SIEMENS

Power Monitoring Device and Power Quality Recorder

SICAM P850/P855 7KG85xx

V2.20

System Manual

E50417-C1040-C482-A6

NOTE

For your own safety, please observe the warnings and safety instructions contained in this document.

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Preface

Purpose of this Manual

This manual describes the communication of the Power Monitoring Device and Power Quality Recorder SICAM P850/P855 7KG85xx and its connection to SICAM PQS.

Target Group

This manual is intended for project engineers, commissioning and operating personnel in electrical systems and power plants.

Scope of Validity of this Manual

This manual is valid for the Power Monitoring Device and Power Quality Recorder SICAM P850/P855 7KG85xx.

Further Support

For any questions concerning your system, please contact your Siemens representative.

Our Customer Support Center provides around-the-clock support.

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Notes On Safety

This manual does not constitute a complete catalog of all safety measures required for operating the equipment (module, device) in question, because special operating conditions may require additional measures. However, it does contain notes that must be adhered to for your own personal safety and to avoid damage to property. These notes are highlighted with a warning triangle and different keywords indicating different degrees of danger.

DANGER

DANGER means that death or severe injury **will** occur if the appropriate safety measures are not taken.

✧ Follow all advice instructions to prevent death or severe injury.

WARNING

WARNING means that death or severe injury **can** occur if the appropriate safety measures are not taken.

✧ Follow all advice instructions to prevent death or severe injury.

CAUTION

CAUTION means that minor or moderate injury can occur if the appropriate safety measures are not taken.

✧ Follow all advice instructions to prevent minor injury.

NOTICE

NOTICE means that damage to property can occur if the appropriate safety measures are not taken.

✧ Follow all advice instructions to prevent damage to property.

NOTE

is important information about the product, the handling of the product, or the part of the documentation in question to which special attention must be paid.

Personnel Qualified in Electrical Engineering

Commissioning and operation of the equipment (module, device) described in this manual must be performed by personnel qualified in electrical engineering only. As used in the safety notes contained in this manual, electrically qualified personnel are those persons who are authorized to commission, release, ground and tag devices, systems, and electrical circuits in accordance with safety standards.

Use as Prescribed

The equipment (device, module) must not be used for any other purposes than those described in the Catalog and the Technical Description. If it is used together with third-party devices and components, these must be recommended or approved by Siemens.

If the device is not used in accordance with the Product Information and this manual, the scheduled protection is impaired.

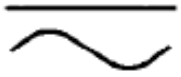
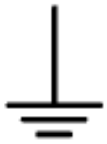
Problem-free and safe operation of the product depends on the following:

- Proper transport
- Proper storage, setup, and installation
- Proper operation and maintenance

When electrical equipment is operated, hazardous voltages are inevitably present in certain parts. If proper action is not taken, death, severe injury, or property damage can result.

- The equipment must be grounded at the grounding terminal before any connections are made.
- All circuit components connected to the power supply may be subject to dangerous voltage.
- Hazardous voltages may be present in equipment even after the supply voltage has been disconnected (capacitors can still be charged).
- Equipment with exposed current transformer circuits must not be operated. Prior to disconnecting the equipment, ensure that the current transformer circuits are short-circuited.
- The limit values stated in the document may not be exceeded. This must also be considered during testing and commissioning.

Used Symbols

No.	Symbol	Description
1		Direct current IEC 60417-5031
2		Alternating current IEC 60417-5032
3		Direct and alternating current IEC 60417-5033
4		3-phase alternating current
5		Earth (ground) terminal IEC 60417-5017
6		Protective conductor terminal IEC 60417-5019
7		Caution, risk of electric shock
8		Caution, risk of danger ISO 7000-0434

Statement of Conformity

CE	This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Council Directive 2004/108/EC - valid until April, 19th of 2016, Low Voltage Directive 2014/35/EU - valid from April, 20th of 2016) and concerning electrical equipment for use within specified voltage limits (Low-voltage Directive 2006/95/EC - valid until April, 19th of 2016, Low Voltage Directive 2014/35/EU - valid from April, 20th of 2016). This conformity has been established by means of tests conducted by Siemens AG according to the Council Directive in agreement with the generic standards EN 61000-6-2 and EN 61000-6-4 for the EMC directives, and with the standard EN 61010-1 for the low-voltage directive. The device has been designed and produced for industrial use. The product conforms to the standard IEC 61557-12.

Further Standards

This product is UL-certified to Standard UL 61010-1, third edition, based on the specification stated in chapter 13 (Technical Data) of Device Manual, order no.: E50417-H1040-C482. UL File No.: E228586	
UL LISTED	Open-type Measuring Equipment 2UD1

For further information see UL database on the internet: **http://ul.com**.

Chose **Online Certifications Directory** and insert E228586 under UL File Number.

Open Source Software

The product contains, among other things, Open Source Software developed by third parties. The Open Source Software used in the product and the license agreements concerning this software can be found in the Readme_OSS.

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Contents

1 User Information

1.1 General User Information

This manual describes how SICAM P850/P855 communicates with peripheral devices/systems and the connection to SICAM PQS. For detailed device information, see the device manual.

Communication

To communicate with the systems control and other process automation equipment, SICAM P850/P855 features an Ethernet interface, and if included in the device model, an RS485 interface.

Ethernet supports the device parameterization, the transmission of measured data, metered values and indications/events, and time synchronization with NTP. Depending on the device model, the communication protocols HTTP, Modbus TCP and/or IEC 61850 are used.

The RS485 interface supports the transmission of the measured data, metered values, indications, and time synchronization. Depending on the device model, the Modbus RTU or IEC 60870-5-103 communication protocols can be used for communication.

Connection to SICAM PQS

SICAM PQS enables fault records and power quality data generated by SICAM P850/P855 to be analyzed. The COMTRADE data format is supported by the fault recorder, PQDIF by the trend recorder and PQDIF/CSV by measurement recorder.

1.2 Contents of this System Manual

The system manual covers all communication options:

- Modbus TCP server/Modbus RTU slave and diagnostics
- IEC 61850 server and diagnostics
- IEC 60870-5-103 and diagnostics

Additionally, it describes the connection of SICAM P850/P855 to SICAM PQS:

- Installation and licensing of SICAM PQS
- Settings in SICAM PQS
- Settings in SICAM P850/P855

2 Communication

2.1 Communication Features

SICAM P850/P855 supports the communication via Ethernet. Device versions equipped with a serial interface also support communication via RS485.

If parameterized accordingly, the device can communicate over the Ethernet interface and simultaneously over the serial interface. It is possible, for example, to parameterize and retrieve data over the Ethernet interface, while the serial interface handles the protocol traffic with a client.

NOTE

Siemens recommends not to use SICAM P850/P855 in Ethernet systems with high utilization (GOOSE, other Ethernet data traffic) without a connected external Ethernet switch. Since none of the devices is equipped with an internal Ethernet switch, high network utilization might result in overloading of the data traffic in the device and thus in malfunctions, even if the data traffic is intended for other devices in the network.

This always applies as soon as a network cable is connected, even if the selected protocol is not an Ethernet protocol, for example Modbus RTU, serial transmission.

2.1.1 Communication via Ethernet Interface

Via the Ethernet interface the following functions are supported:

- Parameterization, analysis and diagnosis with HTML pages
- DHCP (Dynamic Host Configuration Protocol) to assign the network configuration (IP address etc.) to clients in an Ethernet network with DHCP server
- Time synchronization via NTP
- Data transfer to connected devices via Modbus TCP or IEC 61850
- Data transfer to SICAM PQS for fault record and power quality analysis

2.1.1.1 TCP/IP Protocol Stack

SICAM P850/P855 supports the following TCP/IP services:

- TCP/IP IPv4
- DHCP client (Dynamic Host Configuration Protocol)
- NTP (Network Time Protocol)
- HTTP server

2.1.1.2 IP Address

To enable the device to communicate within the Ethernet network, you have to establish a network configuration consisting of IP address, subnet mask and standard gateway.

The device is delivered with a default IP address that can be restored at any time by pressing the F4 softkey. Each device also has a unique MAC address.

The default IP address and the default subnet mask are imprinted on the side panel, see Figure 2-1:

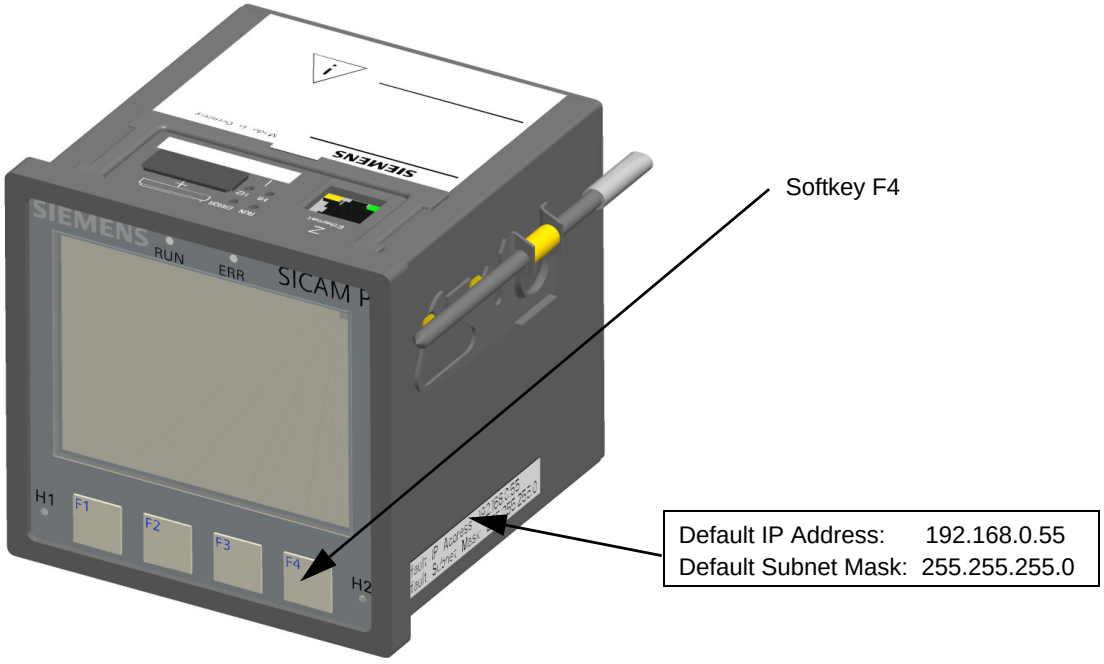


Figure 2-1 Display Side with Softkey F4

Default IP Address and Softkey F4

The F4 softkey (see Figure 2-1) located on the right display side can be used to activate the factory-set default IP address. When pressed (>3 s), this softkey activates the factory-set default IP address. After pressing the softkey F4, the device restarts and the IP address and subnet mask are temporarily activated in the default IP network configuration. The customer-specific IP configuration is not overwritten.

The network configuration settings can be displayed and edited via HTML pages or via the device display (see Device Manual SICAM P850/P855 7KG85xx, order number E50417-H1040-C482, chapters 7 and 8). After a renewed restart the parameterized network configuration is used again.

Check for Twice Assigned IP Address

Serious problems can occur if the same IP address is assigned more than once in a communication network.

For this reason, an ARP request is sent to the own IP address during start-up of the device. If no response is received from the communication network within 2 s, it is assumed that the IP address is not used in the network.

Otherwise, the LEDs (see Device Manual SICAM P850/P855, chapter 12) signal that the IP address is already assigned and the device is not connected to the network. In this case, you have to specify a different IP address.

NOTE

If the device is directly connected to a PC (without Ethernet switch), the PC will need a longer period to be able to detect the connection and therefore to receive the ARP telegram. In this case it may not be detected when PC and device have the same IP address.

Reception of the Network Configuration from the DHCP Server

The network configuration can also be obtained from an external server. Using the DHCP protocol, the device is integrated into an already existing network.

If the IP address 0.0.0.0 is configured, the device sends a query to the external DHCP server requesting the network configuration immediately after booting. Having received the network configuration, the device launches the Ethernet services.

If no DHCP server is available, disconnect the device from the network and start it using the default IP address and subsequently assign a permanent IP address.

2.1.1.3 Ethernet Interface

SICAM P850/P855 is equipped with an Ethernet interface. The data are exchanged via the RJ45 Ethernet plug connector located on the top side of the device.

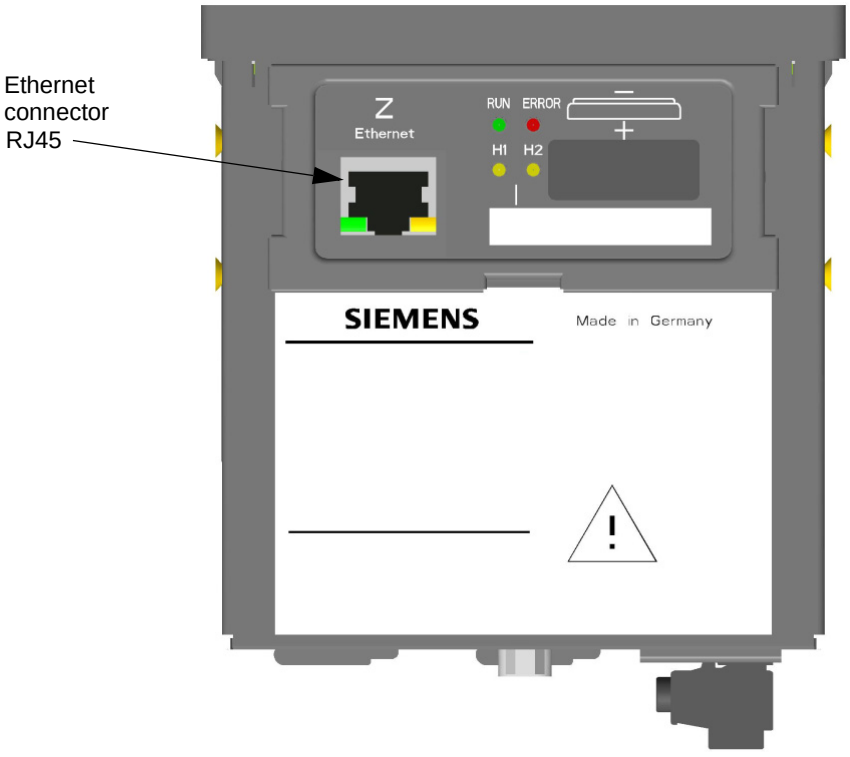


Figure 2-2 RJ45 Ethernet Plug Connector

The Ethernet interface is characterized by the following parameters:

- Transmission rate: 10/100 Mbit/s
- Protocol: IEEE802.3
- Connection: 100Base-T (RJ45), pinout according to DIN EN 50173, automatic patch/ crossover cable recognition
- Connecting cable: 100 Ω to 150 Ω STP, CAT5 (shielded twisted-pair cable), max. 100 m if well installed

2.1.2 Communication via RS485 Interface

Devices equipped with an RS485 interface can communicate serially with peripheral devices using the Modbus RTU or IEC 60870-5-103 bus protocol. The serial interface supports the following actions:

- Transmission of measured data, metered values and indications
- Time synchronization

The connection is a 9-pin D-sub connector plug.

Data of the RS485 Interface when Using the Modbus RTU Protocol (Default Settings)

The RS485 interface comes with the following parameters set by the manufacturer:

- Bus protocol: Modbus RTU
- Device address: 1
- Baud rate: 19 200 bit/s
- Parity: even
- Access rights: Full
- Communication supervision time 1 min

You can modify these parameters during the parameterization, see Device Manual SICAM P850/P855, chapters 7 and 8.

Data of the RS485 Interface when Using the IEC 60870-5-103 Protocol (Default Settings)

The RS485 interface comes with the following parameters set by the manufacturer:

- Bus protocol: IEC 60870-5-103
- Device address: 1
- Baud rate: 9600 bit/s
- Parity: even (not represented, fixed)
- Measured value range: 120 %
- Transmit energy: no
- Transmit harmonics magnitude: no
- Cycle sending period: 5 s
- Communication supervision time: 1 min

The parameters, except for the parity, can be changed during the parameterization, see Device Manual SICAM P850/P855,chapters 7 and 8.

Location of the RS485 Interface on the Device

The RS485 interface is located on the terminal side.

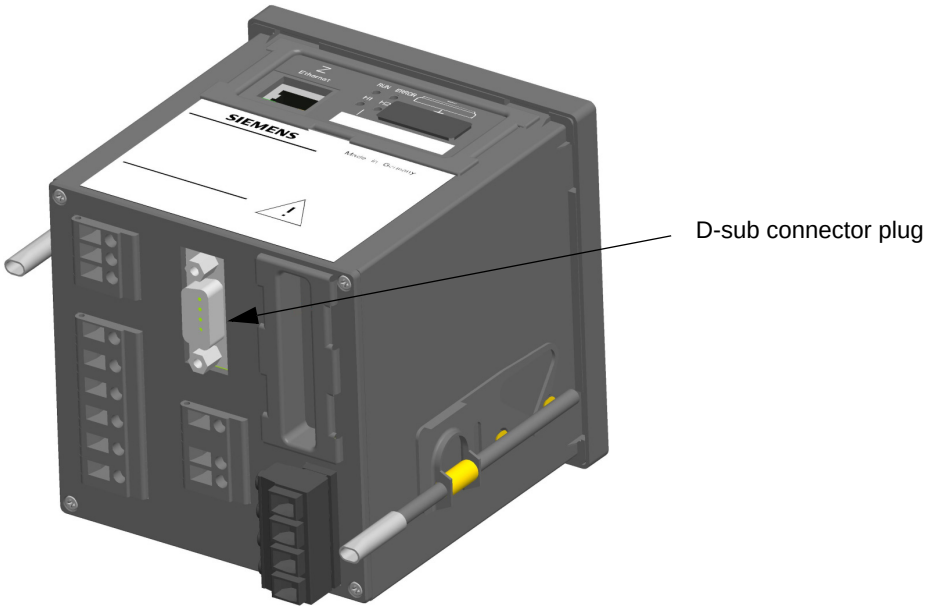


Figure 2-3 D-Sub Connector Plug of SICAM P850/P855

NOTE

The pinout of the D-sub connector plug is described in Device Manual SICAM P850/P855, chapter 13.

2.2 Modbus

When communicating via Ethernet, the Modbus TCP protocol is used; communication via RS485 relies on the Modbus RTU protocol. The Modbus specification with a detailed explanation of the Modbus protocol is provided in:

- Modbus over Serial Line
  Specification & Implementation Guide
  http://www.modbus.org
- Modbus Application Protocol Specification
  http://www.modbus.org
- Modbus Messaging on TCP/IP Implementation Guide
  http://www.modbus.org

2.2.1 Modbus Functions for Modbus TCP Server and Modbus RTU Slave

NOTE

The Modbus functions are the same for Modbus TCP (Ethernet) and Modbus RTU (serial).

The Modbus server of SICAM P850/P855 supports the following Modbus functions:

Table 2-1 Supported Modbus Functions

Function Number	Function Name	Description
03 (03H)	Read Holding Registers	Reading one or more holding registers from the Modbus server Up to 125 registers can be read with one message.
06 (06H)	Write Single Register	Writing a holding register Function 16 is used for writing multiple holding register using one Modbus message.
16 (10H)	Write Multiple Registers	Writing one or more holding registers Up to 123 registers can be written with one message.

2.2.2 Exception Responses for Modbus TCP Server and Modbus RTU Slave

NOTE

The exception responses for Modbus TCP (Ethernet) and Modbus RTU (serial) are the same.

The Modbus server performs a series of consistency checks of the Modbus client requests, and if errors (for example request to read a nonexistent register) are detected, it generates Modbus exception codes which are signaled to the Modbus client in exception responses messages.

The messages contain the following codes:

Exception Code 01 ILLEGAL_FUNCTION

- The Modbus client uses a function that is not supported by the Modbus server of the SICAM P850/P855. The supported Modbus functions are listed in chapter 2.2.1.

Exception Code 02 ILLEGAL_DATA_ADDRESS

- An attempt is made to read out or write to a nonexistent Modbus register (see chapter 2.2.7, Modbus mapping for valid registers).
- An attempt is made to read out or write to too many registers. A Modbus message enables reading out 125 holding registers and writing to 123 holding registers maximum.
- The Modbus client tries to write to a register in the Modbus server for which only read access is allowed according to the Modbus mapping (see chapter 2.2.7).

Exception Code 03 ILLEGAL_DATA_VALUE

- The redundancy client addresses a register that does not allow access to partial data. The register has a complex data structure and is distributed across several registers. The register can be read or written only as a whole.
- The Modbus client tries to write to the Modbus server for which the access rights are set to "read only".

Exception Code 04 SERVER_FAILURE

- Error during the time format conversion in the Modbus server because a faulty date/time format was received via Modbus, for example month format > 12.

2.2.3 Modbus TCP Server

Properties of the Modbus TCP Server

- Connection-oriented Ethernet protocol based on TCP/IP
- Use of IP addresses for addressing individual components connected to the bus (bus nodes)
- The Modbus TCP protocol has the TCP port number 502 reserved on the server side. It is possible to use a parameterized port number.
- All data types in the Modbus TCP messages which are larger than 1 byte are stored in the big-endian format, that is the most significant byte (MSB) is stored at the lowest register address and is transmitted first.
- Communication sequence:
  - The client sends a request to the server to start a data transmission from the server to the client.
  - If the requested data are not available, the server sends an error feedback to the client.
- The Modbus TCP data packet has a maximum size of 260 bytes:
  - 253 bytes max. for data and
  - 7 bytes for the Modbus TCP header

Parameterization

The following parameters can be set for the Modbus TCP bus protocol (see also Device Manual SICAM P850/P855, chapter 8):

Table 2-2 Modbus TCP Settings

Parameter	Default Setting	Settings
IP address	192.168.0.55	any, 0.0.0.0 for DHCP
Subnet mask	255.255.255.0	any
Default gateway	192.168.0.1	any
Enable SNMP	no	no yes
Bus protocol	Modbus TCP	-
Use a user-port number	no	no yes
User-port number (only if *Use a user-port number* **yes** has been parameterized)	10000	10000 to 65535
Access rights for user port 502	Full	Full Read only
Access rights for user port (only if *Use a user-port number* **yes** has been parameterized)	Full	Full Read only
Keep Alive time	10 s	0 s = switch off 1 s to 65 535 s
Communication supervision time	600 * 100 ms	0 s = none 100 ms to 6 553 400 ms

Number of Connections

Up to four TCP connections are possible:

- Without user port number: 4 connections via standard port 502
- With user port number: 2 connections via standard port 502 and 2 connections via the user port

2.2.4 Modbus RTU Slave

Properties of the Modbus RTU Slave

- Client-server protocol
- All clients have a unique address in the range from 1 to 247.
- Packets with the address = 0 are forwarded to all clients (broadcast).
- The individual data bytes in the messages are transmitted asynchronously with 11 bits:
  - 1 start bit,
  - 8 data bits,
  - 1 parity bit and 1 stop bit or
  - No parity bit and 2 stop bits
- Single messages are separated by bus silent intervals of at least 3.5 character times and end with a CRC code for error detection.
- RS485 is used as interface.
- The Modbus RTU message has a maximum size of 256 bytes:
  - 1 byte server address
  - 253 bytes for data
  - 2 bytes for CRC

The following parameters can be set for the Modbus RTU bus protocol:

Table 2-3 Modbus RTU Settings

Parameter	Default Setting	Setting Range
Device address	1	1 to 247
Baud rate	19 200 bit/s	1200 bit/s, 2400 bit/s 4800 bit/s, 9600 bit/s 19 200 bit/s, 38 400 bit/s 57 600 bit/s, 115 200 bit/s
Parity	Even	no/1 stop bit even odd no/2 stop bits
Access rights	Full	Full Read only
Communication supervision time	600 * 100 ms	0 s = none 100 ms to 6 553 400 ms

2.2.5 Register Assignment

Only holding registers are used for SICAM P850/P855. All measured values, indications, metered values etc. are stored in these holding registers.

2.2.6 Data Types

NOTE

The Modbus data types for Modbus TCP (Ethernet) and Modbus RTU (serial) are the same.

The following data types are used for storing variables in the Modbus registers.

- Measured value
- Date/time
- Indication
- Controllable indications
- Counter

NOTE

The following convention applies when storing variables consisting of more complex data types to the Modbus holding register (that is variables which are larger than a holding register, for example 32-bit measured values):

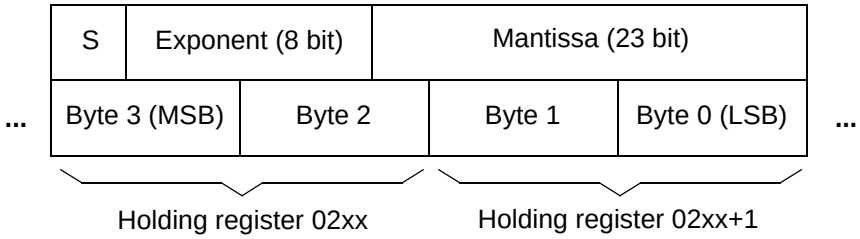
The register with the lowest address contains the most significant byte (MSB), the register with the highest address contains the least significant byte (LSB).

2.2.6.1 Data Type - Measured Value

The *Measured Value* data type is transferred into 2 holding registers in 32-bit floating-point format (single precision) according to IEEE standard 754.

Structure of the Format

The 32-bit floating-point format consists of a sign bit (S), exponent and mantissa:



Value Range

The 32-bit floating-point format has the value range: $\pm(10^{-38}$ to $10^{+38})$.

Value of the Measured Values

The value of a measured value is obtained as follows:

Exponent = 0: Resulting value = 0

Exponent = 255, mantissa = 0: Resulting value = $(-1)^{<sign>} * +Inf$

Exponent = 255, mantissa not equal to 0: Resulting value = NaN

0 < Exponent < 255: Resulting value = $(-1)^{<sign>} * 2^{(<exponent> - 127)} * 1,$ <mantissa>

Status and Quality Information

SICAM P850/P855 uses floating-point numbers with the exponent 255 (Inf, NaN) to display status information of the measured values:

Table 2-4 Floating-point Numbers

Floating-point Number (Hexadecimal)		State	Remark
7F800000H	+Inf	Overflow	Measured value overflow (> 1.2 V_{rated}, > 2 I_{rated})
7F800001H	NaN	invalid	For example, frequency not measured because mains voltage too small (< 15 % V_{rated})
7F800002H	NaN	not calculated	Measured value is not calculated, for instance because it does not exist in the selected network type.

