Y/na
728	BRCB: could PurgeBuf be set when RptEna = TRUE	Y
778	AddCause values – add value not-supported	na
780	What are unsupported trigger options at a control block	Y
783	TimOper Resp- ; add Authorization check	na
786	AddCause values 26 and 27 are switched	Y
820	Mandatory ACSI services (use for PICS template)	Y
858	Typo in enumeration ServiceType	na
861	Dchg of ConfRev attribute	na
1050	GTS Phycomaddr definition in SCL	Y
1071	Length of DO name	Y

Part 7-2 Tissue	Description	Implemented Y/na
1127	Missing owner attribute in BTS and UTS	Y
1202	GI not optional	Y
1232	EntryID needs clarification	Y
1242	NTS definition	N
1307	Segmented report with Buffer overflow	Y
1428	MTS and NTS should use svOptFlds	N
1630	Attributes in CDC=LTS do not match 8-1 definition	Y

Part 7-3 Tissue	Description	Implemented Y/na
697	Persistent command / PulseConfig	na
698	Wrong case is BAC.dB attribute	na
711	blkEna freeze data update while setting its quality to operaterBlocked	na
722	Units for 'h' and 'min' not in UnitKind enumeration.	Y
919	Presence Condition for sVC	na
925	Presence of i or f attribute - Problem with writing	na
926	Presence Conditions within RangeConfig	na
954	Data attributes with FC=CF should have trgOp=dchg	na
1078	CMV.t update if rangeAng changed	na
1565	db = 0 behaviour	Y
1578	DataAttribute NameSpace content	N

Part 7-4 Tissue	Description	Implemented Y/na
671	Mistake in definition of Mod & Beh	na
674	CDC of ZRRC.LocSta is wrong	na
676	Same data object name used with different CDC	na
677	MotStr is used with different CDC in PMMS and SOPM LN classes	na
679	Remove CycTrMod Enum	na
680	SI unit for MHYD.Cndct	na
681	Enum PIDAlg	na
682	ANCR.ParColMod	na
683	Enum QVVR.IntrDetMth	na
685	Enum ParTraMod	na
686	New annex H - enums types in XML	na
694	Data object CmdBlk	na
696	LSVS.St (Status of subscription)	na
712	Interpretation of quality operatorBlocked	na
713	DO Naming of time constants in FFIL	na
714	Enums for ShOpCap and SwOpCap	na
715	RBDR.ChNum1	na
716	TAXD text for condition	na
724	ANCR.Auto	na
725	Loc in LN A-group	na

Part 7-4 Tissue	Description	Implemented Y/na
734	LLN0.OpTmh vs. LPHD.OpTmh	na
736	PFSign	na
742	GAPC.Str, GAPC.Op and GAPC.StrVal	Y
743	CCGR.PmpCtl and CCGR.FanCtl	na
744	LN STMP, EEHealth and EEName	na
772	LPHD.PwrUp/PwrDn should be transient	na
773	Loc, LocKey and LocSta YPSH and YLTC	na
774	ITCI.LocKey	na
776	LPHD.OutOv/InOv and LCCH.OutOv/InOv	na
800	Misspelling in CSYN	na
802	CCGR and Harmonized control authority	na
808	Presence condition of ZMOT.DExt and new Dos	na
831	Setting of ConfRevNum in LGOS	na
838	Presence condition of ZMOT.DExt and new Dos	na
844	MFLK.PhPiMax, MFLK.PhPiLoFil, MFLK.PhPiRoot DEL->WYE	na
877	QVUB -settings should be optional	na
908	ARIS.StrSeq – transient	na
909	Remove ANCR.ColOpR and ColOpL	na
912	Clarification of PwrRtg/VARtg	na
920	Resetable Counter is NOT resetable	na
932	Rename AVCO.SptVol to AVCO.VolSpt	na
933	Presence of LCCH.RedFerCh and RedRxCnt	na
939	Change CDC for ANCR.FixCol	na
991	LGOS: GoCBRef (as well as LSVS.SvCBRef) should be mandatory	na
1007	PTRC as fault indicator - Update of description required	Y
1044	TapChg in AVCO	na
1077	Rename DOnames within LTIM	na
1256	New DO for LTIM to set time "manually"	na
1331	Mod, Beh and Health with q=TEST, client can't receive their states	na
1426	Add two DO for leap seconds in LTIM	na
1456	Annex A and Mod/Beh/Health	na
1568	ISAF.AlmReset ->transient	na

NOTE: Tissues 675, 735, 772, 775, 776, 878 are not relevant for conformance testing.

Part 8-1 Tissue	Description	Implemented Y/na
770	GoID type mitmatch 18.1.1 and 18.1.2.5.2	Y
784	Tracking of control (CTS)	na
817	Fixed-length GOOSE float encoding	Y
827	Mandatory ACSI services (Part of IEC 61850-7-2 TISSUE resolution)	Y
834	File dir name length 64	na

Part 8-1 Tissue	Description	Implemented Y/na
951	Encoding of Owner attribute	Y
1040	More associate error codes	Y
1178	Select Response+ is non-null value	Y
1324	The response- for DeleteNamedVariableList is not defined	Y
1345	Fixed-length GOOSE ASN.1 length encoding	na
1441	Optonal fields in buffered reports	Y
1442	Journal variableTag for ReasonCode	na
1453	Purge buffer on write to BRCB	Y
1454	Reports can be transmitted before write (RptEna=true) is confirmed	na
1500	The response for DeleteNamedVariableList with a non-existent LN is not specified	Y
1626	PICs For Information Report is incorrect	na

For detailed information on the individual Tissues, connect to the TISSUE database: www.tissues.iec61850.com

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