Accuracy of the Floating-point Numbers

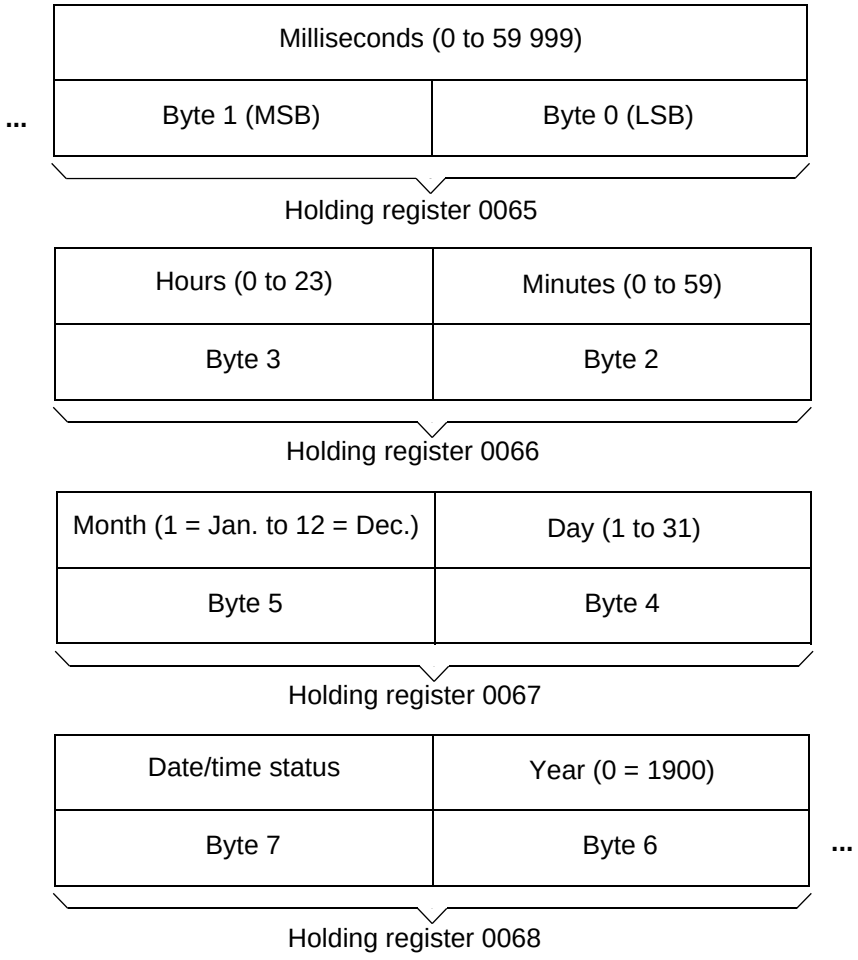
The 32-bit floating-point numbers have a 23-bit mantissa. Integer numbers can be represented in the following ranges without loss of accuracy:

- Binary: ±(1)111 1111 1111 1111 1111 1111
- Hexadecimal: ±FF FF FF
- Decimal: ±16777216

32-bit floating-point numbers are accurate to about 7 decimal digits. An accuracy of 4 decimal digits (0.2 measuring error) is required for measuring alternating current quantities.

2.2.6.2 Data Type - Date/Time

The *Date/Time* data type is used to transmit the local time. The following format is used:



Date/Time Status

10H set: Daylight saving time active

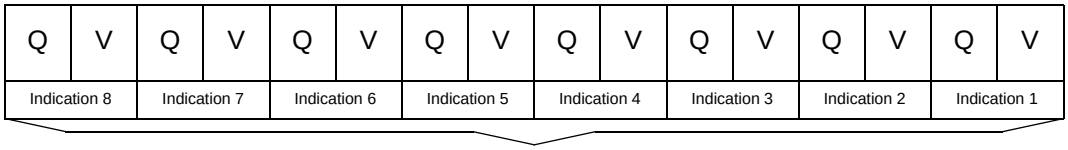
20H set: Date/time error: equivalent to FAIL bit, see Device Manual SICAM P850/P855, Time Synchronization.

NOTE

For the time synchronization via Ethernet, Siemens recommends the use of NTP.

2.2.6.3 Data Type - Indications (Read Only)

The *Indications* data type is represented by two bits in holding registers:



for example Holding register 0101

Where:

- Q: status/quality bit: 0 = OK, 1 = invalid
- V: Value bit: 0 = OFF, 1 = ON

Status or Quality Bit Q

An indication is invalid if the result of a calculation is based on an invalid measured value, for example the calculated limiting value of an invalid measured value. If the indication is invalid, the quality bit is set to **1**. The value bit can be ignored in this case.

Example: The power frequency is invalid if the voltage is smaller than 15 % of the rated voltage when measuring the frequency. Any limit violation indication based on this value is also invalid.

For indications that are always valid, for example the internal device indication *Device OK*, **0** is transmitted as the quality bit.

Value Bit V

The value bit indicates whether an indication is ON (=1) or OFF (=0).

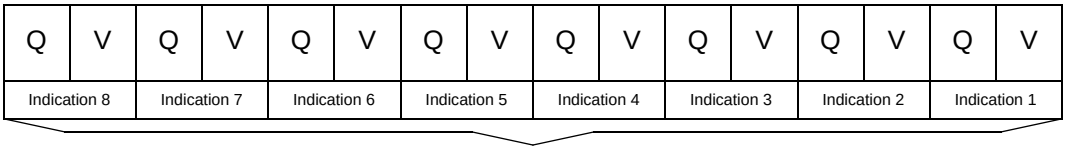
2.2.6.4 Data Type - Controllable Indications (Read/Write)

The *Controllable Indications* data type is needed for:

- The binary outputs of the SICAM P850/P855
- Processing internal device commands (for example resetting the energy counters).

The holding register is used for read and write access in this context.

Use as Read Register



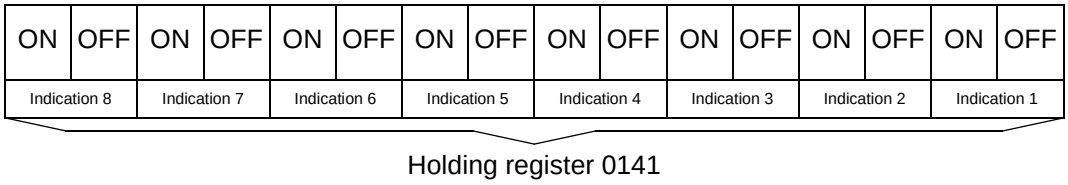
Holding register 0141

Where:

- Q: status/quality bit: 0 = OK, 1 = invalid
- V: Value bit: 0 = OFF, 1 = ON

See also chapter 2.2.6.3.

Use as Write Register



This data format enables up to 8 commands to be transmitted via the holding register for which the ON/OFF bits are set to either 0/1 or to 1/0. If these bits are set to 0/0 or 1/1, no evaluation will be performed.

2.2.6.5 Data Type - Counter

General

With the *Counter* data type, units of energy are transmitted as counter pulses.

To calculate the primary value, the conversion factor 'Energy per counter pulse' is output as the **Measured Value** data type in addition to the counter pulses (see chapter 2.2.6.1). The primary value is calculated as follows:

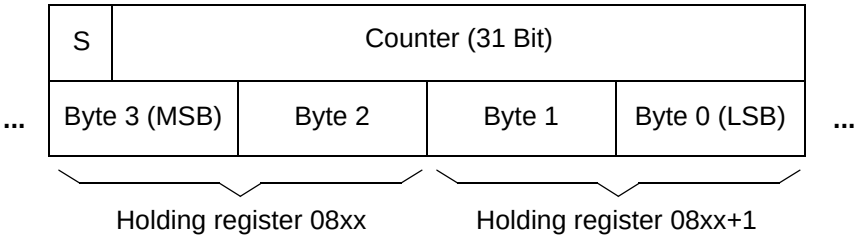
Primary value = number of counter pulses * energy per counter pulse

The following information is sent to each counter using the Modbus protocol:

- Counter pulses as 32-bit values (with sign)
- Separate status indications for **invalid** and **overflow** for each counter
- Energy per counter pulse in floating-point format for measured values (see chapter 2.2.7.16)

Counter Pulses

32-bit integers with sign allow a maximum of ±2 147 483 647 counter pulses before the counter overflows. The *Counter* data type is structured as follows:



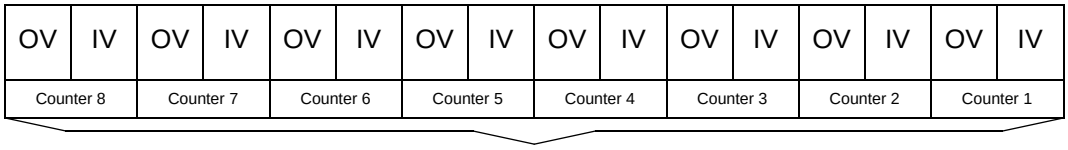
Bit S (Sign)

Reserved for negative metered values

Quality Information

The two following quality bits are stored for each counter in separate holding registers:

- **Overflow OV**: The internal counter pulse exceeds 31 bits. The Overflow bit is reset once the counter has been reset.
- **Invalid IV**: The counter value is invalid due to a reset/device start. The bit is deleted 1 min after the device start.



Holding register 08xx

Energy per Counter Pulse

The energy per counter pulse is identical for all energy metered values calculated from the measured AC quantities so that only one value is transmitted for all energy counters. The energy per counter pulse is determined by the AC network configuration.

At the rated value 60 000 counter pulses per hour are recorded for V_{rated} and I_{rated}.

A counter overflow occurs about 4 years after the counters were reset when V_{rated} and I_{rated} are measured continuously.

2.2.7 Data in the Modbus Registers (Data Mapping)

NOTE

The data for Modbus TCP (Ethernet) and Modbus RTU (serial) in the Modbus registers are the same.

The indications, measured values etc. are stored in Holding registers. The following register groups exist. They are described in the following sections:

- Register 0001 to 0048: Device identification (read only)
- Register 0065 to 0068: Date and time (read and write)
- Register 0071 to 0088: Version information (read only)
- Register 0101/0102: Device status (read only)
- Register 0111/0112: Indications concerning limit violations (read only)
- Register 0113: Group indications (read only)
- Register 0114: PQ events (read only)
- Register 0131: Status of the binary outputs (read only)
- Register 0141: Messages of the communication (read and write)
- Register 0201 to 0322: Measured values (read only), without 0281 to 0292
- Register 0323 to 0382: Flicker (read only)
- Register 0392 to 0395: Date/Time for last period PQ calculation for frequency (fixed period = 10 s) (read only)
- Register 0396 to 0399: Date/Time for last period PQ calculation (configurable) (read only)
- Register 0401 to 0760: PQ Measured (read only)
- Register 0801 to 0846: Energy counters (read only)
- Register 0901 to 0916: Flicker (read only)

- Register 0951 to 0974: Flicker (read only)
- Register 1001 to 1280: Harmonics: voltage values (read only)
- Register 1401 to 1680: Harmonics: current values (read only)
- Register 1801 to 2080: PQ calculation for average harmonic voltage values (read only)
- Register 2201 to 2480: PQ calculation for max. harmonic voltage values (read only)
- Register 2601 to 2880: PQ calculation for average harmonic current values (read only)
- Register 3001 to 3280: PQ calculation for max. harmonic current values (read only)
- Register 5001 to 5099: Last 10 dips (read only)
- Register 5201 to 5299: Last 10 swells (read only)
- Register 5401 to 5499: Last 10 interrupts (read only)
- Register 6001 to 6002: Total number of PQ voltage events (read only)
- Register 6003 to 6004: Number of PQ voltage events since last polling (read only)

2.2.7.1 Register 0001 to 0049: Device Identification

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

Table 2-5 Register 0001 to 0049: Device Identification

Register	Type of Information	Remark
0001 to 0008	Device type (string, max. 16 characters)	Example: SICAM P
0009 to 0024	Device ordering code (MLFB) (string, max. 32 characters)	Example: 7KG85511FA101AA0
0025 to 0040	Device name from the configuration (string, max. 32 characters)	Example: SICAM P #1
0041 to 0049	Device serial number (string, max. 16 characters)	Example: BF0704034576

2.2.7.2 Register 0065 to 0068: Date and Time

The date and time can be transmitted in 64-bit format or in 32-bit format.

64-bit Format

The 4 registers 0065 to 0068 (time and date) are transmitted in one message.

32-bit Format

The registers are transmitted in 2 messages. The 1st message contains the registers 0067 and 0068 (date), the 2nd message contains the registers 0065 and 0066 (time).

The time synchronization only takes effect when the time has been completely transmitted.

Data type: Date/time

Table 2-6 Register 0065 to 0068: Date and Time

Register	Type of Information	Remark
0065	Milliseconds	see chapter 2.2.6.2
0066	Hours/minutes	
0067	Month/day	
0068	Time status/year	

2.2.7.3 Register 0071 to 0089: Version Information

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

Table 2-7 Register 0071 to 0089: Version Information

Register	Type of Information	Remark
0071 to 0076	Boot version	Example: V01.10.01
0077 to 0082	Firmware version	Example: V01.10.01
0083 to 0089	Parameter set version	Example: V01.10.01

2.2.7.4 Register 0101 to 0102: Device Status Indication

This register is write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

Data type: indication

Table 2-8 Register 0101 to 0102: Device Status

Register	Type of Information	Remark
$0101/2^0$	Device OK	1 = Device ready for operation
$0101/2^2$	Battery failure	0 = Battery OK, 1 = Battery failure (exchange battery)
$0101/2^4$	SD card status	1 = SD card error (see notes in device manual, chapter 14, Operational Indications)
$0101/2^6$	Reserved	= 0
$0101/2^8$	Settings Load	1 = Parameter load is in progress

Table 2-8 Register 0101 to 0102: Device Status (cont.)

Register	Type of Information	Remark
0101/2^{10}	Settings Check	1 = Parameter check is in progress
0101/2^{12}	Settings Activate	1 = Parameter activation is in progress
0101/2^{14}	Reserved	= 0
0102/2^{0}	Direction of rotation	0 = Anti-clockwise 1 = Clockwise
0102/2^{2} to 0102/2^{14}	Reserved	= 0

NOTE

Registers between 0103 and 0141 that are not shown can be read too during requests and return the value 0.

2.2.7.5 Register 0111 and 0112: Measurand Limit Violation Indications

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

Data type: indication

Table 2-9 Register 0111 and 0112: Limit Violation Indications

Register	Type of Information	Remark
0111/2^{0}	Limit Violation 1	An indication is output (= 1) if a measured value has exceeded or fallen below a configured limiting value. For more information, see the SICAM P850/P855 device manual, chapter Parameterization.
0111/2^{2}	Limit Violation 2	
0111/2^{4}	Limit Violation 3	
0111/2^{6}	Limit Violation 4	
0111/2^{8}	Limit Violation 5	
0111/2^{10}	Limit Violation 6	
0111/2^{12}	Limit Violation 7	
0111/2^{14}	Limit Violation 8	

Table 2-9 Register 0111 and 0112: Limit Violation Indications (cont.)

Register	Type of Information	Remark
0112/2^0	Limit Violation 9	An indication is output (= 1) if a measured value has exceeded or fallen below a configured limiting value. For more information, see the SICAM P850/P855 device manual, chapter Parameterization.
0112/2^2	Limit Violation 10	
0112/2^4	Limit Violation 11	
0112/2^6	Limit Violation 12	
0112/2^8	Limit Violation 13	
0112/2^{10}	Limit Violation 14	
0112/2^{12}	Limit Violation 15	
0112/2^{14}	Limit Violation 16	

2.2.7.6 Register 0113: Group Indications

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

Data type: indication

Table 2-10 Register 0113: Group Indications

Register	Type of Information	Remark
0113/2^0	Group indication 1	Up to 4 single-point indications can be linked logically and combined to a group indication. A total of 4 group indications can be parameterized: 0 = Off 1 = On
0113/2^2	Group indication 2	
0113/2^4	Group indication 3	
0113/2^6	Group indication 4	
0113/2^8	Reserved	= 0
0113/2^{10}	Reserved	= 0
0113/2^{12}	Reserved	= 0
0113/2^{14}	Reserved	= 0

2.2.7.7 Register 0114: Power Quality Event

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

NOTE

This register is only available for SICAM P855.

Data type: indication

Table 2-11 Register 0114: Power Quality Event

Register	Type of Information	Remark
0114/2^0	PQ Volt event	1 = Voltage event exists 0 = Voltage event is not exists
0114/2^2	PQ Freq event	1 = Frequency event exists 0 = Frequency event is not exists
0114/2^4	PQ VoltUnbal event	1 = Voltage unbalance event exists 0 = Voltage unbalance event is not exists
0114/2^6 to 0114/2^{14}	Reserved	= 0

2.2.7.8 Register 0131: Status of the Binary Outputs

This register is write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

Data type: indication

Table 2-12 Register 0131: Status of the Binary Outputs

Register	Type of Information	Remark
0131/2^0	Binary Output B1	Binary output B1 at terminal G1/3
0131/2^2	Binary Output B2	Binary output B2 at terminal G1/2
0131/2^4 to 0131/2^{14}	Reserved	= 0

2.2.7.9 Register 0141: Indications of the Communication

Data type: controllable indications

Table 2-13 Register 0141: Indications of the Communication

Register	Type of Information	Remark
$0141/2^0$	Indication 1 from Remote	Indications can be used for example for routing to a binary output
$0141/2^2$	Indication 2 from Remote	
$0141/2^4$ to $0141/2^6$	Reserved	= 0
$0141/2^8$	Reset PQ Voltage Event	0 → 1: Resets PQ event [1)]
$0141/2^{10}$	Reset PQ Frequency Event	0 → 1: Resets PQ event [1)]
$0141/2^{12}$	Reset PQ VoltUnbal Event	0 → 1: Resets PQ event [1)]
$0141/2^{14}$	Reset Energy	0 → 1: Resets the energy counters

[1)] This register is only available for SICAM P855.

2.2.7.10 Registers 0201 to 0322: Measured Values

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

Data type: Measured value

Table 2-14 Registers 0201 to 0306: Measured Values

Register	Type of Information	Remark	Unit
0201	Va	Voltage a-N	V
0203	Vb	Voltage b-N	V
0205	Vc	Voltage c-N	V
0207	VN	Voltage neutral conductor	V
0209	Ia	Current a	A
0211	Ib	Current b	A
0213	Ic	Current c	A
0215	IN	Current neutral conductor	A
0217	Vab	Voltage a-b	V

Table 2-14 Registers 0201 to 0306: Measured Values (cont.)

Register	Type of Information	Remark	Unit
0219	Vbc	Voltage b-c	V
0221	Vca	Voltage c-a	V
0223	Vavg	Mean value of voltage (P-N)	V
0225	Iavg	Mean value of currents	A
0227	Pa	Active power a	W
0229	Pb	Active power b	W
0231	Pc	Active power c	W
0233	P	Active power	W
0235	Qa	Reactive power a	var
0237	Qb	Reactive power b	var
0239	Qc	Reactive power c	var
0241	Q	Reactive power	var
0243	Sa	Apparent power a	VA
0245	Sb	Apparent power b	VA
0247	Sc	Apparent power c	VA
0249	S	Apparent power	VA
0251	cos φ (a)	Active power factor a	-
0253	cos φ (b)	Active power factor b	-
0255	cos φ (c)	Active power factor c	-
0257	cos φ	Active power factor	-
0259	PFa	Power factor a	-
0261	PFb	Power factor b	-
0263	PFc	Power factor c	-
0265	PF	Power factor	-
0267	φa	Phase angle a	° (degree)
0269	φb	Phase angle b	° (degree)

Table 2-14 Registers 0201 to 0306: Measured Values (cont.)

Register	Type of Information	Remark	Unit
0271	φc	Phase angle c	° (degree)
0273	φ	Phase angle	° (degree)
0275	f	Power frequency	Hz
0277	U_2	Unbalanced voltage	%
0279	Iunbal	Unbalanced current	%
0281	Va	1 cycle calculation value (internal)	V
0283	Vb	1 cycle calculation value (internal)	V
0285	Vc	1 cycle calculation value (internal)	V
0287	Vab	1 cycle calculation value (internal)	V
0289	Vbc	1 cycle calculation value (internal)	V
0291	Vca	1 cycle calculation value (internal)	V
0293	f (10 s)	Frequency calculated every 10 s (internal)	Hz
0295	THDS (Va/Vab)	Voltage a/ab THDS	-
0297	THDS (Vb/Vbc)	Voltage b/bc THDS	-
0299	THDS (Vc/Vca)	Voltage c/ca THDS	-
0301	THDS (Ia)	Current a THDS	-
0303	THDS (Ib)	Current b THDS	-
0305	THDS (Ic)	Current c THDS	-
0307	Voltage (φ12)	Angle Vab-Vbc	° (degree)
0309	Voltage (φ13)	Angle Vab-Vca	° (degree)
0311	Current (φ12)	Angle Ia-Ib	° (degree)
0313	Current (φ13)	Angle Ia-Ic	° (degree)
0315	Q1a	Reactive power (A)_Fundamental	var
0317	Q1b	Reactive power (B)_Fundamental	var
0319	Q1c	Reactive power (C)_Fundamental	var
0321	Q1	Reactive power (Σ)_Fundamental	var

2.2.7.11 Registers 0323 to 0382, 0951 to 0974 and 0901 to 0916: Flicker

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

NOTE

These registers are only available for SICAM P855.

Registers 0323 to 0382 and 0951 to 0974: Flicker

Data type: Measured value

Table 2-15 Registers 0323 to 0382 and 0951 to 0974: Flicker

Register	Type of Information	Remark
0323	Pinst (a-N)	Flicker instantaneous value voltage Va
0325	Pinst (b-N)	Flicker instantaneous value voltage Vb
0327	Pinst (c-N)	Flicker instantaneous value voltage Vc
0329	Pst (a-N)	Short term flicker voltage Va
0331	Pst (b-N)	Short term flicker voltage Vb
0333	Pst (c-N)	Short term flicker voltage Vc
0335	Plt (a-N)	Long term flicker voltage Va
0337	Plt (b-N)	Long term flicker voltage Vb
0339	Plt (c-N)	Long term flicker voltage Vc
0341	Pinst (a-b)	Flicker instantaneous value voltage Va-b
0343	Pinst (b-c)	Flicker instantaneous value voltage Vb-c
0345	Pinst (c-a)	Flicker instantaneous value voltage Vc-a
0347	Pst (a-b)	Short term flicker voltage Va-b
0349	Pst (b-c)	Short term flicker voltage Vb-c
0351	Pst (c-a)	Short term flicker voltage Vc-a
0353	Plt (a-b)	Long term flicker voltage Va-b
0355	Plt (b-c)	Long term flicker voltage Vb-c
0357	Plt (c-a)	Long term flicker voltage Vc-a
0359	Pvr A	Reference voltage of flicker sensation (A-N)

Table 2-15 Registers 0323 to 0382 and 0951 to 0974: Flicker (cont.)

Register	Type of Information	Remark
0361	Pvr B	Reference voltage of flicker sensation (B-N)
0363	Pvr C	Reference voltage of flicker sensation (C-N)
0365	Pvr AB	Reference voltage of flicker sensation (A-B)
0367	Pvr BC	Reference voltage of flicker sensation (B-C)
0369	Pvr CA	Reference voltage of flicker sensation (C-A)
0371	PinstMax A	Peak value of the Pinst (A-N) [1)]
0373	PinstMax B	Peak value of the Pinst (B-N) [1)]
0375	PinstMax C	Peak value of the Pinst (C-N) [1)]
0377	PinstMax AB	Peak value of the Pinst (A-B) [1)]
0379	PinstMax BC	Peak value of the Pinst (B-C) [1)]
0381	PinstMax CA	Peak value of the Pinst (C-A) [1)]
0951	PQ_Pst (a-n)	10 min Pst A Reference a-n
0953	PQ_Pst (b-n)	10 min Pst A Reference b-n
0955	PQ_Pst (c-n)	10 min Pst A Reference c-n
0957	PQ_Pst (a-b)	10 min Pst A Reference a-b
0959	PQ_Pst (b-c)	10 min Pst A Reference b-c
0961	PQ_Pst (c-a)	10 min Pst A Reference c-a
0963	PQ_Plt (a-n)	2 h Value a-n
0965	PQ_Plt (b-n)	2 h Value b-n
0967	PQ_Plt (c-n)	2 h Value c-n
0969	PQ_Plt (a-b)	2 h Value a-b
0971	PQ_Plt (b-c)	2 h Value b-c
0973	PQ_Plt (c-a)	2 h Value c-a

[1)] This value is the max value since the device is switched on.

NOTE

It depends on the connection type (ph-ph or ph-n) which measured values are available. Phase-to-phase quantities are available in 3-wire networks; phase-to-ground quantities are available with all other connection types. See SICAM P850/P855 Device Manual, chapter 4, section “Measurands Depending on the Connection Type”.

Register 0901 to 0916: Data/Time for PQ Pst

Data type: Data/time

Table 2-16 Register 0901 to 0904: Data/Time for PQ 10 min Pst A

Register	Type of Information	Remark
0901	Milliseconds	see chapter 2.2.6.2
0902	Hours/minutes	
0903	Month/day	
0904	Time status/year	

Table 2-17 Register 0905 to 0908: Data/Time for PQ 2 h Plt A

Register	Type of Information	Remark
0905	Milliseconds	see chapter 2.2.6.2
0906	Hours/minutes	
0907	Month/day	
0908	Time status/year	

Table 2-18 Register 0909 to 0912: Data/Time for PQ 10 min Pst AB

Register	Type of Information	Remark
0909	Milliseconds	see chapter 2.2.6.2
0910	Hours/minutes	
0911	Month/day	
0912	Time status/year	

Table 2-19 Register 09013 to 0916: Data/Time for PQ 2 h Plt AB

Register	Type of Information	Remark
0913	Milliseconds	see chapter 2.2.6.2
0914	Hours/minutes	
0915	Month/day	
0916	Time status/year	

2.2.7.12 Register 0392 to 0399: Data/Time for Last Period PQ Calculation

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

Register 0392 to 0395: Data/Time for Last Period PQ Calculation

Data type: Data/time

Table 2-20 Register 0392 to 0395: Data/Time for Last Period PQ Calculation

Register	Type of Information	Remark
0392	Milliseconds	see chapter 2.2.6.2
0393	Hours/minutes	
0394	Month/day	
0395	Time status/year	

Register 0396 to 0399: Data/Time for Last Period PQ Calculation for Frequency (Configurable Period = 30 s to 2 h)

Data type: Data/time

Table 2-21 Register 0396 to 0399: Data/Time for Last Period PQ Calculation

Register	Type of Information	Remark
0396	Milliseconds	see chapter 2.2.6.2
0397	Hours/minutes	
0398	Month/day	
0399	Time status/year	

2.2.7.13 Registers 0401 to 0510: PQ Measured Values – Average Values

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

The data are calculated within the parameterized time (for example 30 s, 1 min etc.).

Data type: Measured value

Table 2-22 Registers 0401 to 0510: PQ Measured Values – Average Values

Register	Type of Information	Remark	Unit
0401	PQ_Va	Voltage a-N	V
0403	PQ_Vb	Voltage b-N	V
0405	PQ_Vc	Voltage c-N	V
0407	PQ_Vab	Voltage a-b	V
0409	PQ_Vbc	Voltage b-c	V
0411	PQ_Vca	Voltage c-a	V
0413	PQ_Ia	Current a	A
0415	PQ_Ib	Current b	A
0417	PQ_Ic	Current c	A
0419	PQ_VN	Voltage neutral conductor	V
0421	PQ_Vavg	Mean value of voltage (P-N)	V
0423	PQ_IN	Current neutral conductor	A
0425	PQ_Iavg	Mean value of currents	A
0427	PQ_Pa	Active power a	W
0429	PQ_Pb	Active power b	W
0431	PQ_Pc	Active power c	W
0433	PQ_P	Active power	W
0435	PQ_Qa	Reactive power a	var
0437	PQ_Qb	Reactive power b	var
0439	PQ_Qc	Reactive power c	var
0441	PQ_Q	Reactive Power	var
0443	PQ_Sa	Apparent power a	VA

Table 2-22 Registers 0401 to 0510: PQ Measured Values – Average Values (cont.)

Register	Type of Information	Remark	Unit
0445	PQ_Sb	Apparent power b	VA
0447	PQ_Sc	Apparent power c	VA
0449	PQ_S	Apparent power	VA
0451	PQ_cos φ (a)	Active power factor a	-
0453	PQ_cos φ (b)	Active power factor b	-
0455	PQ_cos φ (c)	Active power factor c	-
0457	PQ_cos φ	Active power factor	-
0459	PQ_PFa	Power factor a	-
0461	PQ_PFb	Power factor b	-
0463	PQ_PFc	Power factor c	-
0465	PQ_PF	Power factor	-
0467	PQ_φa	Phase angle a	° (degree)
0469	PQ_φb	Phase angle b	° (degree)
0471	PQ_φc	Phase angle c	° (degree)
0473	PQ_φ	Phase angle	° (degree)
0475	PQ_f	Power frequency	Hz
0477	PQ_Vunbal	Unbalanced voltage	%
0479	PQ_Iunbal	Unbalanced current	%
0481	PQ_Freq_10s	Frequency The period for calculating the power frequency is 10 s.	Hz
0483	PQ_THDS (Va/Vab)	Voltage a/ab THDS	-
0485	PQ_THDS (Vb/Vbc)	Voltage b/bc THDS	-
0487	PQ_THDS (Vc/Vca)	Voltage c/ca THDS	-
0489	PQ_THDS (Ia)	Current a THDS	-
0491	PQ_THDS (Ib)	Current b THDS	-
0493	PQ_THDS (Ic)	Current c THDS	-

Table 2-22 Registers 0401 to 0510: PQ Measured Values – Average Values (cont.)

Register	Type of Information	Remark	Unit
0495	PQ_Voltage (φ12)	Angle Vab-Vbc	° (degree)
0497	PQ_Voltage (φ13)	Angle Vab-Vca	° (degree)
0499	PQ_Current (φ12)	Angle Ia-Ib	° (degree)
0501	PQ_Current (φ13)	Angle Ia-Ic	° (degree)
0503	PQ_Q1a	Reactive power (A)_Fundamental	var
0505	PQ_Q1b	Reactive power (B)_Fundamental	var
0507	PQ_Q1c	Reactive power (C)_Fundamental	var
0509	PQ_Q1	Reactive power (Σ)_Fundamental	var

2.2.7.14 Registers 0531 to 0640: PQ Measured Values – Minimum Values

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

The data are calculated within the parameterized time (for example 30 s, 1 min etc.).

Data type: Measured value

Table 2-23 Registers 0531 to 0640: PQ Measured Values – Minimum Values

Register	Type of Information	Remark	Unit
0531	PQ_Va_min	Voltage a-N	V
0533	PQ_Vb_min	Voltage b-N	V
0535	PQ_Vc_min	Voltage c-N	V
0537	PQ_Vab_min	Voltage a-b	V
0539	PQ_Vbc_min	Voltage b-c	V
0541	PQ_Vca_min	Voltage c-a	V
0543	PQ_Ia_min	Current a	A
0545	PQ_Ib_min	Current b	A
0547	PQ_Ic_min	Current c	A
0549	PQ_VN_min	Voltage neutral conductor	V
0551	PQ_Vavg_min	Mean value of voltage (P-N)	V
0553	PQ_IN_min	Current neutral conductor	A
0555	PQ_Iavg_min	Mean value of currents	A
0557	PQ_Pa_min	Active power a	W
0559	PQ_Pb_min	Active power b	W
0561	PQ_Pc_min	Active power c	W
0563	PQ_P_min	Active power	W
0565	PQ_Qa_min	Reactive power a	var
0567	PQ_Qb_min	Reactive power b	var
0569	PQ_Qc_min	Reactive power c	var
0571	PQ_Q_min	Reactive power	var
0573	PQ_Sa_min	Apparent power a	VA

Table 2-23 Registers 0531 to 0640: PQ Measured Values – Minimum Values (cont.)

Register	Type of Information	Remark	Unit
0575	PQ_Sb_min	Apparent power b	VA
0577	PQ_Sc_min	Apparent power c	VA
0579	PQ_S_min	Apparent power	VA
0581	PQ_cos φ (a)_min	Active power factor a	-
0583	PQ_cos φ (b)_min	Active power factor b	-
0585	PQ_cos φ (c)_min	Active power factor c	-
0587	PQ_cos φ_min	Active power factor	-
0589	PQ_PFa_min	Power factor a	-
0591	PQ_PFb_min	Power factor b	-
0593	PQ_PFc_min	Power factor c	-
0595	PQ_PF_min	Power factor	-
0597	PQ_φa_min	Phase angle a	° (degree)
0599	PQ_φb_min	Phase angle b	° (degree)
0601	PQ_φc_min	Phase angle c	° (degree)
0603	PQ_φ_min	Phase angle	° (degree)
0605	PQ_f_min	Power frequency	Hz
0607	PQ_Vunbal_min	Unbalanced voltage	%
0609	PQ_Iunbal_min	Unbalanced current	%
0611	PQ_Freq_10s_min	Frequency The period for calculating the power frequency is 10 s.	Hz
0613	PQ_THDS (Va/Vab)_min	Voltage a/ab THDS	-
0615	PQ_THDS (Vb/Vbc)_min	Voltage b/bc THDS	-
0617	PQ_THDS (Vc/Vca)_min	Voltage c/ca THDS	-
0619	PQ_THDS (Ia)_min	Current a THDS	-
0621	PQ_THDS (Ib)_min	Current b THDS	-
0623	PQ_THDS (Ic)_min	Current c THDS	-

Table 2-23 Registers 0531 to 0640: PQ Measured Values – Minimum Values (cont.)

Register	Type of Information	Remark	Unit
0625	PQ_Voltage (φ12)_min	Angle Vab-Vbc	° (degree)
0627	PQ_Voltage (φ13)_min	Angle Vab-Vca	° (degree)
0629	PQ_Current (φ12)_min	Angle Ia-Ib	° (degree)
0631	PQ_Current (φ13)_min	Angle Ia-Ic	° (degree)
0633	PQ_Q1a_min	Reactive power (A)_Fundamental	var
0635	PQ_Q1b_min	Reactive power (B)_Fundamental	var
0637	PQ_Q1c_min	Reactive power (C)_Fundamental	var
0639	PQ_Q1_min	Reactive power (Σ)_Fundamental	var

2.2.7.15 Registers 0651 to 0760: PQ Measured Values – Maximum Values

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

The data are calculated within the parameterized time (for example 30 s, 1 min etc.).

Data type: Measured value

Table 2-24 Registers 0651 to 0760: PQ Measured Values – Maximum Values

Register	Type of Information	Remark	Unit
0651	PQ_Va_max	Voltage a-N	V
0653	PQ_Vb_max	Voltage b-N	V
0655	PQ_Vc_max	Voltage c-N	V
0657	PQ_Vab_max	Voltage a-b	V
0659	PQ_Vbc_max	Voltage b-c	V
0661	PQ_Vca_max	Voltage c-a	V
0663	PQ_Ia_max	Current a	A
0665	PQ_Ib_max	Current b	A
0667	PQ_Ic_max	Current c	A
0669	PQ_VN_max	Voltage neutral conductor	V
0671	PQ_Vavg_max	Mean value of voltage (P-N)	V
0673	PQ_IN_max	Current neutral conductor	A
0675	PQ_Iavg_max	Mean value of currents	A
0677	PQ_Pa_max	Active power a	W
0679	PQ_Pb_max	Active power b	W
0681	PQ_Pc_max	Active power c	W
0683	PQ_P_max	Active power	W
0685	PQ_Qa_max	Reactive power a	var
0687	PQ_Qb_max	Reactive power b	var
0689	PQ_Qc_max	Reactive power c	var
0691	PQ_Q_max	Reactive power	var
0693	PQ_Sa_max	Apparent power a	VA

Table 2-24 Registers 0651 to 0760: PQ Measured Values – Maximum Values (cont.)

Register	Type of Information	Remark	Unit
0695	PQ_Sb_max	Apparent power b	VA
0697	PQ_Sc_max	Apparent power c	VA
0699	PQ_S_max	Apparent power	VA
0701	PQ_cos φ (a)_max	Active power factor a	-
0703	PQ_cos φ (b)_max	Active power factor b	-
0705	PQ_cos φ (c)_max	Active power factor c	-
0707	PQ_cos φ_max	Active power factor	-
0709	PQ_PFa_max	Power factor a	-
0711	PQ_PFb_max	Power factor b	-
0713	PQ_PFc_max	Power factor c	-
0715	PQ_PF_max	Power factor	-
0717	PQ_φa_max	Phase angle a	° (degree)
0719	PQ_φb_max	Phase angle b	° (degree)
0721	PQ_φc_max	Phase angle c	° (degree)
0723	PQ_φ_max	Phase angle	° (degree)
0725	PQ_f_max	Power frequency	Hz
0727	PQ_Vunbal_max	Unbalanced voltage	%
0729	PQ_Iunbal_max	Unbalanced current	%
0731	PQ_Freq_10s_max	Frequency The period for calculating the power frequency is 10 s.	Hz
0733	PQ_THDS (Va/Vab)_max	Voltage a/ab THDS	-
0735	PQ_THDS (VbVbc)_max	Voltage b/bc THDS	-
0737	PQ_THDS (VcVca)_max	Voltage c/ca THDS	-
0739	PQ_THDS (Ia)_max	Current a THDS	-
0741	PQ_THDS (Ib)_max	Current b THDS	-
0743	PQ_THDS (Ic)_max	Current c THDS	-

Table 2-24 Registers 0651 to 0760: PQ Measured Values – Maximum Values (cont.)

Register	Type of Information	Remark	Unit
0745	PQ_Voltage (φ12)_max	Angle Vab-Vbc	° (degree)
0747	PQ_Voltage (φ13)_max	Angle Vab-Vca	° (degree)
0749	PQ_Current (φ12)_max	Angle Ia-Ib	° (degree)
0751	PQ_Current (φ13)_max	Angle Ia-Ic	° (degree)
0753	PQ_Q1a_max	Reactive power (A)_Fundamental	var
0755	PQ_Q1b_max	Reactive power (B)_Fundamental	var
0757	PQ_Q1c_max	Reactive power (C)_Fundamental	var
0759	PQ_Q1_max	Reactive power (Σ)_Fundamental	var

2.2.7.16 Registers 0801 to 0846: Energy Counters

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

Register 0801 to 0802: Energy per Counter Pulse

Data type: Measured value

Table 2-25 Register 0801 to 0802: Energy per Counter Pulse

Register	Type of Information	Remark	Unit
0801	PulseQuantity	Conversion factor of counter pulses into energy values	Wh per pulse, varh per pulse or VAh per pulse

Registers 0803 to 0806: Counter Value Status

Data type: Counter (quality information)

Table 2-26 Registers 0803 to 0806: Counter Value Status

Register	Type of Information	Remark	Unit
0803/2^0	Status 1	Status of counters WPa_Demand	-
0803/2^2	Status 2	Status of counters WPb_Demand	-
0803/2^4	Status 3	Status of counters WPc_Demand	-
0803/2^6	Status 4	Status of counters WP_Demand	-
0803/2^8	Status 5	Status of counters WPa_Supply	-
0803/2^{10}	Status 6	Status of counters WPb_Supply	-
0803/2^{12}	Status 7	Status of counters WPc_Supply	-
0803/2^{14}	Status 8	Status of counters WP_Supply	-
0804/2^0	Status 9	Status of counters WQa_inductive	-
0804/2^2	Status 10	Status of counters WQb_inductive	-
0804/2^4	Status 11	Status of counters WQc_inductive	-
0804/2^6	Status 12	Status of counters WQ_inductive	-
0804/2^8	Status 13	Status of counters WQa_capacitive	-
0804/2^{10}	Status 14	Status of counters WQb_capacitive	-
0804/2^{12}	Status 15	Status of counters WQc_capacitive	-

Table 2-26 Registers 0803 to 0806: Counter Value Status (cont.)

Register	Type of Information	Remark	Unit
0804/2^{14}	Status 16	Status of counters WQ_capacitive	-
0805/2^{0}	Status 17	Status of counters WSa	-
0805/2^{2}	Status 18	Status of counters WSb	-
0805/2^{4}	Status 19	Status of counters WSc	-
0805/2^{6}	Status 20	Status of counters WS	-
0805/2^{8} to 0805/2^{15}	Reserved	= 0	-
0806	Reserved	= 0	-

Registers 0807 to 0846: Counter Pulses

Data type: Counter

Table 2-27 Registers 0807 to 0846: Counter Pulses

Register	Type of Information	Remark	Unit
0807	WPa_dmd	Active energy based on active power Pa Demand	Pulse
0809	WPb_dmd	Active energy based on active power Pb Demand	Pulse
0811	WPc_dmd	Active energy based on active power Pc Demand	Pulse
0813	WP_dmd	Active energy based on active power P Demand	Pulse
0815	WPa_sup	Active energy based on active power Pa Supply	Pulse
0817	WPb_sup	Active energy based on active power Pb Supply	Pulse
0819	WPc_sup	Active energy based on active power Pc Supply	Pulse
0821	WP_sup	Active energy based on active power P Supply	Pulse
0823	WQa_ind	Reactive energy based on reactive power Qa inductive	Pulse

Table 2-27 Registers 0807 to 0846: Counter Pulses (cont.)

Register	Type of Information	Remark	Unit
0825	WQb_ind	Reactive energy based on reactive power Qb inductive	Pulse
0827	WQc_ind	Reactive energy based on reactive power Qc inductive	Pulse
0829	WQ_ind	Reactive energy based on reactive power Q inductive	Pulse
0831	WQa_cap	Reactive energy based on reactive power Qa capacitive	Pulse
0833	WQb_cap	Reactive energy based on reactive power Qb capacitive	Pulse
0835	WQc_cap	Reactive energy based on reactive power Qc capacitive	Pulse
0837	WQ_cap	Reactive energy based on reactive power Q capacitive	Pulse
0839	WSa	Apparent energy based on apparent power Sa	Pulse
0841	WSb	Apparent energy based on apparent power Sb	Pulse
0843	WSc	Apparent energy based on apparent power Sc	Pulse
0845	WS	Apparent energy based on apparent power S	Pulse

2.2.7.17 Registers 1001 to 1280: Harmonics – Voltage Values

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

Calculation period: 10/12 cycle (50Hz/60Hz)

Network types: harmonic ph-n is available if 3W used; harmonic ph-ph is available if 4W is used.

Data type: Measured value

Table 2-28 Registers 1001 to 1280: Harmonics – Voltage Values

Register	Type of Information	Remark	Unit
1001	H_Va-1/H_Vab-1	1. Harmonic, voltage value, a-N, ab (Basic wave)	V
1003	H_Va-2/H_Vab-2	2. Harmonic, voltage value, a-N, ab	V/%
1005	H_Va-3/H_Vab-3	3. Harmonic, voltage value, a-N, ab	V/%
1007	H_Va-4/H_Vab-4	4. Harmonic, voltage value, a-N, ab	V/%
1009	H_Va-5/H_Vab-5	5. Harmonic, voltage value, a-N, ab	V/%
1011	H_Va-6/H_Vab-6	6. Harmonic, voltage value, a-N, ab	V/%
1013	H_Va-7/H_Vab-7	7. Harmonic, voltage value, a-N, ab	V/%
1015	H_Va-8/H_Vab-8	8. Harmonic, voltage value, a-N, ab	V/%
1017	H_Va-9/H_Vab-9	9. Harmonic, voltage value, a-N, ab	V/%
1019	H_Va-10/H_Vab-10	10. Harmonic, voltage value, a-N, ab	V/%
1021	H_Va-11/H_Vab-11	11. Harmonic, voltage value, a-N, ab	V/%
1023	H_Va-12/H_Vab-12	12. Harmonic, voltage value, a-N, ab	V/%
1025	H_Va-13/H_Vab-13	13. Harmonic, voltage value, a-N, ab	V/%
1027	H_Va-14/H_Vab-14	14. Harmonic, voltage value, a-N, ab	V/%
1029	H_Va-15/H_Vab-15	15. Harmonic, voltage value, a-N, ab	V/%
1031	H_Va-16/H_Vab-16	16. Harmonic, voltage value, a-N, ab	V/%
1033	H_Va-17/H_Vab-17	17. Harmonic, voltage value, a-N, ab	V/%
1035	H_Va-18/H_Vab-18	18. Harmonic, voltage value, a-N, ab	V/%
1037	H_Va-19/H_Vab-19	19. Harmonic, voltage value, a-N, ab	V/%
1039	H_Va-20/H_Vab-20	20. Harmonic, voltage value, a-N, ab	V/%
1041	H_Va-21/H_Vab-21	21. Harmonic, voltage value, a-N, ab	V/%

Table 2-28 Registers 1001 to 1280: Harmonics – Voltage Values (cont.)

Register	Type of Information	Remark	Unit
1043	H_Va-22/H_Vab-22	22. Harmonic, voltage value, a-N, ab	V/%
1045	H_Va-23/H_Vab-23	23. Harmonic, voltage value, a-N, ab	V/%
1047	H_Va-24/H_Vab-24	24. Harmonic, voltage value, a-N, ab	V/%
1049	H_Va-25/H_Vab-25	25. Harmonic, voltage value, a-N, ab	V/%
1051	H_Va-26/H_Vab-26	26. Harmonic, voltage value, a-N, ab	V/%
1053	H_Va-27/H_Vab-27	27. Harmonic, voltage value, a-N, ab	V/%
1055	H_Va-28/H_Vab-28	28. Harmonic, voltage value, a-N, ab	V/%
1057	H_Va-29/H_Vab-29	29. Harmonic, voltage value, a-N, ab	V/%
1059	H_Va-30/H_Vab-30	30. Harmonic, voltage value, a-N, ab	V/%
1061	H_Va-31/H_Vab-31	31. Harmonic, voltage value, a-N, ab	V/%
1063	H_Va-32/H_Vab-32	32. Harmonic, voltage value, a-N, ab	V/%
1065	H_Va-33/H_Vab-33	33. Harmonic, voltage value, a-N, ab	V/%
1067	H_Va-34/H_Vab-34	34. Harmonic, voltage value, a-N, ab	V/%
1069	H_Va-35/H_Vab-35	35. Harmonic, voltage value, a-N, ab	V/%
1071	H_Va-36/H_Vab-36	36. Harmonic, voltage value, a-N, ab	V/%
1073	H_Va-37/H_Vab-37	37. Harmonic, voltage value, a-N, ab	V/%
1075	H_Va-38/H_Vab-38	38. Harmonic, voltage value, a-N, ab	V/%
1077	H_Va-39/H_Vab-39	39. Harmonic, voltage value, a-N, ab	V/%
1079	H_Va-40/H_Vab-40	40. Harmonic, voltage value, a-N, ab	V/%
1101	H_Vb-1/H_Vbc-1	1. Harmonic, voltage value, b-N, bc (Basic wave)	V
1103	H_Vb-2/H_Vbc-2	2. Harmonic, voltage value, b-N, bc	V/%
1105	H_Vb-3/H_Vbc-3	3. Harmonic, voltage value, b-N, bc	V/%
1107	H_Vb-4/H_Vbc-4	4. Harmonic, voltage value, b-N, bc	V/%
1109	H_Vb-5/H_Vbc-5	5. Harmonic, voltage value, b-N, bc	V/%
1111	H_Vb-6/H_Vbc-6	6. Harmonic, voltage value, b-N, bc	V/%
1113	H_Vb-7/H_Vbc-7	7. Harmonic, voltage value, b-N, bc	V/%

Table 2-28 Registers 1001 to 1280: Harmonics – Voltage Values (cont.)

Register	Type of Information	Remark	Unit
1115	H_Vb-8/H_Vbc-8	8. Harmonic, voltage value, b-N, bc	V/%
1117	H_Vb-9/H_Vbc-9	9. Harmonic, voltage value, b-N, bc	V/%
1119	H_Vb-10/H_Vbc-10	10. Harmonic, voltage value, b-N, bc	V/%
1121	H_Vb-11/H_Vbc-11	11. Harmonic, voltage value, b-N, bc	V/%
1123	H_Vb-12/H_Vbc-12	12. Harmonic, voltage value, b-N, bc	V/%
1125	H_Vb-13/H_Vbc-13	13. Harmonic, voltage value, b-N, bc	V/%
1127	H_Vb-14/H_Vbc-14	14. Harmonic, voltage value, b-N, bc	V/%
1129	H_Vb-15/H_Vbc-15	15. Harmonic, voltage value, b-N, bc	V/%
1131	H_Vb-16/H_Vbc-16	16. Harmonic, voltage value, b-N, bc	V/%
1133	H_Vb-17/H_Vbc-17	17. Harmonic, voltage value, b-N, bc	V/%
1135	H_Vb-18/H_Vbc-18	18. Harmonic, voltage value, b-N, bc	V/%
1137	H_Vb-19/H_Vbc-19	19. Harmonic, voltage value, b-N, bc	V/%
1139	H_Vb-20/H_Vbc-20	20. Harmonic, voltage value, b-N, bc	V/%
1141	H_Vb-21/H_Vbc-21	21. Harmonic, voltage value, b-N, bc	V/%
1143	H_Vb-22/H_Vbc-22	22. Harmonic, voltage value, b-N, bc	V/%
1145	H_Vb-23/H_Vbc-23	23. Harmonic, voltage value, b-N, bc	V/%
1147	H_Vb-24/H_Vbc-24	24. Harmonic, voltage value, b-N, bc	V/%
1149	H_Vb-25/H_Vbc-25	25. Harmonic, voltage value, b-N, bc	V/%
1151	H_Vb-26/H_Vbc-26	26. Harmonic, voltage value, b-N, bc	V/%
1153	H_Vb-27/H_Vbc-27	27. Harmonic, voltage value, b-N, bc	V/%
1155	H_Vb-28/H_Vbc-28	28. Harmonic, voltage value, b-N, bc	V/%
1157	H_Vb-29/H_Vbc-29	29. Harmonic, voltage value, b-N, bc	V/%
1159	H_Vb-30/H_Vbc-30	30. Harmonic, voltage value, b-N, bc	V/%
1161	H_Vb-31/H_Vbc-31	31. Harmonic, voltage value, b-N, bc	V/%
1163	H_Vb-32/H_Vbc-32	32. Harmonic, voltage value, b-N, bc	V/%
1165	H_Vb-33/H_Vbc-33	33. Harmonic, voltage value, b-N, bc	V/%

Table 2-28 Registers 1001 to 1280: Harmonics – Voltage Values (cont.)

Register	Type of Information	Remark	Unit
1167	H_Vb-34/H_Vbc-34	34. Harmonic, voltage value, b-N, bc	V/%
1169	H_Vb-35/H_Vbc-35	35. Harmonic, voltage value, b-N, bc	V/%
1171	H_Vb-36/H_Vbc-36	36. Harmonic, voltage value, b-N, bc	V/%
1173	H_Vb-37/H_Vbc-37	37. Harmonic, voltage value, b-N, bc	V/%
1175	H_Vb-38/H_Vbc-38	38. Harmonic, voltage value, b-N, bc	V/%
1177	H_Vb-39/H_Vbc-39	39. Harmonic, voltage value, b-N, bc	V/%
1179	H_Vb-40/H_Vbc-40	40. Harmonic, voltage value, b-N, bc	V/%
1201	H_Vc-1/H_Vca-1	1. Harmonic, voltage value, c-N, ca (Basic wave)	V
1203	H_Vc-2/H_Vca-2	2. Harmonic, voltage value, c-N, ca	V/%
1205	H_Vc-3/H_Vca-3	3. Harmonic, voltage value, c-N, ca	V/%
1207	H_Vc-4/H_Vca-4	4. Harmonic, voltage value, c-N, ca	V/%
1209	H_Vc-5/H_Vca-5	5. Harmonic, voltage value, c-N, ca	V/%
1211	H_Vc-6/H_Vca-6	6. Harmonic, voltage value, c-N, ca	V/%
1213	H_Vc-7/H_Vca-7	7. Harmonic, voltage value, c-N, ca	V/%
1215	H_Vc-8/H_Vca-8	8. Harmonic, voltage value, c-N, ca	V/%
1217	H_Vc-9/H_Vca-9	9. Harmonic, voltage value, c-N, ca	V/%
1219	H_Vc-10/H_Vca-10	10. Harmonic, voltage value, c-N, ca	V/%
1221	H_Vc-11/H_Vca-11	11. Harmonic, voltage value, c-N, ca	V/%
1223	H_Vc-12/H_Vca-12	12. Harmonic, voltage value, c-N, ca	V/%
1225	H_Vc-13/H_Vca-13	13. Harmonic, voltage value, c-N, ca	V/%
1227	H_Vc-14/H_Vca-14	14. Harmonic, voltage value, c-N, ca	V/%
1229	H_Vc-15/H_Vca-15	15. Harmonic, voltage value, c-N, ca	V/%
1231	H_Vc-16/H_Vca-16	16. Harmonic, voltage value, c-N, ca	V/%
1233	H_Vc-17/H_Vca-17	17. Harmonic, voltage value, c-N, ca	V/%
1235	H_Vc-18/H_Vca-18	18. Harmonic, voltage value, c-N, ca	V/%
1237	H_Vc-19/H_Vca-19	19. Harmonic, voltage value, c-N, ca	V/%

Table 2-28 Registers 1001 to 1280: Harmonics – Voltage Values (cont.)

Register	Type of Information	Remark	Unit
1239	H_Vc-20/H_Vca-20	20. Harmonic, voltage value, c-N, ca	V/%
1241	H_Vc-21/H_Vca-21	21. Harmonic, voltage value, c-N, ca	V/%
1243	H_Vc-22/H_Vca-22	22. Harmonic, voltage value, c-N, ca	V/%
1245	H_Vc-23/H_Vca-23	23. Harmonic, voltage value, c-N, ca	V/%
1247	H_Vc-24/H_Vca-24	24. Harmonic, voltage value, c-N, ca	V/%
1249	H_Vc-25/H_Vca-25	25. Harmonic, voltage value, c-N, ca	V/%
1251	H_Vc-26/H_Vca-26	26. Harmonic, voltage value, c-N, ca	V/%
1253	H_Vc-27/H_Vca-27	27. Harmonic, voltage value, c-N, ca	V/%
1255	H_Vc-28/H_Vca-28	28. Harmonic, voltage value, c-N, ca	V/%
1257	H_Vc-29/H_Vca-29	29. Harmonic, voltage value, c-N, ca	V/%
1259	H_Vc-30/H_Vca-30	30. Harmonic, voltage value, c-N, ca	V/%
1261	H_Vc-31/H_Vca-31	31. Harmonic, voltage value, c-N, ca	V/%
1263	H_Vc-32/H_Vca-32	32. Harmonic, voltage value, c-N, ca	V/%
1265	H_Vc-33/H_Vca-33	33. Harmonic, voltage value, c-N, ca	V/%
1267	H_Vc-34/H_Vca-34	34. Harmonic, voltage value, c-N, ca	V/%
1269	H_Vc-35/H_Vca-35	35. Harmonic, voltage value, c-N, ca	V/%
1271	H_Vc-36/H_Vca-36	36. Harmonic, voltage value, c-N, ca	V/%
1273	H_Vc-37/H_Vca-37	37. Harmonic, voltage value, c-N, ca	V/%
1275	H_Vc-38/H_Vca-38	38. Harmonic, voltage value, c-N, ca	V/%
1277	H_Vc-39/H_Vca-39	39. Harmonic, voltage value, c-N, ca	V/%
1279	H_Vc-40/H_Vca-40	40. Harmonic, voltage value, c-N, ca	V/%

2.2.7.18 Registers 1401 to 1680: Harmonics – Current Values

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

Calculation period: 10/12 cycle (50 Hz/60 Hz)

Data type: Measured value

Table 2-29 Registers 1401 to 1680: Harmonics – Current Values

Register	Type of Information	Remark	Unit
1401	H_Ia-1	1. Harmonic, current value, a-N (Basic wave)	A
1403	H_Ia-2	2. Harmonic, current value, a-N	A
1405	H_Ia-3	3. Harmonic, current value, a-N	A
1407	H_Ia-4	4. Harmonic, current value, a-N	A
1409	H_Ia-5	5. Harmonic, current value, a-N	A
1411	H_Ia-6	6. Harmonic, current value, a-N	A
1413	H_Ia-7	7. Harmonic, current value, a-N	A
1415	H_Ia-8	8. Harmonic, current value, a-N	A
1417	H_Ia-9	9. Harmonic, current value, a-N	A
1419	H_Ia-10	10. Harmonic, current value, a-N	A
1421	H_Ia-11	11. Harmonic, current value, a-N	A
1423	H_Ia-12	12. Harmonic, current value, a-N	A
1425	H_Ia-13	13. Harmonic, current value, a-N	A
1427	H_Ia-14	14. Harmonic, current value, a-N	A
1429	H_Ia-15	15. Harmonic, current value, a-N	A
1431	H_Ia-16	16. Harmonic, current value, a-N	A
1433	H_Ia-17	17. Harmonic, current value, a-N	A
1435	H_Ia-18	18. Harmonic, current value, a-N	A
1437	H_Ia-19	19. Harmonic, current value, a-N	A
1439	H_Ia-20	20. Harmonic, current value, a-N	A
1441	H_Ia-21	21. Harmonic, current value, a-N	A
1443	H_Ia-22	22. Harmonic, current value, a-N	A

Table 2-29 Registers 1401 to 1680: Harmonics – Current Values (cont.)

Register	Type of Information	Remark	Unit
1445	H_Ia-23	23. Harmonic, current value, a-N	A
1447	H_Ia-24	24. Harmonic, current value, a-N	A
1449	H_Ia-25	25. Harmonic, current value, a-N	A
1451	H_Ia-26	26. Harmonic, current value, a-N	A
1453	H_Ia-27	27. Harmonic, current value, a-N	A
1455	H_Ia-28	28. Harmonic, current value, a-N	A
1457	H_Ia-29	29. Harmonic, current value, a-N	A
1459	H_Ia-30	30. Harmonic, current value, a-N	A
1461	H_Ia-31	31. Harmonic, current value, a-N	A
1463	H_Ia-32	32. Harmonic, current value, a-N	A
1465	H_Ia-33	33. Harmonic, current value, a-N	A
1467	H_Ia-34	34. Harmonic, current value, a-N	A
1469	H_Ia-35	35. Harmonic, current value, a-N	A
1471	H_Ia-36	36. Harmonic, current value, a-N	A
1473	H_Ia-37	37. Harmonic, current value, a-N	A
1475	H_Ia-38	38. Harmonic, current value, a-N	A
1477	H_Ia-39	39. Harmonic, current value, a-N	A
1479	H_Ia-40	40. Harmonic, current value, a-N	A
1501	H_Ib-1	1. Harmonic, current value, b-N (Basic wave)	A
1503	H_Ib-2	2. Harmonic, current value, b-N	A
1505	H_Ib-3	3. Harmonic, current value, b-N	A
1507	H_Ib-4	4. Harmonic, current value, b-N	A
1509	H_Ib-5	5. Harmonic, current value, b-N	A
1511	H_Ib-6	6. Harmonic, current value, b-N	A
1513	H_Ib-7	7. Harmonic, current value, b-N	A
1515	H_Ib-8	8. Harmonic, current value, b-N	A

Table 2-29 Registers 1401 to 1680: Harmonics – Current Values (cont.)

Register	Type of Information	Remark	Unit
1517	H_Ib-9	9. Harmonic, current value, b-N	A
1519	H_Ib-10	10. Harmonic, current value, b-N	A
1521	H_Ib-11	11. Harmonic, current value, b-N	A
1523	H_Ib-12	12. Harmonic, current value, b-N	A
1525	H_Ib-13	13. Harmonic, current value, b-N	A
1527	H_Ib-14	14. Harmonic, current value, b-N	A
1529	H_Ib-15	15. Harmonic, current value, b-N	A
1531	H_Ib-16	16. Harmonic, current value, b-N	A
1533	H_Ib-17	17. Harmonic, current value, b-N	A
1535	H_Ib-18	18. Harmonic, current value, b-N	A
1537	H_Ib-19	19. Harmonic, current value, b-N	A
1539	H_Ib-20	20. Harmonic, current value, b-N	A
1541	H_Ib-21	21. Harmonic, current value, b-N	A
1543	H_Ib-22	22. Harmonic, current value, b-N	A
1545	H_Ib-23	23. Harmonic, current value, b-N	A
1547	H_Ib-24	24. Harmonic, current value, b-N	A
1549	H_Ib-25	25. Harmonic, current value, b-N	A
1551	H_Ib-26	26. Harmonic, current value, b-N	A
1553	H_Ib-27	27. Harmonic, current value, b-N	A
1555	H_Ib-28	28. Harmonic, current value, b-N	A
1557	H_Ib-29	29. Harmonic, current value, b-N	A
1559	H_Ib-30	30. Harmonic, current value, b-N	A
1561	H_Ib-31	31. Harmonic, current value, b-N	A
1563	H_Ib-32	32. Harmonic, current value, b-N	A
1565	H_Ib-33	33. Harmonic, current value, b-N	A
1567	H_Ib-34	34. Harmonic, current value, b-N	A

Table 2-29 Registers 1401 to 1680: Harmonics – Current Values (cont.)

Register	Type of Information	Remark	Unit
1569	H_Ib-35	35. Harmonic, current value, b-N	A
1571	H_Ib-36	36. Harmonic, current value, b-N	A
1573	H_Ib-37	37. Harmonic, current value, b-N	A
1575	H_Ib-38	38. Harmonic, current value, b-N	A
1577	H_Ib-39	39. Harmonic, current value, b-N	A
1579	H_Ib-40	40. Harmonic, current value, b-N	A
1601	H_Ic-1	1. Harmonic, current value, c-N (Basic wave)	A
1603	H_Ic-2	2. Harmonic, current value, c-N	A
1605	H_Ic-3	3. Harmonic, current value, c-N	A
1607	H_Ic-4	4. Harmonic, current value, c-N	A
1609	H_Ic-5	5. Harmonic, current value, c-N	A
1611	H_Ic-6	6. Harmonic, current value, c-N	A
1613	H_Ic-7	7. Harmonic, current value, c-N	A
1615	H_Ic-8	8. Harmonic, current value, c-N	A
1617	H_Ic-9	9. Harmonic, current value, c-N	A
1619	H_Ic-10	10. Harmonic, current value, c-N	A
1621	H_Ic-11	11. Harmonic, current value, c-N	A
1623	H_Ic-12	12. Harmonic, current value, c-N	A
1625	H_Ic-13	13. Harmonic, current value, c-N	A
1627	H_Ic-14	14. Harmonic, current value, c-N	A
1629	H_Ic-15	15. Harmonic, current value, c-N	A
1631	H_Ic-16	16. Harmonic, current value, c-N	A
1633	H_Ic-17	17. Harmonic, current value, c-N	A
1635	H_Ic-18	18. Harmonic, current value, c-N	A
1637	H_Ic-19	19. Harmonic, current value, c-N	A
1639	H_Ic-20	20. Harmonic, current value, c-N	A

Table 2-29 Registers 1401 to 1680: Harmonics – Current Values (cont.)

Register	Type of Information	Remark	Unit
1641	H_Ic-21	21. Harmonic, current value, c-N	A
1643	H_Ic-22	22. Harmonic, current value, c-N	A
1645	H_Ic-23	23. Harmonic, current value, c-N	A
1647	H_Ic-24	24. Harmonic, current value, c-N	A
1649	H_Ic-25	25. Harmonic, current value, c-N	A
1651	H_Ic-26	26. Harmonic, current value, c-N	A
1653	H_Ic-27	27. Harmonic, current value, c-N	A
1655	H_Ic-28	28. Harmonic, current value, c-N	A
1657	H_Ic-29	29. Harmonic, current value, c-N	A
1659	H_Ic-30	30. Harmonic, current value, c-N	A
1661	H_Ic-31	31. Harmonic, current value, c-N	A
1663	H_Ic-32	32. Harmonic, current value, c-N	A
1665	H_Ic-33	33. Harmonic, current value, c-N	A
1667	H_Ic-34	34. Harmonic, current value, c-N	A
1669	H_Ic-35	35. Harmonic, current value, c-N	A
1671	H_Ic-36	36. Harmonic, current value, c-N	A
1673	H_Ic-37	37. Harmonic, current value, c-N	A
1675	H_Ic-38	38. Harmonic, current value, c-N	A
1677	H_Ic-39	39. Harmonic, current value, c-N	A
1679	H_Ic-40	40. Harmonic, current value, c-N	A

2.2.7.19 Registers 1801 to 2080: PQ Calculation for Harmonic (Average Values) – Voltage Values

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

The data are calculated within the parameterized time (for example 30 s, 1 min etc.).

Network types: harmonic ph-n is available if 3W used; harmonic ph-ph is available if 4W is used.

Data type: Measured value

Table 2-30 Registers 1801 to 2080: PQ Calculation for Harmonics (Average Values) – Voltage Values

Register	Type of Information	Remark	Unit
1801	H_Va/Vab-1_AVG	1. Harmonic (average value), voltage value, a-N, ab (Basic wave)	V
1803	H_Va/Vab-2_AVG	2. Harmonic (average value), voltage value, a-N, ab	V/%
1805	H_Va/Vab-3_AVG	3. Harmonic (average value), voltage value, a-N, ab	V/%
1807	H_Va/Vab-4_AVG	4. Harmonic (average value), voltage value, a-N, ab	V/%
1809	H_Va/Vab-5_AVG	5. Harmonic (average value), voltage value, a-N, ab	V/%
1811	H_Va/Vab-6_AVG	6. Harmonic (average value), voltage value, a-N, ab	V/%
1813	H_Va/Vab-7_AVG	7. Harmonic (average value), voltage value, a-N, ab	V/%
1815	H_Va/Vab-8_AVG	8. Harmonic (average value), voltage value, a-N, ab	V/%
1817	H_Va/Vab-9_AVG	9. Harmonic (average value), voltage value, a-N, ab	V/%
1819	H_Va/Vab-10_AVG	10. Harmonic (average value), voltage value, a-N, ab	V/%
1821	H_Va/Vab-11_AVG	11. Harmonic (average value), voltage value, a-N, ab	V/%
1823	H_Va/Vab-12_AVG	12. Harmonic (average value), voltage value, a-N, ab	V/%
1825	H_Va/Vab-13_AVG	13. Harmonic (average value), voltage value, a-N, ab	V/%
1827	H_Va/Vab-14_AVG	14. Harmonic (average value), voltage value, a-N, ab	V/%
1829	H_Va/Vab-15_AVG	15. Harmonic (average value), voltage value, a-N, ab	V/%
1831	H_Va/Vab-16_AVG	16. Harmonic (average value), voltage value, a-N, ab	V/%
1833	H_Va/Vab-17_AVG	17. Harmonic (average value), voltage value, a-N, ab	V/%
1835	H_Va/Vab-18_AVG	18. Harmonic (average value), voltage value, a-N, ab	V/%
1837	H_Va/Vab-19_AVG	19. Harmonic (average value), voltage value, a-N, ab	V/%
1839	H_Va/Vab-20_AVG	20. Harmonic (average value), voltage value, a-N, ab	V/%

Table 2-30 Registers 1801 to 2080: PQ Calculation for Harmonics (Average Values) – Voltage Values

Register	Type of Information	Remark	Unit
1841	H_Va/Vab-21_AVG	21. Harmonic (average value), voltage value, a-N, ab	V/%
1843	H_Va/Vab-22_AVG	22. Harmonic (average value), voltage value, a-N, ab	V/%
1845	H_Va/Vab-23_AVG	23. Harmonic (average value), voltage value, a-N, ab	V/%
1847	H_Va/Vab-24_AVG	24. Harmonic (average value), voltage value, a-N, ab	V/%
1849	H_Va/Vab-25_AVG	25. Harmonic (average value), voltage value, a-N, ab	V/%
1851	H_Va/Vab-26_AVG	26. Harmonic (average value), voltage value, a-N, ab	V/%
1853	H_Va/Vab-27_AVG	27. Harmonic (average value), voltage value, a-N, ab	V/%
1855	H_Va/Vab-28_AVG	28. Harmonic (average value), voltage value, a-N, ab	V/%
1857	H_Va/Vab-29_AVG	29. Harmonic (average value), voltage value, a-N, ab	V/%
1859	H_Va/Vab-30_AVG	30. Harmonic (average value), voltage value, a-N, ab	V/%
1861	H_Va/Vab-31_AVG	31. Harmonic (average value), voltage value, a-N, ab	V/%
1863	H_Va/Vab-32_AVG	32. Harmonic (average value), voltage value, a-N, ab	V/%
1865	H_Va/Vab-33_AVG	33. Harmonic (average value), voltage value, a-N, ab	V/%
1867	H_Va/Vab-34_AVG	34. Harmonic (average value), voltage value, a-N, ab	V/%
1869	H_Va/Vab-35_AVG	35. Harmonic (average value), voltage value, a-N, ab	V/%
1871	H_Va/Vab-36_AVG	36. Harmonic (average value), voltage value, a-N, ab	V/%
1873	H_Va/Vab-37_AVG	37. Harmonic (average value), voltage value, a-N, ab	V/%
1875	H_Va/Vab-38_AVG	38. Harmonic (average value), voltage value, a-N, ab	V/%
1877	H_Va/Vab-39_AVG	39. Harmonic (average value), voltage value, a-N, ab	V/%
1879	H_Va/Vab-40_AVG	40. Harmonic (average value), voltage value, a-N, ab	V/%
1901	H_Vb/Vbc-1_AVG	1. Harmonic (average value), voltage value, b-N, bc (Basic wave)	V
1903	H_Vb/Vbc-2_AVG	2. Harmonic (average value), voltage value, b-N, bc	V/%
1905	H_Vb/Vbc-3_AVG	3. Harmonic (average value), voltage value, b-N, bc	V/%
1907	H_Vb/Vbc-4_AVG	4. Harmonic (average value), voltage value, b-N, bc	V/%
1909	H_Vb/Vbc-5_AVG	5. Harmonic (average value), voltage value, b-N, bc	V/%

Table 2-30 Registers 1801 to 2080: PQ Calculation for Harmonics (Average Values) – Voltage Values

Register	Type of Information	Remark	Unit
1911	H_Vb/Vbc-6_AVG	6. Harmonic (average value), voltage value, b-N, bc	V/%
1913	H_Vb/Vbc-7_AVG	7. Harmonic (average value), voltage value, b-N, bc	V/%
1915	H_Vb/Vbc-8_AVG	8. Harmonic (average value), voltage value, b-N, bc	V/%
1917	H_Vb/Vbc-9_AVG	9. Harmonic (average value), voltage value, b-N, bc	V/%
1919	H_Vb/Vbc-10_AVG	10. Harmonic (average value), voltage value, b-N, bc	V/%
1921	H_Vb/Vbc-11_AVG	11. Harmonic (average value), voltage value, b-N, bc	V/%
1923	H_Vb/Vbc-12_AVG	12. Harmonic (average value), voltage value, b-N, bc	V/%
1925	H_Vb/Vbc-13_AVG	13. Harmonic (average value), voltage value, b-N, bc	V/%
1927	H_Vb/Vbc-14_AVG	14. Harmonic (average value), voltage value, b-N, bc	V/%
1929	H_Vb/Vbc-15_AVG	15. Harmonic (average value), voltage value, b-N, bc	V/%
1931	H_Vb/Vbc-16_AVG	16. Harmonic (average value), voltage value, b-N, bc	V/%
1933	H_Vb/Vbc-17_AVG	17. Harmonic (average value), voltage value, b-N, bc	V/%
1935	H_Vb/Vbc-18_AVG	18. Harmonic (average value), voltage value, b-N, bc	V/%
1937	H_Vb/Vbc-19_AVG	19. Harmonic (average value), voltage value, b-N, bc	V/%
1939	H_Vb/Vbc-20_AVG	20. Harmonic (average value), voltage value, b-N, bc	V/%
1941	H_Vb/Vbc-21_AVG	21. Harmonic (average value), voltage value, b-N, bc	V/%
1943	H_Vb/Vbc-22_AVG	22. Harmonic (average value), voltage value, b-N, bc	V/%
1945	H_Vb/Vbc-23_AVG	23. Harmonic (average value), voltage value, b-N, bc	V/%
1947	H_Vb/Vbc-24_AVG	24. Harmonic (average value), voltage value, b-N, bc	V/%
1949	H_Vb/Vbc-25_AVG	25. Harmonic (average value), voltage value, b-N, bc	V/%
1951	H_Vb/Vbc-26_AVG	26. Harmonic (average value), voltage value, b-N, bc	V/%
1953	H_Vb/Vbc-27_AVG	27. Harmonic (average value), voltage value, b-N, bc	V/%
1955	H_Vb/Vbc-28_AVG	28. Harmonic (average value), voltage value, b-N, bc	V/%
1957	H_Vb/Vbc-29_AVG	29. Harmonic (average value), voltage value, b-N, bc	V/%
1959	H_Vb/Vbc-30_AVG	30. Harmonic (average value), voltage value, b-N, bc	V/%
1961	H_Vb/Vbc-31_AVG	31. Harmonic (average value), voltage value, b-N, bc	V/%

Table 2-30 Registers 1801 to 2080: PQ Calculation for Harmonics (Average Values) – Voltage Values

Register	Type of Information	Remark	Unit
1963	H_Vb/Vbc-32_AVG	32. Harmonic (average value), voltage value, b-N, bc	V/%
1965	H_Vb/Vbc-33_AVG	33. Harmonic (average value), voltage value, b-N, bc	V/%
1967	H_Vb/Vbc-34_AVG	34. Harmonic (average value), voltage value, b-N, bc	V/%
1969	H_Vb/Vbc-35_AVG	35. Harmonic (average value), voltage value, b-N, bc	V/%
1971	H_Vb/Vbc-36_AVG	36. Harmonic (average value), voltage value, b-N, bc	V/%
1973	H_Vb/Vbc-37_AVG	37. Harmonic (average value), voltage value, b-N, bc	V/%
1975	H_Vb/Vbc-38_AVG	38. Harmonic (average value), voltage value, b-N, bc	V/%
1977	H_Vb/Vbc-39_AVG	39. Harmonic (average value), voltage value, b-N, bc	V/%
1979	H_Vb/Vbc-40_AVG	40. Harmonic (average value), voltage value, b-N, bc	V/%
2001	H_Vc/Vca-1_AVG	1. Harmonic (average value), voltage value, c-N, ca (Basic wave)	V
2003	H_Vc/Vca-2_AVG	2. Harmonic (average value), voltage value, c-N, ca	V/%
2005	H_Vc/Vca-3_AVG	3. Harmonic (average value), voltage value, c-N, ca	V/%
2007	H_Vc/Vca-4_AVG	4. Harmonic (average value), voltage value, c-N, ca	V/%
2009	H_Vc/Vca-5_AVG	5. Harmonic (average value), voltage value, c-N, ca	V/%
2011	H_Vc/Vca-6_AVG	6. Harmonic (average value), voltage value, c-N, ca	V/%
2013	H_Vc/Vca-7_AVG	7. Harmonic (average value), voltage value, c-N, ca	V/%
2015	H_Vc/Vca-8_AVG	8. Harmonic (average value), voltage value, c-N, ca	V/%
2017	H_Vc/Vca-9_AVG	9. Harmonic (average value), voltage value, c-N, ca	V/%
2019	H_Vc/Vca-10_AVG	10. Harmonic (average value), voltage value, c-N, ca	V/%
2021	H_Vc/Vca-11_AVG	11. Harmonic (average value), voltage value, c-N, ca	V/%
2023	H_Vc/Vca-12_AVG	12. Harmonic (average value), voltage value, c-N, ca	V/%
2025	H_Vc/Vca-13_AVG	13. Harmonic (average value), voltage value, c-N, ca	V/%
2027	H_Vc/Vca-14_AVG	14. Harmonic (average value), voltage value, c-N, ca	V/%
2029	H_Vc/Vca-15_AVG	15. Harmonic (average value), voltage value, c-N, ca	V/%
2031	H_Vc/Vca-16_AVG	16. Harmonic (average value), voltage value, c-N, ca	V/%

Table 2-30 Registers 1801 to 2080: PQ Calculation for Harmonics (Average Values) – Voltage Values

Register	Type of Information	Remark	Unit
2033	H_Vc/Vca-17_AVG	17. Harmonic (average value), voltage value, c-N, ca	V/%
2035	H_Vc/Vca-18_AVG	18. Harmonic (average value), voltage value, c-N, ca	V/%
2037	H_Vc/Vca-19_AVG	19. Harmonic (average value), voltage value, c-N, ca	V/%
2039	H_Vc/Vca-20_AVG	20. Harmonic (average value), voltage value, c-N, ca	V/%
2041	H_Vc/Vca-21_AVG	21. Harmonic (average value), voltage value, c-N, ca	V/%
2043	H_Vc/Vca-22_AVG	22. Harmonic (average value), voltage value, c-N, ca	V/%
2045	H_Vc/Vca-23_AVG	23. Harmonic (average value), voltage value, c-N, ca	V/%
2047	H_Vc/Vca-24_AVG	24. Harmonic (average value), voltage value, c-N, ca	V/%
2049	H_Vc/Vca-25_AVG	25. Harmonic (average value), voltage value, c-N, ca	V/%
2051	H_Vc/Vca-26_AVG	26. Harmonic (average value), voltage value, c-N, ca	V/%
2053	H_Vc/Vca-27_AVG	27. Harmonic (average value), voltage value, c-N, ca	V/%
2055	H_Vc/Vca-28_AVG	28. Harmonic (average value), voltage value, c-N, ca	V/%
2057	H_Vc/Vca-29_AVG	29. Harmonic (average value), voltage value, c-N, ca	V/%
2059	H_Vc/Vca-30_AVG	30. Harmonic (average value), voltage value, c-N, ca	V/%
2061	H_Vc/Vca-31_AVG	31. Harmonic (average value), voltage value, c-N, ca	V/%
2063	H_Vc/Vca-32_AVG	32. Harmonic (average value), voltage value, c-N, ca	V/%
2065	H_Vc/Vca-33_AVG	33. Harmonic (average value), voltage value, c-N, ca	V/%
2067	H_Vc/Vca-34_AVG	34. Harmonic (average value), voltage value, c-N, ca	V/%
2069	H_Vc/Vca-35_AVG	35. Harmonic (average value), voltage value, c-N, ca	V/%
2071	H_Vc/Vca-36_AVG	36. Harmonic (average value), voltage value, c-N, ca	V/%
2073	H_Vc/Vca-37_AVG	37. Harmonic (average value), voltage value, c-N, ca	V/%
2075	H_Vc/Vca-38_AVG	38. Harmonic (average value), voltage value, c-N, ca	V/%
2077	H_Vc/Vca-39_AVG	39. Harmonic (average value), voltage value, c-N, ca	V/%
2079	H_Vc/Vca-40_AVG	40. Harmonic (average value), voltage value, c-N, ca	V/%

2.2.7.20 Registers 2201 to 2480: PQ Calculation for Maximum Harmonic – Voltage Values

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

The data are calculated within the parameterized time (for example 30 s, 1 min etc.).

Data type: Measured value

Table 2-31 Registers 2201 to 2480: PQ Calculation for Harmonics (Maximum Values) – Voltage Values

Register	Type of Information	Remark	Unit
2201	H_Va/Vab-1_MAX	1. Harmonic (maximum value), voltage value, a-N, ab (Basic wave)	V
2203	H_Va/Vab-2_MAX	2. Harmonic (maximum value), voltage value, a-N, ab	V/%
2205	H_Va/Vab-3_MAX	3. Harmonic (maximum value), voltage value, a-N, ab	V/%
2207	H_Va/Vab-4_MAX	4. Harmonic (maximum value), voltage value, a-N, ab	V/%
2209	H_Va/Vab-5_MAX	5. Harmonic (maximum value), voltage value, a-N, ab	V/%
2211	H_Va/Vab-6_MAX	6. Harmonic (maximum value), voltage value, a-N, ab	V/%
2213	H_Va/Vab-7_MAX	7. Harmonic (maximum value), voltage value, a-N, ab	V/%
2215	H_Va/Vab-8_MAX	8. Harmonic (maximum value), voltage value, a-N, ab	V/%
2217	H_Va/Vab-9_MAX	9. Harmonic (maximum value), voltage value, a-N, ab	V/%
2219	H_Va/Vab-10_MAX	10. Harmonic (maximum value), voltage value, a-N, ab	V/%
2221	H_Va/Vab-11_MAX	11. Harmonic (maximum value), voltage value, a-N, ab	V/%
2223	H_Va/Vab-12_MAX	12. Harmonic (maximum value), voltage value, a-N, ab	V/%
2225	H_Va/Vab-13_MAX	13. Harmonic (maximum value), voltage value, a-N, ab	V/%
2227	H_Va/Vab-14_MAX	14. Harmonic (maximum value), voltage value, a-N, ab	V/%
2229	H_Va/Vab-15_MAX	15. Harmonic (maximum value), voltage value, a-N, ab	V/%
2231	H_Va/Vab-16_MAX	16. Harmonic (maximum value), voltage value, a-N, ab	V/%
2233	H_Va/Vab-17_MAX	17. Harmonic (maximum value), voltage value, a-N, ab	V/%
2235	H_Va/Vab-18_MAX	18. Harmonic (maximum value), voltage value, a-N, ab	V/%
2237	H_Va/Vab-19_MAX	19. Harmonic (maximum value), voltage value, a-N, ab	V/%
2239	H_Va/Vab-20_MAX	20. Harmonic (maximum value), voltage value, a-N, ab	V/%
2241	H_Va/Vab-21_MAX	21. Harmonic (maximum value), voltage value, a-N, ab	V/%

Table 2-31 Registers 2201 to 2480: PQ Calculation for Harmonics (Maximum Values) – Voltage Values

Register	Type of Information	Remark	Unit
2243	H_Va/Vab-22_MAX	22. Harmonic (maximum value), voltage value, a-N, ab	V/%
2245	H_Va/Vab-23_MAX	23. Harmonic (maximum value), voltage value, a-N, ab	V/%
2247	H_Va/Vab-24_MAX	24. Harmonic (maximum value), voltage value, a-N, ab	V/%
2249	H_Va/Vab-25_MAX	25. Harmonic (maximum value), voltage value, a-N, ab	V/%
2251	H_Va/Vab-26_MAX	26. Harmonic (maximum value), voltage value, a-N, ab	V/%
2253	H_Va/Vab-27_MAX	27. Harmonic (maximum value), voltage value, a-N, ab	V/%
2255	H_Va/Vab-28_MAX	28. Harmonic (maximum value), voltage value, a-N, ab	V/%
2257	H_Va/Vab-29_MAX	29. Harmonic (maximum value), voltage value, a-N, ab	V/%
2259	H_Va/Vab-30_MAX	30. Harmonic (maximum value), voltage value, a-N, ab	V/%
2261	H_Va/Vab-31_MAX	31. Harmonic (maximum value), voltage value, a-N, ab	V/%
2263	H_Va/Vab-32_MAX	32. Harmonic (maximum value), voltage value, a-N, ab	V/%
2265	H_Va/Vab-33_MAX	33. Harmonic (maximum value), voltage value, a-N, ab	V/%
2267	H_Va/Vab-34_MAX	34. Harmonic (maximum value), voltage value, a-N, ab	V/%
2269	H_Va/Vab-35_MAX	35. Harmonic (maximum value), voltage value, a-N, ab	V/%
2271	H_Va/Vab-36_MAX	36. Harmonic (maximum value), voltage value, a-N, ab	V/%
2273	H_Va/Vab-37_MAX	37. Harmonic (maximum value), voltage value, a-N, ab	V/%
2275	H_Va/Vab-38_MAX	38. Harmonic (maximum value), voltage value, a-N, ab	V/%
2277	H_Va/Vab-39_MAX	39. Harmonic (maximum value), voltage value, a-N, ab	V/%
2279	H_Va/Vab-40_MAX	40. Harmonic (maximum value), voltage value, a-N, ab	V/%
2301	H_Vb/Vbc-1_MAX	1. Harmonic (maximum value), voltage value, b-N, bc (Basic wave)	V
2303	H_Vb/Vbc-2_MAX	2. Harmonic (maximum value), voltage value, b-N, bc	V/%
2305	H_Vb/Vbc-3_MAX	3. Harmonic (maximum value), voltage value, b-N, bc	V/%
2307	H_Vb/Vbc-4_MAX	4. Harmonic (maximum value), voltage value, b-N, bc	V/%
2309	H_Vb/Vbc-5_MAX	5. Harmonic (maximum value), voltage value, b-N, bc	V/%
2311	H_Vb/Vbc-6_MAX	6. Harmonic (maximum value), voltage value, b-N, bc	V/%

Table 2-31 Registers 2201 to 2480: PQ Calculation for Harmonics (Maximum Values) – Voltage Values

Register	Type of Information	Remark	Unit
2313	H_Vb/Vbc-7_MAX	7. Harmonic (maximum value), voltage value, b-N, bc	V/%
2315	H_Vb/Vbc-8_MAX	8. Harmonic (maximum value), voltage value, b-N, bc	V/%
2317	H_Vb/Vbc-9_MAX	9. Harmonic (maximum value), voltage value, b-N, bc	V/%
2323	H_Vb/Vbc-10_MAX	10. Harmonic (maximum value), voltage value, b-N, bc	V/%
2321	H_Vb/Vbc-11_MAX	11. Harmonic (maximum value), voltage value, b-N, bc	V/%
2323	H_Vb/Vbc-12_MAX	12. Harmonic (maximum value), voltage value, b-N, bc	V/%
2325	H_Vb/Vbc-13_MAX	13. Harmonic (maximum value), voltage value, b-N, bc	V/%
2327	H_Vb/Vbc-14_MAX	14. Harmonic (maximum value), voltage value, b-N, bc	V/%
2329	H_Vb/Vbc-15_MAX	15. Harmonic (maximum value), voltage value, b-N, bc	V/%
2331	H_Vb/Vbc-16_MAX	16. Harmonic (maximum value), voltage value, b-N, bc	V/%
2333	H_Vb/Vbc-17_MAX	17. Harmonic (maximum value), voltage value, b-N, bc	V/%
2335	H_Vb/Vbc-18_MAX	18. Harmonic (maximum value), voltage value, b-N, bc	V/%
2337	H_Vb/Vbc-19_MAX	19. Harmonic (maximum value), voltage value, b-N, bc	V/%
2339	H_Vb/Vbc-20_MAX	20. Harmonic (maximum value), voltage value, b-N, bc	V/%
2341	H_Vb/Vbc-21_MAX	21. Harmonic (maximum value), voltage value, b-N, bc	V/%
2343	H_Vb/Vbc-22_MAX	22. Harmonic (maximum value), voltage value, b-N, bc	V/%
2345	H_Vb/Vbc-23_MAX	23. Harmonic (maximum value), voltage value, b-N, bc	V/%
2347	H_Vb/Vbc-24_MAX	24. Harmonic (maximum value), voltage value, b-N, bc	V/%
2349	H_Vb/Vbc-25_MAX	25. Harmonic (maximum value), voltage value, b-N, bc	V/%
2351	H_Vb/Vbc-26_MAX	26. Harmonic (maximum value), voltage value, b-N, bc	V/%
2353	H_Vb/Vbc-27_MAX	27. Harmonic (maximum value), voltage value, b-N, bc	V/%
2355	H_Vb/Vbc-28_MAX	28. Harmonic (maximum value), voltage value, b-N, bc	V/%
2357	H_Vb/Vbc-29_MAX	29. Harmonic (maximum value), voltage value, b-N, bc	V/%
2359	H_Vb/Vbc-30_MAX	30. Harmonic (maximum value), voltage value, b-N, bc	V/%
2361	H_Vb/Vbc-31_MAX	31. Harmonic (maximum value), voltage value, b-N, bc	V/%
2363	H_Vb/Vbc-32_MAX	32. Harmonic (maximum value), voltage value, b-N, bc	V/%

Table 2-31 Registers 2201 to 2480: PQ Calculation for Harmonics (Maximum Values) – Voltage Values

Register	Type of Information	Remark	Unit
2365	H_Vb/Vbc-33_MAX	33. Harmonic (maximum value), voltage value, b-N, bc	V/%
2367	H_Vb/Vbc-34_MAX	34. Harmonic (maximum value), voltage value, b-N, bc	V/%
2369	H_Vb/Vbc-35_MAX	35. Harmonic (maximum value), voltage value, b-N, bc	V/%
2371	H_Vb/Vbc-36_MAX	36. Harmonic (maximum value), voltage value, b-N, bc	V/%
2373	H_Vb/Vbc-37_MAX	37. Harmonic (maximum value), voltage value, b-N, bc	V/%
2375	H_Vb/Vbc-38_MAX	38. Harmonic (maximum value), voltage value, b-N, bc	V/%
2377	H_Vb/Vbc-39_MAX	39. Harmonic (maximum value), voltage value, b-N, bc	V/%
2379	H_Vb/Vbc-40_MAX	40. Harmonic (maximum value), voltage value, b-N, bc	V/%
2401	H_Vc/Vca-1_MAX	1. Harmonic (maximum value), voltage value, c-N, ca (Basic wave)	V
2403	H_Vc/Vca-2_MAX	2. Harmonic (maximum value), voltage value, c-N, ca	V/%
2405	H_Vc/Vca-3_MAX	3. Harmonic (maximum value), voltage value, c-N, ca	V/%
2407	H_Vc/Vca-4_MAX	4. Harmonic (maximum value), voltage value, c-N, ca	V/%
2409	H_Vc/Vca-5_MAX	5. Harmonic (maximum value), voltage value, c-N, ca	V/%
2411	H_Vc/Vca-6_MAX	6. Harmonic (maximum value), voltage value, c-N, ca	V/%
2413	H_Vc/Vca-7_MAX	7. Harmonic (maximum value), voltage value, c-N, ca	V/%
2415	H_Vc/Vca-8_MAX	8. Harmonic (maximum value), voltage value, c-N, ca	V/%
2417	H_Vc/Vca-9_MAX	9. Harmonic (maximum value), voltage value, c-N, ca	V/%
2419	H_Vc/Vca-10_MAX	10. Harmonic (maximum value), voltage value, c-N, ca	V/%
2421	H_Vc/Vca-11_MAX	11. Harmonic (maximum value), voltage value, c-N, ca	V/%
2423	H_Vc/Vca-12_MAX	12. Harmonic (maximum value), voltage value, c-N, ca	V/%
2425	H_Vc/Vca-13_MAX	13. Harmonic (maximum value), voltage value, c-N, ca	V/%
2427	H_Vc/Vca-14_MAX	14. Harmonic (maximum value), voltage value, c-N, ca	V/%
2429	H_Vc/Vca-15_MAX	15. Harmonic (maximum value), voltage value, c-N, ca	V/%
2431	H_Vc/Vca-16_MAX	16. Harmonic (maximum value), voltage value, c-N, ca	V/%
2433	H_Vc/Vca-17_MAX	17. Harmonic (maximum value), voltage value, c-N, ca	V/%

Table 2-31 Registers 2201 to 2480: PQ Calculation for Harmonics (Maximum Values) – Voltage Values

Register	Type of Information	Remark	Unit
2435	H_Vc/Vca-18_MAX	18. Harmonic (maximum value), voltage value, c-N, ca	V/%
2437	H_Vc/Vca-19_MAX	19. Harmonic (maximum value), voltage value, c-N, ca	V/%
2439	H_Vc/Vca-20_MAX	20. Harmonic (maximum value), voltage value, c-N, ca	V/%
2441	H_Vc/Vca-21_MAX	21. Harmonic (maximum value), voltage value, c-N, ca	V/%
2443	H_Vc/Vca-22_MAX	22. Harmonic (maximum value), voltage value, c-N, ca	V/%
2445	H_Vc/Vca-23_MAX	23. Harmonic (maximum value), voltage value, c-N, ca	V/%
2447	H_Vc/Vca-24_MAX	24. Harmonic (maximum value), voltage value, c-N, ca	V/%
2449	H_Vc/Vca-25_MAX	25. Harmonic (maximum value), voltage value, c-N, ca	V/%
2451	H_Vc/Vca-26_MAX	26. Harmonic (maximum value), voltage value, c-N, ca	V/%
2453	H_Vc/Vca-27_MAX	27. Harmonic (maximum value), voltage value, c-N, ca	V/%
2455	H_Vc/Vca-28_MAX	28. Harmonic (maximum value), voltage value, c-N, ca	V/%
2457	H_Vc/Vca-29_MAX	29. Harmonic (maximum value), voltage value, c-N, ca	V/%
2459	H_Vc/Vca-30_MAX	30. Harmonic (maximum value), voltage value, c-N, ca	V/%
2461	H_Vc/Vca-31_MAX	31. Harmonic (maximum value), voltage value, c-N, ca	V/%
2463	H_Vc/Vca-32_MAX	32. Harmonic (maximum value), voltage value, c-N, ca	V/%
2465	H_Vc/Vca-33_MAX	33. Harmonic (maximum value), voltage value, c-N, ca	V/%
2467	H_Vc/Vca-34_MAX	34. Harmonic (maximum value), voltage value, c-N, ca	V/%
2469	H_Vc/Vca-35_MAX	35. Harmonic (maximum value), voltage value, c-N, ca	V/%
2471	H_Vc/Vca-36_MAX	36. Harmonic (maximum value), voltage value, c-N, ca	V/%
2473	H_Vc/Vca-37_MAX	37. Harmonic (maximum value), voltage value, c-N, ca	V/%
2475	H_Vc/Vca-38_MAX	38. Harmonic (maximum value), voltage value, c-N, ca	V/%
2477	H_Vc/Vca-39_MAX	39. Harmonic (maximum value), voltage value, c-N, ca	V/%
2479	H_Vc/Vca-40_MAX	40. Harmonic (maximum value), voltage value, c-N, ca	V/%

2.2.7.21 Registers 2601 to 2880: PQ Calculation for Average Harmonic – Current Values

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

The data are calculated within the parameterized time (for example 30 s, 1 min etc.).

Data type: Measured value

Table 2-32 Registers 2601 to 2880: PQ Calculation for Harmonics (Average Values) – Current Values

Register	Type of Information	Remark	Unit
2601	H_Ia-1_AVG	1. Harmonic (average value), current value, a-N (Basic wave)	A
2603	H_Ia-2_AVG	2. Harmonic (average value), current value, a-N	A
2605	H_Ia-3_AVG	3. Harmonic (average value), current value, a-N	A
2607	H_Ia-4_AVG	4. Harmonic (average value), current value, a-N	A
2609	H_Ia-5_AVG	5. Harmonic (average value), current value, a-N	A
2611	H_Ia-6_AVG	6. Harmonic (average value), current value, a-N	A
2613	H_Ia-7_AVG	7. Harmonic (average value), current value, a-N	A
2615	H_Ia-8_AVG	8. Harmonic (average value), current value, a-N	A
2617	H_Ia-9_AVG	9. Harmonic (average value), current value, a-N	A
2619	H_Ia-10_AVG	10. Harmonic (average value), current value, a-N	A
2621	H_Ia-11_AVG	11. Harmonic (average value), current value, a-N	A
2623	H_Ia-12_AVG	12. Harmonic (average value), current value, a-N	A
2625	H_Ia-13_AVG	13. Harmonic (average value), current value, a-N	A
2627	H_Ia-14_AVG	14. Harmonic (average value), current value, a-N	A
2629	H_Ia-15_AVG	15. Harmonic (average value), current value, a-N	A
2631	H_Ia-16_AVG	16. Harmonic (average value), current value, a-N	A
2633	H_Ia-17_AVG	17. Harmonic (average value), current value, a-N	A
2635	H_Ia-18_AVG	18. Harmonic (average value), current value, a-N	A
2637	H_Ia-19_AVG	19. Harmonic (average value), current value, a-N	A
2639	H_Ia-20_AVG	20. Harmonic (average value), current value, a-N	A
2641	H_Ia-21_AVG	21. Harmonic (average value), current value, a-N	A

Table 2-32 Registers 2601 to 2880: PQ Calculation for Harmonics (Average Values) – Current Values

Register	Type of Information	Remark	Unit
2643	H_Ia-22_AVG	22. Harmonic (average value), current value, a-N	A
2645	H_Ia-23_AVG	23. Harmonic (average value), current value, a-N	A
2647	H_Ia-24_AVG	24. Harmonic (average value), current value, a-N	A
2649	H_Ia-25_AVG	25. Harmonic (average value), current value, a-N	A
2651	H_Ia-26_AVG	26. Harmonic (average value), current value, a-N	A
2653	H_Ia-27_AVG	27. Harmonic (average value), current value, a-N	A
2655	H_Ia-28_AVG	28. Harmonic (average value), current value, a-N	A
2657	H_Ia-29_AVG	29. Harmonic (average value), current value, a-N	A
2659	H_Ia-30_AVG	30. Harmonic (average value), current value, a-N	A
2661	H_Ia-31_AVG	31. Harmonic (average value), current value, a-N	A
2663	H_Ia-32_AVG	32. Harmonic (average value), current value, a-N	A
2665	H_Ia-33_AVG	33. Harmonic (average value), current value, a-N	A
2667	H_Ia-34_AVG	34. Harmonic (average value), current value, a-N	A
2669	H_Ia-35_AVG	35. Harmonic (average value), current value, a-N	A
2671	H_Ia-36_AVG	36. Harmonic (average value), current value, a-N	A
2673	H_Ia-37_AVG	37. Harmonic (average value), current value, a-N	A
2675	H_Ia-38_AVG	38. Harmonic (average value), current value, a-N	A
2677	H_Ia-39_AVG	39. Harmonic (average value), current value, a-N	A
2679	H_Ia-40_AVG	40. Harmonic (average value), current value, a-N	A
2701	H_Ib-1_AVG	1. Harmonic (average value), current value, b-N (Basic wave)	A
2703	H_Ib-2_AVG	2. Harmonic (average value), current value, b-N	A
2705	H_Ib-3_AVG	3. Harmonic (average value), current value, b-N	A
2707	H_Ib-4_AVG	4. Harmonic (average value), current value, b-N	A
2709	H_Ib-5_AVG	5. Harmonic (average value), current value, b-N	A
2711	H_Ib-6_AVG	6. Harmonic (average value), current value, b-N	A

Table 2-32 Registers 2601 to 2880: PQ Calculation for Harmonics (Average Values) – Current Values

Register	Type of Information	Remark	Unit
2713	H_Ib-7_AVG	7. Harmonic (average value), current value, b-N	A
2715	H_Ib-8_AVG	8. Harmonic (average value), current value, b-N	A
2717	H_Ib-9_AVG	9. Harmonic (average value), current value, b-N	A
2719	H_Ib-10_AVG	10. Harmonic (average value), current value, b-N	A
2721	H_Ib-11_AVG	11. Harmonic (average value), current value, b-N	A
2723	H_Ib-12_AVG	12. Harmonic (average value), current value, b-N	A
2725	H_Ib-13_AVG	13. Harmonic (average value), current value, b-N	A
2727	H_Ib-14_AVG	14. Harmonic (average value), current value, b-N	A
2729	H_Ib-15_AVG	15. Harmonic (average value), current value, b-N	A
2731	H_Ib-16_AVG	16. Harmonic (average value), current value, b-N	A
2733	H_Ib-17_AVG	17. Harmonic (average value), current value, b-N	A
2735	H_Ib-18_AVG	18. Harmonic (average value), current value, b-N	A
2737	H_Ib-19_AVG	19. Harmonic (average value), current value, b-N	A
2739	H_Ib-20_AVG	20. Harmonic (average value), current value, b-N	A
2741	H_Ib-21_AVG	21. Harmonic (average value), current value, b-N	A
2743	H_Ib-22_AVG	22. Harmonic (average value), current value, b-N	A
2745	H_Ib-23_AVG	23. Harmonic (average value), current value, b-N	A
2747	H_Ib-24_AVG	24. Harmonic (average value), current value, b-N	A
2749	H_Ib-25_AVG	25. Harmonic (average value), current value, b-N	A
2751	H_Ib-26_AVG	26. Harmonic (average value), current value, b-N	A
2753	H_Ib-27_AVG	27. Harmonic (average value), current value, b-N	A
2755	H_Ib-28_AVG	28. Harmonic (average value), current value, b-N	A
2757	H_Ib-29_AVG	29. Harmonic (average value), current value, b-N	A
2759	H_Ib-30_AVG	30. Harmonic (average value), current value, b-N	A
2761	H_Ib-31_AVG	31. Harmonic (average value), current value, b-N	A
2763	H_Ib-32_AVG	32. Harmonic (average value), current value, b-N	A

Table 2-32 Registers 2601 to 2880: PQ Calculation for Harmonics (Average Values) – Current Values

Register	Type of Information	Remark	Unit
2765	H_Ib-33_AVG	33. Harmonic (average value), current value, b-N	A
2767	H_Ib-34_AVG	34. Harmonic (average value), current value, b-N	A
2769	H_Ib-35_AVG	35. Harmonic (average value), current value, b-N	A
2771	H_Ib-36_AVG	36. Harmonic (average value), current value, b-N	A
2773	H_Ib-37_AVG	37. Harmonic (average value), current value, b-N	A
2775	H_Ib-38_AVG	38. Harmonic (average value), current value, b-N	A
2777	H_Ib-39_AVG	39. Harmonic (average value), current value, b-N	A
2779	H_Ib-40_AVG	40. Harmonic (average value), current value, b-N	A
2801	H_Ic-1_AVG	1. Harmonic (average value), current value, c-N (Basic wave)	A
2803	H_Ic-2_AVG	2. Harmonic (average value), current value, c-N	A
2805	H_Ic-3_AVG	3. Harmonic (average value), current value, c-N	A
2807	H_Ic-4_AVG	4. Harmonic (average value), current value, c-N	A
2809	H_Ic-5_AVG	5. Harmonic (average value), current value, c-N	A
2811	H_Ic-6_AVG	6. Harmonic (average value), current value, c-N	A
2813	H_Ic-7_AVG	7. Harmonic (average value), current value, c-N	A
2815	H_Ic-8_AVG	8. Harmonic (average value), current value, c-N	A
2817	H_Ic-9_AVG	9. Harmonic (average value), current value, c-N	A
2819	H_Ic-10_AVG	10. Harmonic (average value), current value, c-N	A
2821	H_Ic-11_AVG	11. Harmonic (average value), current value, c-N	A
2823	H_Ic-12_AVG	12. Harmonic (average value), current value, c-N	A
2825	H_Ic-13_AVG	13. Harmonic (average value), current value, c-N	A
2827	H_Ic-14_AVG	14. Harmonic (average value), current value, c-N	A
2829	H_Ic-15_AVG	15. Harmonic (average value), current value, c-N	A
2831	H_Ic-16_AVG	16. Harmonic (average value), current value, c-N	A
2833	H_Ic-17_AVG	17. Harmonic (average value), current value, c-N	A

Table 2-32 Registers 2601 to 2880: PQ Calculation for Harmonics (Average Values) – Current Values

Register	Type of Information	Remark	Unit
2835	H_Ic-18_AVG	18. Harmonic (average value), current value, c-N	A
2837	H_Ic-19_AVG	19. Harmonic (average value), current value, c-N	A
2839	H_Ic-20_AVG	20. Harmonic (average value), current value, c-N	A
2841	H_Ic-21_AVG	21. Harmonic (average value), current value, c-N	A
2843	H_Ic-22_AVG	22. Harmonic (average value), current value, c-N	A
2845	H_Ic-23_AVG	23. Harmonic (average value), current value, c-N	A
2847	H_Ic-24_AVG	24. Harmonic (average value), current value, c-N	A
2849	H_Ic-25_AVG	25. Harmonic (average value), current value, c-N	A
2851	H_Ic-26_AVG	26. Harmonic (average value), current value, c-N	A
2853	H_Ic-27_AVG	27. Harmonic (average value), current value, c-N	A
2855	H_Ic-28_AVG	28. Harmonic (average value), current value, c-N	A
2857	H_Ic-29_AVG	29. Harmonic (average value), current value, c-N	A
2859	H_Ic-30_AVG	30. Harmonic (average value), current value, c-N	A
2861	H_Ic-31_AVG	31. Harmonic (average value), current value, c-N	A
2863	H_Ic-32_AVG	32. Harmonic (average value), current value, c-N	A
2865	H_Ic-33_AVG	33. Harmonic (average value), current value, c-N	A
2867	H_Ic-34_AVG	34. Harmonic (average value), current value, c-N	A
2869	H_Ic-35_AVG	35. Harmonic (average value), current value, c-N	A
2871	H_Ic-36_AVG	36. Harmonic (average value), current value, c-N	A
2873	H_Ic-37_AVG	37. Harmonic (average value), current value, c-N	A
2875	H_Ic-38_AVG	38. Harmonic (average value), current value, c-N	A
2877	H_Ic-39_AVG	39. Harmonic (average value), current value, c-N	A
2879	H_Ic-40_AVG	40. Harmonic (average value), current value, c-N	A

2.2.7.22 Registers 3001 to 3280: PQ Calculation for Maximum Harmonic – Current Values

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

The data are calculated within the parameterized time (for example 30 s, 1 min etc.).

Data type: Measured value

Table 2-33 Registers 3001 to 3280: PQ Calculation for Harmonics (Maximum Values) – Current Values

Register	Type of Information	Remark	Unit
3001	H_Ia-1_MAX	1. Harmonic (maximum value), current value, a-N (Basic wave)	A
3003	H_Ia-2_MAX	2. Harmonic (maximum value), current value, a-N	A
3005	H_Ia-3_MAX	3. Harmonic (maximum value), current value, a-N	A
3007	H_Ia-4_MAX	4. Harmonic (maximum value), current value, a-N	A
3009	H_Ia-5_MAX	5. Harmonic (maximum value), current value, a-N	A
3011	H_Ia-6_MAX	6. Harmonic (maximum value), current value, a-N	A
3013	H_Ia-7_MAX	7. Harmonic (maximum value), current value, a-N	A
3015	H_Ia-8_MAX	8. Harmonic (maximum value), current value, a-N	A
3017	H_Ia-9_MAX	9. Harmonic (maximum value), current value, a-N	A
3019	H_Ia-10_MAX	10. Harmonic (maximum value), current value, a-N	A
3021	H_Ia-11_MAX	11. Harmonic (maximum value), current value, a-N	A
3023	H_Ia-12_MAX	12. Harmonic (maximum value), current value, a-N	A
3025	H_Ia-13_MAX	13. Harmonic (maximum value), current value, a-N	A
3027	H_Ia-14_MAX	14. Harmonic (maximum value), current value, a-N	A
3029	H_Ia-15_MAX	15. Harmonic (maximum value), current value, a-N	A
3031	H_Ia-16_MAX	16. Harmonic (maximum value), current value, a-N	A
3033	H_Ia-17_MAX	17. Harmonic (maximum value), current value, a-N	A
3035	H_Ia-18_MAX	18. Harmonic (maximum value), current value, a-N	A
3037	H_Ia-19_MAX	19. Harmonic (maximum value), current value, a-N	A
3039	H_Ia-20_MAX	20. Harmonic (maximum value), current value, a-N	A
3041	H_Ia-21_MAX	21. Harmonic (maximum value), current value, a-N	A

Table 2-33 Registers 3001 to 3280: PQ Calculation for Harmonics (Maximum Values) – Current Values

Register	Type of Information	Remark	Unit
3043	H_Ia-22_MAX	22. Harmonic (maximum value), current value, a-N	A
3045	H_Ia-23_MAX	23. Harmonic (maximum value), current value, a-N	A
3047	H_Ia-24_MAX	24. Harmonic (maximum value), current value, a-N	A
3049	H_Ia-25_MAX	25. Harmonic (maximum value), current value, a-N	A
3051	H_Ia-26_MAX	26. Harmonic (maximum value), current value, a-N	A
3053	H_Ia-27_MAX	27. Harmonic (maximum value), current value, a-N	A
3055	H_Ia-28_MAX	28. Harmonic (maximum value), current value, a-N	A
3057	H_Ia-29_MAX	29. Harmonic (maximum value), current value, a-N	A
3059	H_Ia-30_MAX	30. Harmonic (maximum value), current value, a-N	A
3061	H_Ia-31_MAX	31. Harmonic (maximum value), current value, a-N	A
3063	H_Ia-32_MAX	32. Harmonic (maximum value), current value, a-N	A
3065	H_Ia-33_MAX	33. Harmonic (maximum value), current value, a-N	A
3067	H_Ia-34_MAX	34. Harmonic (maximum value), current value, a-N	A
3069	H_Ia-35_MAX	35. Harmonic (maximum value), current value, a-N	A
3071	H_Ia-36_MAX	36. Harmonic (maximum value), current value, a-N	A
3073	H_Ia-37_MAX	37. Harmonic (maximum value), current value, a-N	A
3075	H_Ia-38_MAX	38. Harmonic (maximum value), current value, a-N	A
3077	H_Ia-39_MAX	39. Harmonic (maximum value), current value, a-N	A
3079	H_Ia-40_MAX	40. Harmonic (maximum value), current value, a-N	A
3101	H_Ib-1_MAX	1. Harmonic (maximum value), current value, b-N (Basic wave)	A
3103	H_Ib-2_MAX	2. Harmonic (maximum value), current value, b-N	A
3105	H_Ib-3_MAX	3. Harmonic (maximum value), current value, b-N	A
3107	H_Ib-4_MAX	4. Harmonic (maximum value), current value, b-N	A
3109	H_Ib-5_MAX	5. Harmonic (maximum value), current value, b-N	A
3111	H_Ib-6_MAX	6. Harmonic (maximum value), current value, b-N	A

Table 2-33 Registers 3001 to 3280: PQ Calculation for Harmonics (Maximum Values) – Current Values

Register	Type of Information	Remark	Unit
3113	H_Ib-7_MAX	7. Harmonic (maximum value), current value, b-N	A
3115	H_Ib-8_MAX	8. Harmonic (maximum value), current value, b-N	A
3117	H_Ib-9_MAX	9. Harmonic (maximum value), current value, b-N	A
3119	H_Ib-10_MAX	10. Harmonic (maximum value), current value, b-N	A
3121	H_Ib-11_MAX	11. Harmonic (maximum value), current value, b-N	A
3123	H_Ib-12_MAX	12. Harmonic (maximum value), current value, b-N	A
3125	H_Ib-13_MAX	13. Harmonic (maximum value), current value, b-N	A
3127	H_Ib-14_MAX	14. Harmonic (maximum value), current value, b-N	A
3129	H_Ib-15_MAX	15. Harmonic (maximum value), current value, b-N	A
3131	H_Ib-16_MAX	16. Harmonic (maximum value), current value, b-N	A
3133	H_Ib-17_MAX	17. Harmonic (maximum value), current value, b-N	A
3135	H_Ib-18_MAX	18. Harmonic (maximum value), current value, b-N	A
3137	H_Ib-19_MAX	19. Harmonic (maximum value), current value, b-N	A
3139	H_Ib-20_MAX	20. Harmonic (maximum value), current value, b-N	A
3141	H_Ib-21_MAX	21. Harmonic (maximum value), current value, b-N	A
3143	H_Ib-22_MAX	22. Harmonic (maximum value), current value, b-N	A
3145	H_Ib-23_MAX	23. Harmonic (maximum value), current value, b-N	A
3147	H_Ib-24_MAX	24. Harmonic (maximum value), current value, b-N	A
3149	H_Ib-25_MAX	25. Harmonic (maximum value), current value, b-N	A
3151	H_Ib-26_MAX	26. Harmonic (maximum value), current value, b-N	A
3153	H_Ib-27_MAX	27. Harmonic (maximum value), current value, b-N	A
3155	H_Ib-28_MAX	28. Harmonic (maximum value), current value, b-N	A
3157	H_Ib-29_MAX	29. Harmonic (maximum value), current value, b-N	A
3159	H_Ib-30_MAX	30. Harmonic (maximum value), current value, b-N	A
3161	H_Ib-31_MAX	31. Harmonic (maximum value), current value, b-N	A
3163	H_Ib-32_MAX	32. Harmonic (maximum value), current value, b-N	A

Table 2-33 Registers 3001 to 3280: PQ Calculation for Harmonics (Maximum Values) – Current Values

Register	Type of Information	Remark	Unit
3165	H_Ib-33_MAX	33. Harmonic (maximum value), current value, b-N	A
3167	H_Ib-34_MAX	34. Harmonic (maximum value), current value, b-N	A
3169	H_Ib-35_MAX	35. Harmonic (maximum value), current value, b-N	A
3171	H_Ib-36_MAX	36. Harmonic (maximum value), current value, b-N	A
3173	H_Ib-37_MAX	37. Harmonic (maximum value), current value, b-N	A
3175	H_Ib-38_MAX	38. Harmonic (maximum value), current value, b-N	A
3177	H_Ib-39_MAX	39. Harmonic (maximum value), current value, b-N	A
3179	H_Ib-40_MAX	40. Harmonic (maximum value), current value, b-N	A
3201	H_Ic-1_MAX	1. Harmonic (maximum value), current value, c-N (Basic wave)	A
3203	H_Ic-2_MAX	2. Harmonic (maximum value), current value, c-N	A
3205	H_Ic-3_MAX	3. Harmonic (maximum value), current value, c-N	A
3207	H_Ic-4_MAX	4. Harmonic (maximum value), current value, c-N	A
3209	H_Ic-5_MAX	5. Harmonic (maximum value), current value, c-N	A
3211	H_Ic-6_MAX	6. Harmonic (maximum value), current value, c-N	A
3213	H_Ic-7_MAX	7. Harmonic (maximum value), current value, c-N	A
3215	H_Ic-8_MAX	8. Harmonic (maximum value), current value, c-N	A
3217	H_Ic-9_MAX	9. Harmonic (maximum value), current value, c-N	A
3219	H_Ic-10_MAX	10. Harmonic (maximum value), current value, c-N	A
3221	H_Ic-11_MAX	11. Harmonic (maximum value), current value, c-N	A
3223	H_Ic-12_MAX	12. Harmonic (maximum value), current value, c-N	A
3225	H_Ic-13_MAX	13. Harmonic (maximum value), current value, c-N	A
3227	H_Ic-14_MAX	14. Harmonic (maximum value), current value, c-N	A
3229	H_Ic-15_MAX	15. Harmonic (maximum value), current value, c-N	A
3231	H_Ic-16_MAX	16. Harmonic (maximum value), current value, c-N	A
3233	H_Ic-17_MAX	17. Harmonic (maximum value), current value, c-N	A

Table 2-33 Registers 3001 to 3280: PQ Calculation for Harmonics (Maximum Values) – Current Values

Register	Type of Information	Remark	Unit
3235	H_Ic-18_MAX	18. Harmonic (maximum value), current value, c-N	A
3237	H_Ic-19_MAX	19. Harmonic (maximum value), current value, c-N	A
3239	H_Ic-20_MAX	20. Harmonic (maximum value), current value, c-N	A
3241	H_Ic-21_MAX	21. Harmonic (maximum value), current value, c-N	A
3243	H_Ic-22_MAX	22. Harmonic (maximum value), current value, c-N	A
3245	H_Ic-23_MAX	23. Harmonic (maximum value), current value, c-N	A
3247	H_Ic-24_MAX	24. Harmonic (maximum value), current value, c-N	A
3249	H_Ic-25_MAX	25. Harmonic (maximum value), current value, c-N	A
3251	H_Ic-26_MAX	26. Harmonic (maximum value), current value, c-N	A
3253	H_Ic-27_MAX	27. Harmonic (maximum value), current value, c-N	A
3255	H_Ic-28_MAX	28. Harmonic (maximum value), current value, c-N	A
3257	H_Ic-29_MAX	29. Harmonic (maximum value), current value, c-N	A
3259	H_Ic-30_MAX	30. Harmonic (maximum value), current value, c-N	A
3261	H_Ic-31_MAX	31. Harmonic (maximum value), current value, c-N	A
3263	H_Ic-32_MAX	32. Harmonic (maximum value), current value, c-N	A
3265	H_Ic-33_MAX	33. Harmonic (maximum value), current value, c-N	A
3267	H_Ic-34_MAX	34. Harmonic (maximum value), current value, c-N	A
3269	H_Ic-35_MAX	35. Harmonic (maximum value), current value, c-N	A
3271	H_Ic-36_MAX	36. Harmonic (maximum value), current value, c-N	A
3273	H_Ic-37_MAX	37. Harmonic (maximum value), current value, c-N	A
3275	H_Ic-38_MAX	38. Harmonic (maximum value), current value, c-N	A
3277	H_Ic-39_MAX	39. Harmonic (maximum value), current value, c-N	A
3279	H_Ic-40_MAX	40. Harmonic (maximum value), current value, c-N	A

2.2.7.23 Register 5001 to 5099: Latest 10 Dips

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

NOTE

These registers are only available for SICAM P855.

Data type: Measured value

Table 2-34 Register 5001 to 5099: Latest 10 Dips

Register	Type of Information	Unit	Remark
5001	Milliseconds	Start time of dip Data format see chapter 2.2.6.2	
5002	Hours/minutes		
5003	Month/day		
5004	Time status/year		
5005 to 5006	Voltage dip 1	V	Minimum voltage value during dip 1
5007 to 5008	Voltage dip 1 time duration	s	Dip 1 time duration
5009	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5011	Milliseconds	Start time of dip Data format see chapter 2.2.6.2	
5012	Hours/minutes		
5013	Month/day		
5014	Time status/year		
5015 to 5016	Voltage dip 2	V	Minimum voltage value during dip 2
5017 to 5018	Voltage dip 2 time duration	s	Dip 2 time duration
5019	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced

Table 2-34 Register 5001 to 5099: Latest 10 Dips (cont.)

Register	Type of Information	Unit	Remark
5021	Milliseconds	Start time of dip Data format see chapter 2.2.6.2	
5022	Hours/minutes		
5023	Month/day		
5024	Time status/year		
5025 to 5026	Voltage dip 3	V	Minimum voltage value during dip 3
5027 to 5028	Voltage dip 3 time duration	s	Dip 3 time duration
5029	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5031	Milliseconds	Start time of dip Data format see chapter 2.2.6.2	
5032	Hours/minutes		
5033	Month/day		
5034	Time status/year		
5035 to 5036	Voltage dip 4	V	Minimum voltage value during dip 4
5037 to 5038	Voltage dip 4 time duration	s	Dip 4 time duration
5039	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5041	Milliseconds	Start time of dip Data format see chapter 2.2.6.2	
5042	Hours/minutes		
5043	Month/day		
5044	Time status/year		
5045 to 5046	Voltage dip 5	V	Minimum voltage value during dip 5
5047 to 5048	Voltage dip 5 time duration	s	Dip 5 time duration

Table 2-34 Register 5001 to 5099: Latest 10 Dips (cont.)

Register	Type of Information	Unit	Remark
5049	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5051	Milliseconds	Start time of dip Data format see chapter 2.2.6.2	
5052	Hours/minutes		
5053	Month/day		
5054	Time status/year		
5055 to 5056	Voltage dip 6	V	Minimum voltage value during dip 6
5057 to 5058	Voltage dip 6 time duration	s	Dip 6 time duration
5059	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5061	Milliseconds	Start time of dip Data format see chapter 2.2.6.2	
5062	Hours/minutes		
5063	Month/day		
5064	Time status/year		
5065 to 5066	Voltage dip 7	V	Minimum voltage value during dip 7
5067 to 5068	Voltage dip 7 time duration	s	Dip 7 time duration
5069	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5071	Milliseconds	Start time of dip Data format see chapter 2.2.6.2	
5072	Hours/minutes		
5073	Month/day		
5074	Time status/year		
5075 to 5076	Voltage dip 8	V	Minimum voltage value during dip 8

Table 2-34 Register 5001 to 5099: Latest 10 Dips (cont.)

Register	Type of Information	Unit	Remark
5077 to 5078	Voltage dip 8 time duration	s	Dip 8 time duration
5079	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5081	Milliseconds	Start time of dip Data format see chapter 2.2.6.2	
5082	Hours/minutes		
5083	Month/day		
5084	Time status/year		
5085 to 5086	Voltage dip 9	V	Minimum voltage value during dip 9
5087 to 5088	Voltage dip 9 time duration	s	Dip 9 time duration
5089	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5091	Milliseconds	Start time of dip Data format see chapter 2.2.6.2	
5092	Hours/minutes		
5093	Month/day		
5094	Time status/year		
5095 to 5096	Voltage dip 10	V	Minimum voltage value during dip 10
5097 to 5098	Voltage dip 10 time duration	s	Dip 10 time duration
5099	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced

2.2.7.24 Register 5201 to 5299: Latest 10 Swells

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

NOTE

These registers are only available for SICAM P855.

Data type: Measured value

Table 2-35 Register 5201 to 5299: Latest 10 Swells

Register	Type of Information	Unit	Remark
5201	Milliseconds	Start time of swell Data format see chapter 2.2.6.2	
5202	Hours/minutes		
5203	Month/day		
5204	Time status/year		
5205 to 5206	Voltage swell 1	V	Maximum voltage value during swell 1
5207 to 5208	Voltage swell 1 time duration	s	Swell 1 time duration
5209	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5211	Milliseconds	Start time of swell Data format see chapter 2.2.6.2	
5212	Hours/minutes		
5213	Month/day		
5214	Time status/year		
5215 to 5216	Voltage swell 2	V	Maximum voltage value during swell 2
5217 to 5218	Voltage swell 2 time duration	s	Swell 2 time duration
5219	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced

Table 2-35 Register 5201 to 5299: Latest 10 Swells (cont.)

Register	Type of Information	Unit	Remark
5221	Milliseconds	Start time of swell Data format see chapter 2.2.6.2	
5222	Hours/minutes		
5223	Month/day		
5224	Time status/year		
5225 to 5226	Voltage swell 3	V	Maximum voltage value during swell 3
5227 to 5228	Voltage swell 3 time duration	s	Swell 3 time duration
5229	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5231	Milliseconds	Start time of swell Data format see chapter 2.2.6.2	
5232	Hours/minutes		
5233	Month/day		
5234	Time status/year		
5235 to 5236	Voltage swell 4	V	Maximum voltage value during swell 4
5237 to 5238	Voltage swell 4 time duration	s	Swell 4 time duration
5239	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5241	Milliseconds	Start time of swell Data format see chapter 2.2.6.2	
5242	Hours/minutes		
5243	Month/day		
5244	Time status/year		
5245 to 5246	Voltage swell 5	V	Maximum voltage value during swell 5
5247 to 5248	Voltage swell 5 time duration	s	Swell 5 time duration

Table 2-35 Register 5201 to 5299: Latest 10 Swells (cont.)

Register	Type of Information	Unit	Remark
5249	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5251	Milliseconds	Start time of swell Data format see chapter 2.2.6.2	
5252	Hours/minutes		
5253	Month/day		
5254	Time status/year		
5255 to 5256	Voltage swell 6	V	Maximum voltage value during swell 6
5257 to 5258	Voltage swell 6 time duration	s	Swell 6 time duration
5259	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5261	Milliseconds	Start time of swell Data format see chapter 2.2.6.2	
5262	Hours/minutes		
5263	Month/day		
5264	Time status/year		
5265 to 5266	Voltage swell 7	V	Maximum voltage value during swell 7
5267 to 5268	Voltage swell 7 time duration	s	Swell 7 time duration
5269	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5271	Milliseconds	Start time of swell Data format see chapter 2.2.6.2	
5272	Hours/minutes		
5273	Month/day		
5274	Time status/year		
5275 to 5276	Voltage swell 8	V	Maximum voltage value during swell 8

Table 2-35 Register 5201 to 5299: Latest 10 Swells (cont.)

Register	Type of Information	Unit	Remark
5277 to 5278	Voltage swell 8 time duration	s	Swell 8 time duration
5279	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5281	Milliseconds	Start time of swell Data format see chapter 2.2.6.2	
5282	Hours/minutes		
5283	Month/day		
5284	Time status/year		
5285 to 5286	Voltage swell 9	V	Maximum voltage value during swell 9
5287 to 5288	Voltage swell 9 time duration	s	Swell 9 time duration
5289	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5291	Milliseconds	Start time of swell Data format see chapter 2.2.6.2	
5292	Hours/minutes		
5293	Month/day		
5294	Time status/year		
5295 to 5296	Voltage swell 10	V	Maximum voltage value during swell 10
5297 to 5298	Voltage swell 10 time duration	s	Swell 10 time duration
5299	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced

2.2.7.25 Register 5401 to 5499: Latest 10 Voltage Interrupts

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

NOTE

These registers are only available for SICAM P855.

Data type: Measured value

Table 2-36 Register 5401 to 5499: Latest 10 Voltage Interrupts

Register	Type of Information	Unit	Remark
5401	Milliseconds	Start time of interrupt Data format see chapter 2.2.6.2	
5402	Hours/minutes		
5403	Month/day		
5404	Time status/year		
5405 to 5406	Voltage interrupt 1	V	Minimum voltage value during interrupt 1
5407 to 5408	Voltage interrupt 1 time duration	s	Interrupt 1 time duration
5409	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5411	Milliseconds	Start time of interrupt Data format see chapter 2.2.6.2	
5412	Hours/minutes		
5413	Month/day		
5414	Time status/year		
5415 to 5416	Voltage interrupt 2	V	Minimum voltage value during interrupt 2
5417 to 5418	Voltage interrupt 2 time duration	s	Interrupt 2 time duration
5419	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced

Table 2-36 Register 5401 to 5499: Latest 10 Voltage Interrupts (cont.)

Register	Type of Information	Unit	Remark
5421	Milliseconds	Start time of interrupt Data format see chapter 2.2.6.2	
5422	Hours/minutes		
5423	Month/day		
5424	Time status/year		
5425 to 5426	Voltage interrupt 3	V	Minimum voltage value during interrupt 3
5427 to 5428	Voltage interrupt 3 time duration	s	Interrupt 3 time duration
5429	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5431	Milliseconds	Start time of interrupt Data format see chapter 2.2.6.2	
5432	Hours/minutes		
5433	Month/day		
5434	Time status/year		
5435 to 5436	Voltage interrupt 4	V	Minimum voltage value during interrupt 4
5437 to 5438	Voltage interrupt 4 time duration	s	Interrupt 4 time duration
5439	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5441	Milliseconds	Start time of interrupt Data format see chapter 2.2.6.2	
5442	Hours/minutes		
5443	Month/day		
5444	Time status/year		
5445 to 5446	Voltage interrupt 5	V	Minimum voltage value during interrupt 5
5447 to 5448	Voltage interrupt 5 time duration	s	Interrupt 5 time duration

Table 2-36 Register 5401 to 5499: Latest 10 Voltage Interrupts (cont.)

Register	Type of Information	Unit	Remark
5449	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5451	Milliseconds	Start time of interrupt Data format see chapter 2.2.6.2	
5452	Hours/minutes		
5453	Month/day		
5454	Time status/year		
5455 to 5456	Voltage interrupt 6	V	Minimum voltage value during interrupt 6
5457 to 5458	Voltage interrupt 6 time duration	s	Interrupt 6 time duration
5459	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5461	Milliseconds	Start time of interrupt Data format see chapter 2.2.6.2	
5462	Hours/minutes		
5463	Month/day		
5464	Time status/year		
5465 to 5466	Voltage interrupt 7	V	Minimum voltage value during interrupt 7
5467 to 5468	Voltage interrupt 7 time duration	s	Interrupt 7 time duration
5469	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5471	Milliseconds	Start time of interrupt Data format see chapter 2.2.6.2	
5472	Hours/minutes		
5473	Month/day		
5474	Time status/year		

Table 2-36 Register 5401 to 5499: Latest 10 Voltage Interrupts (cont.)

Register	Type of Information	Unit	Remark
5475 to 5476	Voltage interrupt 8	V	Minimum voltage value during interrupt 8
5477 to 5478	Voltage interrupt 8 time duration	s	Interrupt 8 time duration
5479	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5481	Milliseconds	Start time of interrupt Data format see chapter 2.2.6.2	
5482	Hours/minutes		
5483	Month/day		
5484	Time status/year		
5485 to 5486	Voltage interrupt 9	V	Minimum voltage value during interrupt 9
5487 to 5488	Voltage interrupt 9 time duration	s	Interrupt 9 time duration
5489	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced
5491	Milliseconds	Start time of interrupt Data format see chapter 2.2.6.2	
5492	Hours/minutes		
5493	Month/day		
5494	Time status/year		
5495 to 5496	Voltage interrupt 10	V	Minimum voltage value during interrupt 10
5497 to 5498	Voltage interrupt 10 time duration	s	Interrupt 10 time duration
5499	Influenced phase	-	Related phases bit 0: Va, bit 1: Vb, bit 2: Vc, bit 3: Vab, bit 4: Vbc, bit 5: Vca if any bit =1 means corresponding phase is influenced

2.2.7.26 Register 6001 to 6004: Number of PQ Voltage Events

These registers are write-protected. A write attempt will be rejected with exception code 03 (ILLEGAL_DATA_VALUE).

NOTE

These registers are only available for SICAM P855.

For more information on PQ events, see Chapter 4 of the Device Manual.

Table 2-37 Register 6001 to 6004: Number of PQ Voltage Events

Register	Type of Information	Remark
6001 to 6002	PQ_Event_Number	Total number of PQ voltage events
6003 to 6004	PQ_Event_Number	Number of PQ voltage events since last polling

2.2.8 Modbus Diagnosis

The diagnostics for Modbus TCP and Modbus RTU allows analyzing the parameters and communication as well as resetting the diagnostics counters. For more information, see the SICAM P850/P855 device manual, chapter 7.5.5 Configuration of the Device.

2.2.8.1 Modbus TCP Diagnosis

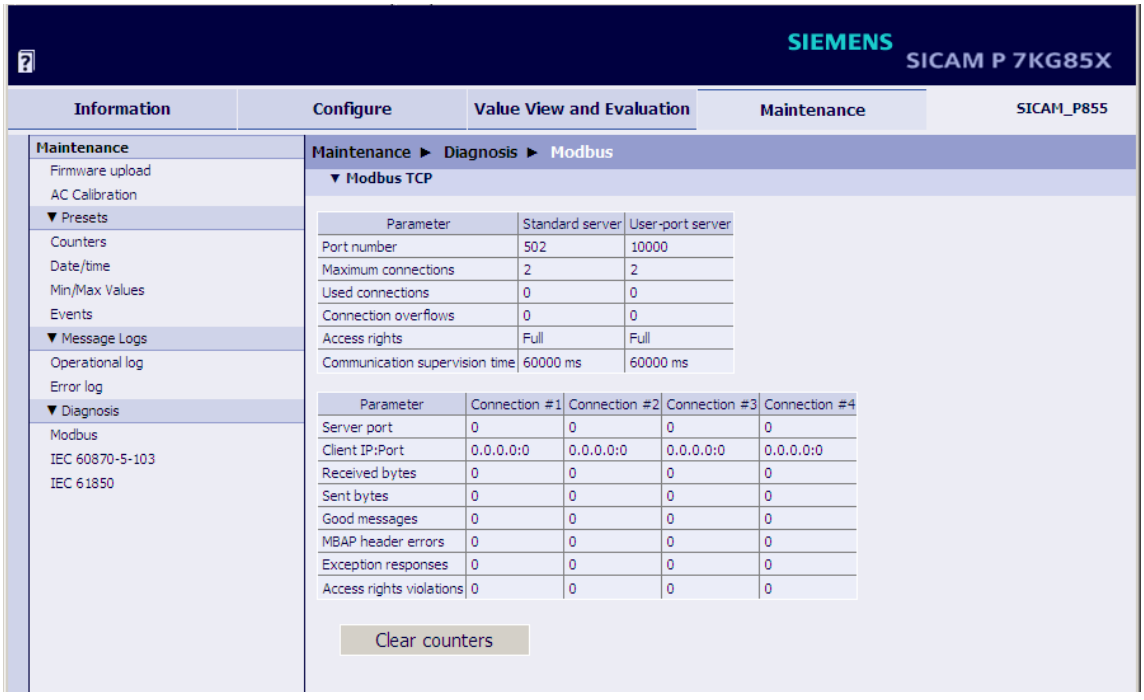


Figure 2-4 Modbus TCP Diagnosis

Parameter for Standard Server and User-port Server

- Port number: Standard port 502 and configured user port
- Maximum connections: For user port number 502: 4 connections via standard port 502

  For other user port numbers: 2 connections via standard port 502 and 2 connections via the user port
- Used connections: Number of connections that are actually used
- Connection overflows: Counter of the attempts to establish more connections than allowed;

  Number of allowed connection attempts:

  For user port number 502: ≥ 5 connection attempts via standard port 502

  For other user port numbers: ≥ 3 connection attempts via standard port 502 and/or ≥ 3 connection attempts via user port
- Access rights: Factory setting: Full
- Communication supervision time: Factory setting: 60 000 ms

Parameter of Connections

- Server port: Server port number of the current connection in the respective column; if **0** is displayed, the connection is inactive or down
- Client IP:Port: Last or current IP address and port number of the client
- Received bytes: Total number of bytes received by the TCP port
- Sent bytes: Total number of bytes sent to the TCP port
- Good messages: Total number of messages received that were detected as valid Modbus messages
- MBAP header errors: Error in the MBAP header: incorrect protocol ID or implausible length of data
- Exception responses: Counters of the transmitted exception response messages (see chapter 2.2.2)
- Access rights violations: Total number of write accesses received if the parameter **Access rights for port xxx** is set to **Read only** of the associated TCP port (for example 502) in the **Communication Ethernet** input/output window. For more information, see the device manual, chapter Operation - Ethernet Communication)

2.2.8.2 Modbus RTU Diagnosis

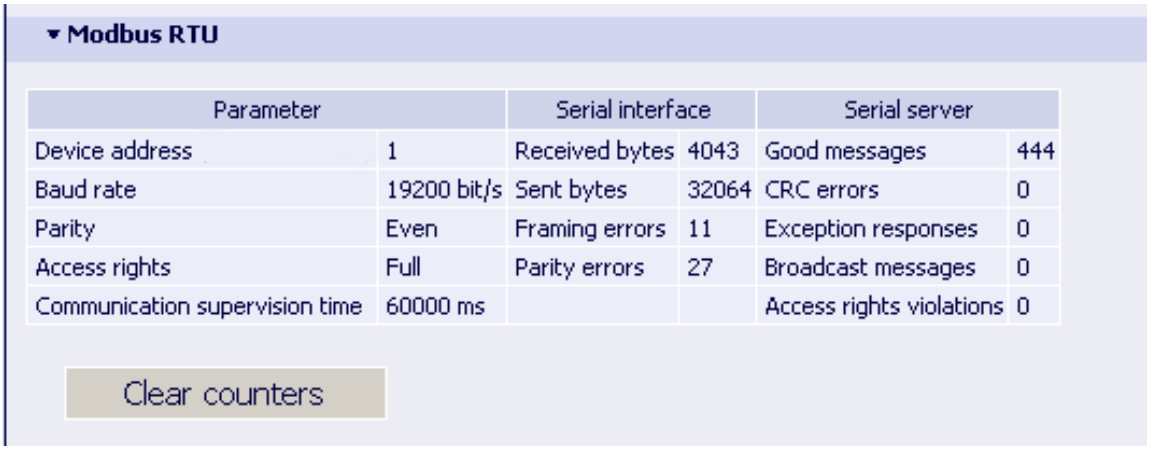


Figure 2-5 Modbus RTU Diagnosis

Parameter

The following parameters are displayed with Modbus RTU:

- Device address: Default setting: 1
- Baud rate: Default setting: 19 200 bit/s
- Parity: Default setting: Even
- Access rights: Default setting: Full
- Communication supervision time: Default setting: 60 000 ms

Serial Interface

- Received bytes: Total number of bytes received by the RS485 interface
- Sent bytes: Total number of bytes sent to the RS485 interface
- Framing errors: Number of detected frame errors (invalid stop bit, for example if the baud rate is wrong)
- Parity errors: Number of detected parity errors (wrong parity)

Serial Server

- Good messages: Total number of messages received that were detected as valid Modbus messages
- CRC errors: Total number of messages received in which CRC errors were detected
- Exception responses: Counters of the transmitted exception response messages (see chapter 2.2.2)
- Broadcast messages: Total number of the broadcast messages received with the server address 0
- Access rights violations: Total number of write accesses received if the parameter **Access rights** is set to **Read only** in the **Communication serial** input/output window (see Device Manual, chapter Operation - Serial Communication)

2.3 IEC 61850 Server

The IEC 61850 protocol is also used for communication via the Ethernet interface. The IEC 61850 specification with a detailed explanation of the protocol is given in “International Standard IEC 61850”.

SICAM P850/P855 supports 6 input configurations (see Device Manual SICAM P850/P855):

- 1-phase system
- 3-wire network - balanced (1I)
- 3-wire network - unbalanced (3I)
- 3-wire network - unbalanced (2I)
- 4-wire network - balanced (1I)
- 4-wire network - unbalanced (3I)

All measurands are activated and transferred automatically.

2.3.1 Logical Node: Measurement

1-phase System

Table 2-38 1-phase System

inst		**1**
desc		**Measurand**
lnClass		**MMXU**
lnName		**IED_nameMEAS/MMXU1**
clcMth		**TRUE_RMS**
Data Objects	**Common Data Class**	**Measurand**
Hz	MV	f
PhV	WYE	Van
A	WYE	Ia
W	WYE	Pa
VAr	WYE	Qa
VA	WYE	Sa
PF	WYE	PFa

3-wire Network - Balanced (1I)

Table 2-39 3-wire Network - Balanced (1I)

inst		**1**
desc		**Measurand**
lnClass		**MMXU**
lnName		**IED_nameMEAS/MMXU1**
clcMth		**TRUE_RMS**
Data Objects	**Common Data Class**	**Measurand**
TotW	MV	P
TotVAr	MV	Q
TotVA	MV	S
TotPF	MV	PF
Hz	MV	f
PPV	DEL	Vab
		Vbc
		Vca
A	WYE	Ia

3-wire Network - Unbalanced (3I)

Table 2-40 3-wire Network - Unbalanced (3I)

inst		**1**
desc		**Measurand**
lnClass		**MMXU**
lnName		**IED_nameMEAS/MMXU1**
clcMth		**TRUE_RMS**
Data Objects	**Common Data Class**	**Measurand**
TotW	MV	P
TotVAr	MV	Q
TotVA	MV	S
TotPF	MV	PF
Hz	MV	f
PPV	DEL	Vab
		Vbc
		Vca
A	WYE	Ia
		Ib
		Ic
		In
		Iavg

3-wire Network - Unbalanced (2I)

Table 2-41 3-wire Network - Unbalanced (2I)

inst		**1**
desc		**Measurand**
lnClass		**MMXU**
lnName		**IED_nameMEAS/MMXU1**
clcMth		**TRUE_RMS**
Data Objects	**Common Data Class**	**Measurand**
TotW	MV	P
TotVAr	MV	Q
TotVA	MV	S
TotPF	MV	PF
Hz	MV	f
PPV	DEL	Vab
		Vbc
		Vca
A	WYE	Ia
		Ib
		Ic
		Iavg

4-wire Network - Balanced (1I)

Table 2-42 4-wire Network - Balanced (1I)

inst		**1**
desc		**Measurand**
lnClass		**MMXU**
lnName		**IED_nameMEAS/MMXU1**
clcMth		**TRUE_RMS**
Data Objects	**Common Data Class**	**Measurand**
TotW	MV	P
TotVAr	MV	Q
TotVA	MV	S
TotPF	MV	PF
Hz	MV	f
PhV	WYE	Van
PhV	WYE	Vavg
A	WYE	Ia

4-wire Network - Unbalanced (3I)

Table 2-43 4-wire Network - Unbalanced (3I)

inst		**1**
desc		**Measurand**
lnClass		**MMXU**
lnName		**IED_nameMEAS/MMXU1**
clcMth		**TRUE_RMS**
Data Objects	**Common Data Class**	**Measurand**
TotW	MV	P
TotVAr	MV	Q
TotVA	MV	S
TotPF	MV	PF
Hz	MV	f
PPV	DEL	Vab
		Vbc
		Vca
PhV	WYE	Van
		Vbn
		Vcn
		Vn
		Vavg
A	WYE	Ia
		Ib
		Ic
		In
		Iavg

Table 2-43 4-wire Network - Unbalanced (3I) (cont.)

W	WYE	Pa
		Pb
		Pc
VAr	WYE	Qa
		Qb
		Qc
VA	WYE	Sa
		Sb
		Sc
PF	WYE	PFa
		PFb
		PFc

2.3.2 Logical Node: Metering

1-phase System

Table 2-44 1-phase System

inst		**1**
desc		**Measurand**
InClass		**MMTN**
InName		**IED_nameMEAS/MMTN**
Data Objects	**Common Data Class**	**Counter**
SupWh	BCR	WP_Supply
SupVArh	BCR	WQ_Inductive
DmdWh	BCR	WP_Demand
DmdVArh	BCR	WQ_Capacitive

3-wire and 4-wire Network

Table 2-45 3-wire and 4-wire Network

inst		**1**
desc		**Measurand**
InClass		**MMTR**
InName		**IED_nameMEAS/MMTR**
Data Objects	**Common Data Class**	**Counter**
TotVAh	BCR	WS
SupWh	BCR	WP_Supply
SupVArh	BCR	WQ_Inductive
DmdWh	BCR	WP_Demand
DmdVArh	BCR	WQ_Capacitive

2.3.3 Logical Node: General I/O Processes

Table 2-46 Limit Violations/Group Indications

inst		**1**
desc		**Indications**
InClass		**GGIO**
InName		**IED_nameMEAS/GGIO1**
Data Objects	**Common Data Class**	
Status information		
Alm1~16	SPS	Limit violations 1 to 16
Alm17~20	SPS	Group indications 1 to 4

Table 2-47 Indications

inst		**2**
desc		**Indications**
InClass		**GGIO**
InName		**IED_nameMEAS/GGIO2**
Data Objects	**Common Data Class**	
Status information		
Ind1	SPS	Indication 1 from remote
Ind2	SPS	Indication 2 from remote
Alm1	SPS	Reset Energy
Alm2	SPS	Parameter load
Alm3	SPS	Time synchronization error
Alm4	SPS	Rotation
Alm5	SPS	SD card error

2.3.4 Logical Node: Battery

Table 2-48 Battery

inst		**1**
desc		**Battery status**
InClass		**ZBAT**
InName		**IED_nameMEAS/ZBAT1**
Data Objects	**Common Data Class**	
Status information		
Vol	MV	Battery voltage (not available, invalid)
BatLo	SPS	Battery failure (undervoltage or battery is missing)

2.3.5 Logical Node: Voltage Variation

Table 2-49 Voltage Variation

inst		**1**
desc		**Voltage variation**
InClass		**QVVR**
InName		**IED_nameMEAS/QVVR1**
Data Objects	**Common Data Class**	
Status information		
VarStr	SPS	Start of event: Voltage variation
DipStr	SPS	Start: Voltage dip
SwlStr	SPS	Start: Voltage swell
IntrStr	SPS	Start: Voltage interruption
VVa [1)]	MV	Highest or lowest voltage magnitude of the last completed event
VVaTm [1)]	MV	Voltage variation duration of the last completed event
PhsAff [1)]	ENS	Affected phase(s) of the last completed event

[1)] acc. to Tissue 952

2.3.6 Logical Node: Frequency Variation

Table 2-50 Frequency Variation

inst		**1**
desc		**Frequency variation**
InClass		**QFVR**
InName		**IED_nameMEAS/QVVR1**
Data Objects	**Common Data Class**	
Status information		
VarStr	SPS	Start of event: Frequency variation
UnHzStr	SPS	Start: Underfrequency
OvHzStr	SPS	Start: Overfrequency

2.3.7 Logical Node: Voltage Unbalance Variation

Table 2-51 Voltage Unbalance Variation

inst		**1**
desc		**Voltage unbalance variation**
InClass		**QVUB**
InName		**IED_nameMEAS/QVUB1**
Data Objects	**Common Data Class**	
Status information		
VarStr	SPS	Start of event: Voltage unbalance variation

2.3.8 Logical Node: Disturbance Recorder Function

Table 2-52 Disturbance Recorder Function

inst		**1**
desc		**Disturbance Recorder Function**
InClass		**RDRE**
InName		**IED_nameMEAS/RDRE1**
Data Objects	**Common data class**	
Status information		
RcdMade	SPS	Recording made
FltNum	INS	Fault number

2.3.9 Logical Node: Harmonics for 1-phase

Table 2-53 Harmonics for 1-phase

inst		**1**
desc		**Harmonics**
InClass		**MHAN**
InName		**IED_nameMEAS/MHAN1**
Data Objects	**Common data class**	
Status information		
Hz	MV	Basic frequency
HaAmp	HMV	Sequence of harmonics current
HaVol	HMV	Sequence of harmonics voltages
ThdsAmp	MV	Current THDS for 1-phase
ThdsVol	MV	Voltage THDS for 1-phase

2.3.10 Logical Node: Harmonics - 3-phase/3-wire

Table 2-54 Harmonics - 3-phase/3-wire

inst		**1**
desc		**Harmonics**
lnClass		**MHAI**
lnName		**IED_nameMEAS/MHAI1**
Data Objects	**Common data class**	
Status information		
Hz	MV	Basic frequency
HA	HWYE	Sequence of harmonics current
HPPV	HDEL	Sequence of harmonics phase to phase voltages
ThdsA	WYE	Current THDS
ThdsPPV	DEL	Voltage THDS for phase to phase only available in 3p3w (balance, unbalance 2I, unbalance 3I)

2.3.11 Logical Node: Harmonics - 3-phase/4-wire

Table 2-55 Harmonics - 3-phase/4-wire

inst		**1**
desc		**Harmonics**
lnClass		**MHAI**
lnName		**IED_nameMEAS/MHAI1**
Data Objects	**Common data class**	
Status information		
Hz	MV	Basic frequency
HA	HWYE	Sequence of harmonics current
HPhV	HWYE	Sequence of harmonics phase to ground voltages
ThdsA	WYE	Current THDS
ThdsPhV	WYE	Voltage THDS for phase to ground (only available in 1p2w (1-phase), and 3p4w (3-phase,4-wire balance and unbalanced))

2.3.12 Logical Node: Flicker

Table 2-56 Flicker

inst		**1**
desc		**Flicker**
InClass		**MFLK**
InName		**IED_nameMEAS/MFLK**
Data Objects	**Common data class**	
Status information		
PPPst	DEL	Short-term flicker severity of last complete interval for phase to phase measurements
PhPst	WYE	Short-term flicker severity of last complete interval for phase to ground measurements
PPPlt	DEL	Long-term flicker severity of last complete interval for phase to phase measurements
PhPlt	WYE	Long-term flicker severity of last complete interval for phase to ground measurements

2.3.13 PICS - ACSI Conformance Statement

(PICS = Protocol Implementation Conformance Statement)

NOTE

The following information is an excerpt from the English original document.

ACSI Basic Conformance Statement

Table 2-57 Basic Conformance Statement

		Client/ Subscriber	Server/ Publisher
Client-Server roles			
B11	**Server** side (of TWO-PARTY-APPLICATION-ASSOCIATION)	-	Y
B12	**Client** side of (TWO-PARTY-APPLICATION-ASSOCIATION)	N	-
SCSMs supported			
B21	**SCSM**: IEC 6185-8-1 used	N	Y
B22	**SCSM**: IEC 6185-9-1 used	N	N
B23	**SCSM**: IEC 6185-9-2 used	N	N
B24	**SCSM**: other	N/A	N/A
Generic substation event model (GSE)			
B31	**Publisher** side	-	N
B32	**Subscriber** side	N	-
Transmission of sampled value model (SVC)			
B41	**Publisher** side	-	N
B42	**Subscriber** side	N	-

Y = supported; N or empty: not supported

ACSI Models Conformance Statement

Table 2-58 ACSI Models Conformance Statement

		Client/ Subscriber	Server/ Publisher
If Server or Client side (B11/12) supported			
M1	**Logical device**	N	Y
M2	**Logical node**	N	Y
M3	**Data**	N	Y
M4	**Data set**	N	Y
M5	**Substitution**	N	N
M6	**Setting group control**	N	N
Reporting			
M7	**Buffered report control**	N	Y
M7-1	Sequence-number	N	Y
M7-2	Report-time-stamp	N	Y
M7-3	Reason-for-inclusion	N	Y
M7-4	Data-set-name	N	Y
M7-5	Data-reference	N	Y
M7-6	Buffer-overflow	N	Y
M7-7	EntryID	N	Y
M7-8	BufTim	N	Y
M7-9	IntgPd	N	Y
M7-10	GI	N	Y
M7-11	Conf-revision	N	Y
M8	**Unbuffered report control**	N	Y
M8-1	Sequence-number	N	Y
M8-2	Report-time-stamp	N	Y
M8-3	Reason-for-inclusion	N	Y

Table 2-58 ACSI Models Conformance Statement (cont.)

		Client/ Subscriber	Server/ Publisher
M8-4	Data-set-name	N	Y
M8-5	Data-reference	N	Y
M8-6	BufTim	N	Y
M8-7	IntgPd	N	Y
M8-8	GI	N	Y
M8-9	Conf-revision	N	Y
Logging		N	N
M9	**Log control**	N	N
M9-1	IntgPd	N	N
M10	**Log**	N	N
M11	**Control**	N	N
If GSE (B31/32) is supported			
M12	**GOOSE**	N	N
M13	**GSSE**	N	N
If SVC (41/42) is supported			
M14	**Multicast SVC**	N	N
M15	**Unicast SVC**	N	N
If Server or Client side (B11/12) supported			
M16	Time	Y	N
M17	File Transfer	N	Y

Y = supported; N or empty: not supported

ACSI Service Conformance Statement

Table 2-59 ACSI Service Conformance Statement

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Server					
S1	ServerDirectory	TP	N	Y	-
Application association					
S2	Associate		N	Y	-
S3	Abort		N	Y	-
S4	Release		N	Y	-
Logical device					
S5	LogicalDeviceDirectory	TP	N	Y	-
Logical node					
S6	LogicalNodeDirectory	TP	N	Y	-
S7	GetAllDataValues	TP	N	Y	-
Data					
S8	GetDataValues	TP	N	Y	-
S9	SetDataValues	TP	N	N	-
S10	GetDataDirectory	TP	N	Y	-
S11	GetDataDefinition	TP	N	Y	-
Data set					
S12	GetDataSetValues	TP	N	Y	-
S13	SetDataSetValues	TP	N	N	-
S14	CreateDataSet	TP	N	N	-

Table 2-59 ACSI Service Conformance Statement (cont.)

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
S15	DeleteDataSet	TP	N	N	-
S16	GetDataSetDirectory	TP	N	Y	-
Substitution					
S17	SetDataValues	TP	N	N	-
Setting group control					
S18	SelectActiveSG	TP	N	N	-
S19	SelectEditSG	TP	N	N	-
S20	SetSGValues	TP	N	N	-
S21	ConfirmEditSGValues	TP	N	N	-
S22	GetSGValues	TP	N	N	-
S23	GetSGCBValues	TP	N	N	-
Reporting					
Buffered report control block (BRCB)					
S24	Report	TP	N	Y	-
S24-1	data-change (dchg)		N	Y	-
S24-2	qchg-change (qchg)		N	Y	-
S24-3	data-update (dupd)		N	N	-
S25	GetBRCBValues	TP	N	Y	-
S26	SetBRCBValues	TP	N	Y	-
Unbuffered report control block (URCB)					
S27	Report	TP	N	Y	-
S27-1	data-change (dchg)		N	Y	-
S27-2	qchg-change (qchg)		N	Y	-

Table 2-59 ACSI Service Conformance Statement (cont.)

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
S27-3	data-update (dupd)		N	N	-
S28	GetURCBValues	TP	N	Y	-
S29	SetURCBValues	TP	N	Y	-
Logging					
Log control block					
S30	GetLCBValues	TP	N	N	-
S31	SetLCBValues	TP	N	N	-
Log					
S32	QueryLogByTime	TP	N	N	-
S33	QueryLogByEntry	TP	N	N	-
S34	GetLogStatusValues	TP	N	N	-
Generic substation event model (GSE)					
GOOSE-CONTROL-BLOCK					
S35	SendGOOSEMessage	MC	N	N	-
S36	GetReference	TP	N	N	-
S37	GetGOOSEElementNumber	TP	N	N	-
S38	GetGoCBValues	TP	N	N	-
S39	SetGoCBValues	TP	N	N	-
GSSE-CONTROL-BLOCK					
S40	SendGSSEMessage	MC	N	N	-
S41	GetReference	TP	N	N	-
S42	GetGSSEElementNumber	TP	N	N	-
S43	GetGsCBValues	TP	N	N	-
S44	SetGsCBValues	TP	N	N	-

Table 2-59 ACSI Service Conformance Statement (cont.)

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Transmission of sampled value model (SVC)					
	Multicast SVC				
S45	SendMSVMessage	MC	N	N	-
S46	GetMSVCBValues	TP	N	N	-
S47	SetMSVCBValues	TP	N	N	-
	Unicast SVC				
S48	SendUSVMessage	TP	N	N	-
S49	GetUSVCBValues	TP	N	N	-
S50	SetUSVCBValues	TP	N	N	-
Control					
S51	Select	TP	N	N	-
S52	SelectWithValue	TP	N	N	-
S53	Cancel	TP	N	N	-
S54	Operate	TP	N	N	-
S55	Command-Termination	TP	N	N	-
S56	TimeActivated-Operate	TP	N	N	-
File transfer					
S57	GetFile	TP	N	Y	-
S58	SetFile	TP	N	N	-
S59	DeleteFile	TP	N	N	-
S60	GetFileAttributeValues	TP	N	Y	-

Table 2-59 ACSI Service Conformance Statement (cont.)

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Time					
T1	Time resolution of internal clock			10 (1 ms)	Nearest negative power of 2 in seconds
T2	Time accuracy of internal clock			Y	T0 (10 ms)
				Y	T1 (1 ms)
				N	T2 (100 µs)
				N	T3 (25 µs)
				N	T4 (4 µs)
				N	T5 (1 µs)
T3	Supported TimeStamp resolution	-		10 (1 ms)	Nearest negative power of 2 in seconds

Y = supported; N or empty: not supported

2.3.14 PIXIT

(PIXIT = Protocol Implementation Extra Information for Testing)

NOTE

The following information is an excerpt of the English original document.

PIXIT for Association Model

Table 2-60 PIXIT for Association Model

Description	Value/Clarification		Example
Maximum number of clients that can set-up an association simultaneously	6		
TCP_KEEPALIVE value	10 seconds		
Lost connection detection time	30 seconds		
Is authentication supported	No		
What association parameters are necessary for successful association	Transport selector	Yes	0001
	Session selector	Yes	0001
	Presentation selector	Yes	00000001
	AP Title	No	Any
	AP Qualifier	No	Any
What is the maximum and minimum MMS PDU size	Max MMS PDU size	20 000	
	Min MMS PDU size	8192	
What is the maximum start time after a power supply interrupt	45 seconds		

PIXIT for Server Model

Table 2-61 PIXIT for Server Model

Description	Value/Clarification		
Which analog value (MX) quality bits are supported (can be set by server)	Validity	Yes	Good
		Yes	Invalid
		No	Reserved
		No	Questionable
		Yes	Overflow
		No	OutofRange
		No	BadReference
		Yes	Failure
		No	OldData
		No	Inconsistent
		No	Inaccurate
	Source	Yes	Process
		No	Substituted
		No	Test
		No	OperatorBlocked

Table 2-61 PIXIT for Server Model (cont.)

Description	Value/Clarification		
Which status value (ST) quality bits are supported (can be set by server)	Valitity	Yes	Good
		Yes	Invalid
		No	Reserved
		No	Questionable
		No	BadReference
		No	Oscillatory
		Yes	Failure
		No	OldData
		No	Inconsistent
		No	Inaccurate
	Source	Yes	Process
		No	Substituted
		No	Test
		No	OperatorBlocked
What is the maximum number of data values in one GetDataValues request	Not restricted; depends on the max. MMS PDU size given above.		
What is the maximum number of data values in one SetDataValues request	N/A		

PIXIT for Data Set Model

Table 2-62 PIXIT for Data Set Model

Description	Value/Clarification
What is the maximum number of data elements in one data set (compare CID setting)	N/A, data sets are fix
How many persistent data sets can be created by one or more clients	N/A, data sets are fix
How many non-persistent data sets can be created by one or more clients	N/A, data sets are fix

PIXIT for Reporting Model

Table 2-63 PIXIT for Reporting Model

Description	Value/Clarification	
The supported trigger conditions are (compare PICS)	integrity	Yes
	data change	Yes
	quality change	Yes
	data update	No
	general interrogation	Yes
The supported optional fields are	sequence-number	Yes
	report-time-stamp	Yes
	reason-for-inclusion	Yes
	data-set-name	Yes
	data-reference	Yes
	buffer-overflow	Yes
	entryID	Yes
	conf-rev	Yes
	segmentation	Yes
Can the server send segmented reports	Yes	
A data value in a report changes for the second time during the report buffer time (Compare IEC 61850-7-2 §14.2.2.9)	If a data value in a report changes for the second time during the report buffer time, the report with the first value is initially sent without delay and the second, new value is entered subsequently.	
Multi-client URCB approach (compare IEC 61850-7-2 §14.2.1)	Each URCB is visible to all clients	
What is the format of entryID	First 2 Byte: Integer Last 6 Bytes: BTime6 time stamp	
What is the buffer size for each BRCB or how many reports can be buffered	No fixed size, depends on total number of BRCBs	
Pre-configured RCB attributes that cannot be changed online when RptEna = FALSE (see also the CID report settings)		

Table 2-63 PIXIT for Reporting Model (cont.)

Description	Value/Clarification
May the reported data set contain: - structured data objects? - data attributes? - timestamp data attributes?	 Yes No Yes, will not be included in a dchg report
What is the interrogation cycle for binary events? Is this fixed, configurable	200 ms (if measurement inputs are used to generate binary events) Fixed
additional items:	
Dynamic BRCB reservation after an abort of the client/server association	Reservation of the BRCB has been fixed with TISSUE 453. A Value of -1 for ResvTms is not supported

PIXIT for Time and Time Synchronization Model

Table 2-64 PIXIT for Time and Time Synchronization Model

Description	Value/Clarification	
What quality bits are supported	LeapSecondsKnown	No
	ClockFailure	Yes
	ClockNotSynchronized	Yes
Describe the behavior when the time synchronization signal/messages are lost	After a waiting period, time quality is set to ClockNotSynchronized and ClockFailure	
When is the time quality bit "Clock failure" set?	At faulty internal clock or failure of the synchronization source (SNTP, field bus) or RTC failure	
When is the time quality bit "Clock not synchronized" set?	After a waiting period, time quality is set to ClockNotSynchronized and ClockFailure	
Is the time stamp of a binary event adjusted to the configured interrogation cycle?	No	
Does the device support time zone and daylight saving?	Yes	

Table 2-64 PIXIT for Time and Time Synchronization Model (cont.)

Description	Value/Clarification	
Which attributes of the NTP response packet are validated?	Leap indicator not equal to 3?	Yes
	Mode is equal to SERVER	No
	OriginateTimestamp is equal to value sent by the SNTP client as TransmitTimestamp	No
	RX/TX time stamp fields are checked for reasonableness	Yes
	SNTP version 3 and/or 4	No
	Other (describe)	No

PIXIT for File Transfer Model

Table 2-65 PIXIT for File Transfer Model

Description	Value/Clarification
What is structure of files and directories? Where are the COMTRADE files stored? Where are the PQDIF files stored? Are COMTRADE files zipped and what files are included in each zip file?	 Directory name \COMTRADE*; Directory name \PQDIF*; N
Directory names are separated from the file name by	„\“
The maximum file name size including path (default 64 characters)	64
Are directory/file name case sensitive	Case sensitive
Maximum file size for SetFile	SetFile is not supported
Is the requested file path included in the file name of the MMS fileDirectory respond?	Y
Is the wildcard supported MMS fileDirectory request?	N
Is it allowed that 2 clients get a file at the same time?	N
Additional items:	
Maximum number of clients that can use the file transfer service simultaneously	1
Maximum number of files that can be accessed simultaneously	1
Maximum time the file transfer service is locked for one client	10 min

TICS

Table 2-66 TICS

Topic	Tissue No.	Link	Description	Impact of Interoper.	Imple-mented
Object Model	120	http://www.tissues.iec61850.com/tissue.mspx?issueid=120	Type - Mod.stVal and Mod.ctlVal	-	Y
	146	http://www.tissues.iec61850.com/tissue.mspx?issueid=146	CtxInt	-	Y
	173	http://www.tissues.iec61850.com/tissue.mspx?issueid=173	Ctl modelling harmonization	-	N/A
	234	http://www.tissues.iec61850.com/tissue.mspx?issueid=234	New type CtxInt	x	Y
Services	377	http://www.tissues.iec61850.com/tissue.mspx?issueid=377	DeleteDataSet response	-	N/A
	276	http://www.tissues.iec61850.com/tissue.mspx?issueid=276	File Services Negative Responses	-	Y
	183	http://www.tissues.iec61850.com/tissue.mspx?issueid=183	GetNameList error handling	x	Y
	165	http://www.tissues.iec61850.com/tissue.mspx?issueid=165	Improper Error Response for GetDataSetValues	x	Y
	116	http://www.tissues.iec61850.com/tissue.mspx?issueid=116	GetNameList with empty response?	x	Y
Reporting	474	http://www.tissues.iec61850.com/tissue.mspx?issueid=474	GI for URCB	-	Y
	453	http://www.tissues.iec61850.com/tissue.mspx?issueid=453	Reporting & Logging model revision	x	Y
	438	http://www.tissues.iec61850.com/tissue.mspx?issueid=438	EntryTime base should be GMT	-	Y
	349	http://www.tissues.iec61850.com/tissue.mspx?issueid=349	BRCB TimeOfEntry has 2 definitions	x	Y
	348	http://www.tissues.iec61850.com/tissue.mspx?issueid=348	URCB class and report	x	Y
	344	http://www.tissues.iec61850.com/tissue.mspx?issueid=344	TimeOfEntry misspelled	-	Y
	335	http://www.tissues.iec61850.com/tissue.mspx?issueid=335	Clearing of Bufovfl	x	Y
	332	http://www.tissues.iec61850.com/tissue.mspx?issueid=332	Ambiguity in use of trigger options	x	Y
	329	http://www.tissues.iec61850.com/tissue.mspx?issueid=329	Reporting and BufOvl	x	Y
	322	http://www.tissues.iec61850.com/tissue.mspx?issueid=322	Write Configuration attribute of BRCBs	-	Y
	301	http://www.tissues.iec61850.com/tissue.mspx?issueid=301	SqNum in Buffered Reports	-	Y
	300	http://www.tissues.iec61850.com/tissue.mspx?issueid=300	Attribute Resv in BRCB	x	Y

Table 2-66 TICS (cont.)

Topic	Tissue No.	Link	Description	Impact of Interoper.	Imple-mented
Reporting (cont.)	298	http://www.tissues.iec61850.com/tissue.mspx?issueid=298	Type of SqNum	x	Y
	297	http://www.tissues.iec61850.com/tissue.mspx?issueid=297	Sequence number	x	Y
	278	http://www.tissues.iec61850.com/tissue.mspx?issueid=278	EntryId not valid for a server	x	Y
	275	http://www.tissues.iec61850.com/tissue.mspx?issueid=275	Confusing statement on GI usage	x	Y
	191	http://www.tissues.iec61850.com/tissue.mspx?issueid=191	BRCB: Integrity and buffer-ing reports	x	Y
	190	http://www.tissues.iec61850.com/tissue.mspx?issueid=190	BRCB: EntryId and Time-OfEntry	x	Y
	177	http://www.tissues.iec61850.com/tissue.mspx?issueid=177	Ignoring OptFlds bits for URCB	-	Y
	52	http://www.tissues.iec61850.com/tissue.mspx?issueid=52	Ambiguity GOOSE SqNum	x	N/A
	49	http://www.tissues.iec61850.com/tissue.mspx?issueid=49	BRCB TimeOfEntry?	x	Y
Control model	46	http://www.tissues.iec61850.com/tissue.mspx?issueid=46	Synchrocheck cancel	x	N/A
	44	http://www.tissues.iec61850.com/tissue.mspx?issueid=44	AddCause - Object not sel	x	N/A
	30	http://www.tissues.iec61850.com/tissue.mspx?issueid=30	Control parameter T	x	N/A
File trans-fer model	545	http://www.tissues.iec61850.com/tissue.mspx?issueid=545	File directories	x	Y

Services Which are Not Supported

- Substitution model
- Settings group control model
- Logging model
- Generic substation event model
- Control model

2.3.15 Diagnosis IEC 61850

The diagnostics for IEC 61850 allows the analysis of parameters and communication. For more information, see the SICAM P850/P855 device manual.

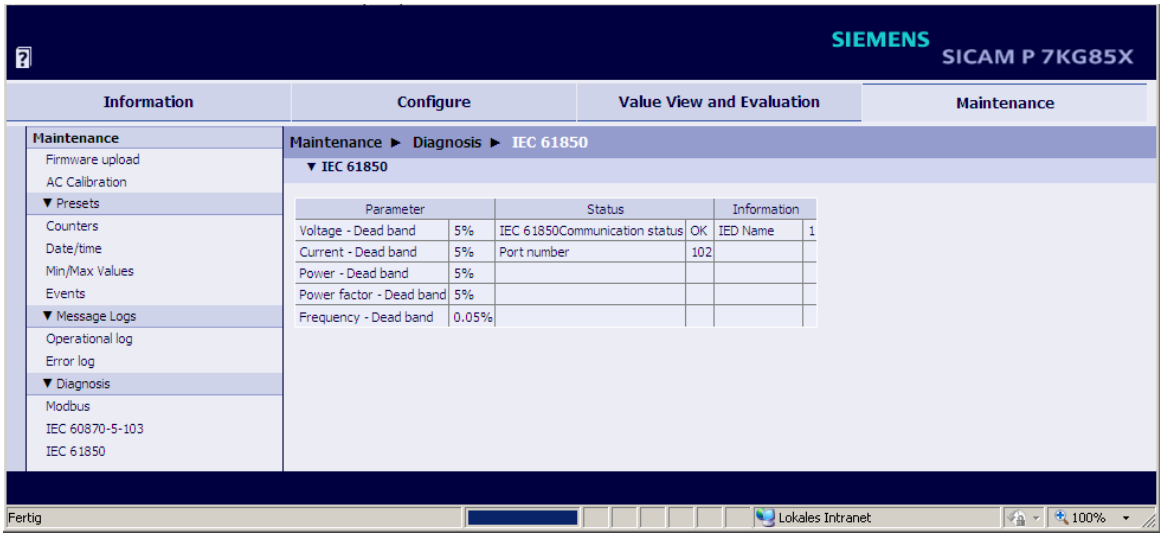


Figure 2-6 Diagnosis IEC 61850

Parameters

With IEC 61850, the following parameters are displayed:

- Voltage - Dead band: Default: 5 %
- Current - Dead band: Default: 5 %
- Power - Dead band: Default: 5 %
- Power factor - Dead band Default: 5 %
- Frequency - Dead band Default: 0.05 %

Status

With IEC 61850, the following statuses are displayed:

IEC 61850 Communication status: Status of communication: OK or Fail

Port number: TCP port number, for example 102

Information

IED Name: Default: SICAM_P85x_01

2.4 IEC 60870-5-103

The IEC 60870-5-103 protocol is also used for communication via the RS485 interface. The IEC 60870-5-103 specification with a detailed explanation of the protocol is given in “International Standard IEC 60870-5-103”.

2.4.1 Function Ranges

2.4.1.1 Basic Application Functions

Table 2-67 Basic Application Functions

IEC 60870-5-103 Function	Supported by SICAM P850/P855	Remark
Station Initialization	Yes	The station must be initialized in the following cases: • after device start-up (power-up or reset) • after the device has received no message addressed to the slave for a period of 5 minutes, or there is a broadcast telegram
General Interrogation	Yes	Events which are contained in general interrogation.
Clock Synchronization	Yes	Using the individual IEC 60870-5-103 device address or the broadcast address.
Command Transmission	Yes	Reset energy value/remote control
Test Mode	No	-
Blocking of Monitoring Direction	No	-
Transmission of Disturbance Data	No	-
Generic Services	No	-

2.4.1.2 Standard ASDUs in Monitoring Direction

Table 2-68 Standard ASDUs in Monitoring Direction

#	Designation	Supported by SICAM P850/P855	Remark
ASDU 1	Time-tagged message	Yes	All available events and binary information with time stamp.
ASDU 2	Time-tagged message with relative time	No	-
ASDU 3	Measurands I	No	-
ASDU 4	Time-tagged measurands with relative time	No	-
ASDU 5	Identification	Yes	Manufacturer (8 ASCII characters): „SIEMENS “ (8^{th} character = space)
ASDU 6	Time synchronization	Yes	-
ASDU 8	General interrogation termination	Yes	-
ASDU 9	Measurands II	Yes	Refer to chapter 2.4.2.2, “Telegrams for Measured Values”
ASDU 10	Generic data	No	-
ASDU 11	Generic identification	No	-
ASDU 23	List of disturbance data	No	-
ASDU 26	Ready for transmission of disturbance data	No	-
ASDU 27	Ready for transmission of channel	No	-
ASDU 28	Ready for transmission of tags	No	-
ASDU 29	Transmission of tags	No	-
ASDU 30	Transmission of disturbance values	No	-
ASDU 31	End of transmission	No	-

2.4.1.3 Standard ASDUs in Control Direction

Table 2-69 Standard ASDUs in Control Direction

#	Designation	Supported by SICAM P850/P855	Remark
ASDU 6	Time synchronization	Yes	-
ASDU 7	General interrogation	Yes	-
ASDU 10	Generic data	No	-
ASDU 20	General command	Yes	-
ASDU 21	Generic command	No	-
ASDU 24	Order for disturbance data transmission	No	-
ASDU 25	ACK for disturbance data transmission	No	-

2.4.1.4 Private ASDU in Monitoring Direction

Table 2-70 Private ASDU in Monitoring Direction

#	Designation	Supported by SICAM P850/P855	Remark
ASDU 205 *	Counters	Yes	Energy counters

* Definition acc. to SIPROTEC for energy and pulse counters

NOTE

For information on ASDU 205, see: http://siemens.siprotec.com; pdf document: Additional information for users of the IEC 60870-5-103

2.4.2 Data Mapping and Telegrams for Measured Values

2.4.2.1 Data Mapping for Measured Values

The SICAM P850/P855 device supports transmission of measured values via the communication protocol IEC 60870-5-103 (see Table 2-71). All measured values are transferred as per-unit values. The column "100 % corresponds to" in the Table 2-71 shows the relation between the 100 % per-unit value and the corresponding measured value.

Explanations to the 100 % corresponds to Values: Alternating voltages and Alternating Currents

All 100 % values correspond to the associated selected nominal operating values (AC 1 A or AC 5 A for currents and AC 110 V, AC 190 V, AC 400 V or AC 690 V (max. 600 V for UL) for voltages V_{ph-ph}).

The following special cases apply to the frequency and the active power factors:

Explanations to the 100 % corresponds to Value: Frequency f

The device automatically recognizes the power frequency (either 50 Hz or 60 Hz). Via IEC 60870-5-103 protocol the deviation of the power frequency is transmitted.

Examples for 50 Hz nominal frequency:

- Power frequency = 50 Hz → IEC 60870-5-103 value = 0 %
- Power frequency = 55 Hz → IEC 60870-5-103 value = 100 %
- Power frequency = 49 Hz → IEC 60870-5-103 value = -20 %

Explanations to the "100 % corresponds to" Values: Active Power Factor cos φ

The active power factor cos φ has a sign:

- Negative cos φ: capacitive
- Positive cos φ: inductive

Table 2-71 Measured Value Mapping

#	Value	Measured Quantity	100 % Corresponds to	Function Type	Information Number	Compatibility	Data Unit	Position
1	Va	Voltage (A-N)	$V_{ph-N\ (nom.)}$	130	148	Yes	9	4
2	Vb	Voltage (B-N)	$V_{ph-N\ (nom.)}$	130	148	Yes	9	5
3	Vc	Voltage (C-N)	$V_{ph-N\ (nom.)}$	130	148	Yes	9	6
4	Vab	Voltage (A-B)	$V_{ph-ph\ (nom.)}$	130	151	No	9	1
5	Vbc	Voltage (B-C)	$V_{ph-ph\ (nom.)}$	130	151	No	9	2

Table 2-71 Measured Value Mapping

#	Value	Measured Quantity	100 % Corresponds to	Function Type	Information Number	Compatibility	Data Unit	Position
6	Vca	Voltage (C-A)	$V_{ph\text{-}ph\ (nom.)}$	130	151	No	9	3
7	Vavg	Average Voltage	$V_{ph\text{-}N\ (nom.)}$	130	151	No	9	4
8	VN	Neutral-point displacement voltage	$V_{ph\text{-}N\ (nom.)}$	130	150	No	9	7
9	Ia	Current (A)	$I_{(nom.)}$	130	148	Yes	9	1
10	Ib	Current (B)	$I_{(nom.)}$	130	148	Yes	9	2
11	Ic	Current (C)	$I_{(nom.)}$	130	148	Yes	9	3
12	Iavg	Average Current	$I_{(nom.)}$	130	151	No	9	9
13	IN	Neutral-point current	$I_{(nom.)}$	130	151	No	9	10
14	Pa	Active power (A)	$I_{(nom.)} * V_{ph\text{-}N\ (nom.)}$	130	150	No	9	1
15	Pb	Active power (B)	$I_{(nom.)} * V_{ph\text{-}N\ (nom.)}$	130	152	No	9	1
16	Pc	Active power (C)	$I_{(nom.)} * V_{ph\text{-}N\ (nom.)}$	130	152	No	9	2
17	P	Active power	$3 * I_{(nom.)} * V_{ph\text{-}N\ (nom.)}$	130	148	Yes	9	7
18	Qa	Reactive power (A)	$I_{(nom.)} * V_{ph\text{-}N\ (nom.)}$	130	150	No	9	2
19	Qb	Reactive power (B)	$I_{(nom.)} * V_{ph\text{-}N\ (nom.)}$	130	152	No	9	3
20	Qc	Reactive power (C)	$I_{(nom.)} * V_{ph\text{-}N\ (nom.)}$	130	152	No	9	4
21	Q	Reactive power	$3 * I_{(nom.)} * V_{ph\text{-}N\ (nom.)}$	130	148	Yes	9	8
22	Sa	Apparent power (A)	$I_{(nom.)} * V_{ph\text{-}N\ (nom.)}$	130	150	No	9	3
23	Sb	Apparent power (B)	$I_{(nom.)} * V_{ph\text{-}N\ (nom.)}$	130	152	No	9	5
24	Sc	Apparent power (C)	$I_{(nom.)} * V_{ph\text{-}N\ (nom.)}$	130	152	No	9	6
25	S	Apparent power	$3 * I_{(nom.)} * V_{ph\text{-}N\ (nom.)}$	130	151	Yes	9	5

Table 2-71 Measured Value Mapping

#	Value	Measured Quantity	100 % Corresponds to	Function Type	Information Number	Compatibility	Data Unit	Position
26	cos φ (a)	Active power factor cos φ (A)	1	130	150	No	9	4
27	cos φ (b)	Active power factor cos φ (B)	1	130	152	No	9	7
28	cos φ (c)	Active power factor cos φ (C)	1	130	152	No	9	8
29	cos φ	Active power factor cos φ	1	130	151	No	9	6
30	PFa	Power factor (A)	1	130	150	No	9	5
31	PFb	Power factor (B)	1	130	152	No	9	9
32	PFc	Power factor (C)	1	130	152	No	9	10
33	PF	Power factor	1	130	151	No	9	7
34	φa	Phase angle (A)	180°	130	150	No	9	6
35	φb	Phase angle (B)	180°	130	152	No	9	11
36	φc	Phase angle (C)	180°	130	152	No	9	12
37	φ	Phase angle	180°	130	151	No	9	8
38	f	Power frequency	5 Hz deviation	130	148	Yes	9	9
39	U_2	Unbalanced voltage	100 %	130	151	No	9	11
40	Iunbal	Unbalanced current	100 %	130	151	No	9	12
41	THDS Va	Subgroup total harmonic distortion, voltage (a)	100 %	130	153	No	9	1
42	THDS Vb	Subgroup total harmonic distortion, voltage (b)	100 %	130	153	No	9	2
43	THDS Vc	Subgroup total harmonic distortion, voltage (c)	100 %	130	153	No	9	3

Table 2-71 Measured Value Mapping

#	Value	Measured Quantity	100 % Corresponds to	Function Type	Information Number	Compatibility	Data Unit	Position
44	THDS Ia	Subgroup total harmonic distortion, current (a)	100 %	130	154	No	9	1
45	THDS Ib	Subgroup total harmonic distortion, current (b)	100 %	130	154	No	9	2
46	THDS Ic	Subgroup total harmonic distortion, current (c)	100 %	130	154	No	9	3
47 to 66	H_Va_1 to H_Va_39	Odd harmonic (1 to 39), voltage (a-N)	100 %	130	170	No	9	1 to 20
67 to 86	H_Vb_1 to H_Vb_39	Odd harmonic (1 to 39), voltage (b-N)	100 %	130	171	No	9	1 to 20
87 to 106	H_Vc_1 to H_Vc_39	Odd harmonic (1 to 39), voltage (c-N)	100 %	130	172	No	9	1 to 20
107 to 126	H_Va_2 to H_Va_40	Even harmonic (2 to 40), voltage (a-N)	100 %	130	173	No	9	1 to 20
127 to 146	H_Vb_2 to H_Vb_40	Even harmonic (2 to 40), voltage (b-N)	100 %	130	174	No	9	1 to 20
147 to 166	H_Vc_2 to H_Vc_40	Even harmonic (2 to 40), voltage (c-N)	100 %	130	175	No	9	1 to 20
167 to 187	H_Ia_1 to H_Ia_21	Harmonic (1, 2, 3 to 21), current (a)	100 %	130	176	No	9	1 to 21
188 to 208	H_Ib_1 to H_Ib_21	Harmonic (1, 2, 3 to 21), current (b)	100 %	130	177	No	9	1 to 21
209 to 229	H_Ic_1 to H_Ic_21	Harmonic (1, 2, 3 to 21), current (c)	100 %	130	178	No	9	1 to 21
230 to 248	H_Ia_22 to H_Ia_40	Harmonic (22, 23, 24 to 40), current (a)	100 %	130	179	No	9	1 to 19

Table 2-71 Measured Value Mapping

#	Value	Measured Quantity	100 % Corresponds to	Function Type	Information Number	Compatibility	Data Unit	Position
249 to 267	H_Ib_22 to H_Ib_40	Harmonic (22, 23, 24 to 40), current (b)	100 %	130	180	No	9	1 to 19
268 to 286	H_Ic_22 to H_Ic_40	Harmonic (22, 23, 24 to 40), current (c)	100 %	130	181	No	9	1 to 19

2.4.2.2 Telegrams for Measured Values

The measured values of SICAM P850/P855 are transmitted via IEC 60870-5-103 using 18 different telegrams. Depending on the selected **Network type**, specific measured values are sent (see Device Manual, chapter Operation - Setting the Operational Parameters).

Function Type FUN

Each telegram from the slave device to the master device contains a function type the function type FUN:

FUN = 130: AC measurement - AC measurands and associated indications

Information Number INF

INF = 148: Compatible measurands II

INF = 150: Private measurands 1-phase additional

INF = 151 to 154: Private measurands 3-phase, 1. to 4. additional

INF = 170 to 181: Private measurands 3-phase, 5. to 16. additional

18 different measurands telegrams are defined as follows:

Compatible Measurands II

Data Unit (ASDU) = 9
Identifier (max. 9 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 148
Current (Ia)
Current (Ib)
Current (Ic)
Voltage (Va)
Voltage (Vb)
Voltage (Vc)
Active Power (P)
Reactive Power (Q)
Power Frequency (f)

Private Measurands 1-phase Additional

Data Unit (ASDU) = 9
Identifier (max. 7 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 150
Active Power (Pa)
Reactive Power (Qa)
Apparent Power (Sa)
Active power factor cos φ (a)
Power Factor (PFa)
Phase Angle (φa)
Neutral-point Displacement Voltage (VN)

Private Measurands 3-phase, 1. Additional

Data Unit (ASDU) = 9
Identifier (max. 10 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 151
Voltage (Vab)
Voltage (Vbc)
Voltage (Vca)
Average Voltage (Vavg)
Apparent Power (S)
Active Power Factor cos φ
Power Factor (PF)
Phase Angle (φ)
Average Current (I)
Neutral-Point Current (In)
Voltage unbalance (U_2)
Current unbalance (Iunbal)

Private Measurands 3-phase, 2. Additional

Data Unit (ASDU) = 9
Identifier (max. 12 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 152
Active Power (Pb)
Active Power (Pc)
Reactive Power (Qb)
Reactive Power (Qc)
Apparent Power (Sb)
Apparent Power (Sc)
cos φ (b)
cos φ (c)
Power Factor (PFb)
Power Factor (PFc)
Phase Angle (φb)
Phase Angle (φc)

Private Measurands 3-phase, 3. Additional

Data Unit (ASDU) = 9
Identifier (max. 3 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 153
THDS Va-N
THDS Vb-N
THDS Vc-N

Private Measurands 3-phase, 4. Additional

Data Unit (ASDU) = 9
Identifier (max. 3 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 154
THDS Ia
THDS Ib
THDS Ic

Private Measurands 3-phase, 5. Additional

Data Unit (ASDU) = 9
Identifier (max. 20 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 170
Fundamental component (Va-N)
3rd harmonic (Va-N)
5th harmonic (Va-N)
...
39th harmonic (Va-N)

Private Measurands 3-phase, 6. Additional

Data Unit (ASDU) = 9
Identifier (max. 20 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 171
Fundamental component (Vb-N)
3rd harmonic (Vb-N)
5th harmonic (Vb-N)
...
39th harmonic (Vb-N)

Private Measurands 3-phase, 7. Additional

Data Unit (ASDU) = 9
Identifier (max. 20 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 172
Fundamental component (Vc-N)
3rd harmonic (Vc-N)
5th harmonic (Vc-N)
...
39th harmonic (Vc-N)

Private Measurands 3-phase, 8. Additional

Data Unit (ASDU) = 9
Identifier (max. 20 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 173
2nd harmonic (Va-N)
4th harmonic (Va-N)
...
40th harmonic (Va-N)

Private Measurands 3-phase, 9. Additional

Data Unit (ASDU) = 9
Identifier (max. 20 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 174
2nd harmonic (Vb-N)
4th harmonic (Vb-N)
...
40th harmonic (Vb-N)

Private Measurands 3-phase, 10. Additional

Data Unit (ASDU) = 9
Identifier (max. 20 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 175
2nd harmonic (Vc-N)
4th harmonic (Vc-N)
...
40th harmonic (Vc-N)

Private Measurands 3-phase, 11. Additional

Data Unit (ASDU) = 9
Identifier (max. 21 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 176
Fundamental component (Ia)
2nd harmonic (Ia)
3rd harmonic (Ia)
...
21st harmonic (Ia)

Private Measurands 3-phase, 12. Additional

Data Unit (ASDU) = 9
Identifier (max. 21 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 177
Fundamental component (Ib)
2nd harmonic (Ib)
3rd harmonic (Ib)
...
21st harmonic (Ib)

Private Measurands 3-phase, 13. Additional

Data Unit (ASDU) = 9
Identifier (max. 21 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 178
Fundamental component (Ic)
2nd harmonic (Ic)
3rd harmonic (Ic)
...
21st harmonic (Ic)

Private Measurands 3-phase, 14. Additional

Data Unit (ASDU) = 9
Identifier (max. 19 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 179
22nd harmonic (Ia)
23rd harmonic (Ia)
...
40th harmonic (Ia)

Private Measurands 3-phase, 15. Additional

Data Unit (ASDU) = 9
Identifier (max. 19 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 180
22nd harmonic (Ib)
23rd harmonic (Ib)
...
40th harmonic (Ib)

Private Measurands 3-phase, 16. Additional

Data Unit (ASDU) = 9
Identifier (max. 19 elements)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 181
22nd harmonic (Ic)
23rd harmonic (Ic)
...
40th harmonic (Ic)

Private Measurands 3-phase, 17. Additional

Data Unit (ASDU) = 9
No. of Elements (1 to 6)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 155
Pst Vab
Pst Vbc
Pst Vca
Plt Vab
Plt Vbc
Plt Vca

Private Measurands 3-phase, 18. Additional

Data Unit (ASDU) = 9
No. of Elements (1 to 6)
Cause of Transmission (COT)
Common Address of ASDU
Function Type (FUN) = 130
Information Number (INF) = 156
Pst Va-N
Pst Vb-N
Pst Vc-N
Plt Va-N
Plt Vb-N
Plt Vc-N

2.4.2.3 Transmitted Telegrams in the Various Network Types

Depending on the selected **Network type**, 2 or 4 of the telegrams for AC measurands are sent to the IEC 60870-5-103 master.

Table 2-72 Transmitted Telegrams vs. Network Type

	Network Type					
	1-phase Network	**3-wire 3-phase**			**4-wire 3-phase**	
		Bal-anced	**Unbal-anced 3I**	**Unbal-anced 2I**	**Bal-anced**	**Unbal-anced**
Compatible Measurands II	X[1)]	X[2)]	X[2)]	X[2)]	X	X
Private Measurands 1-phase additional	X	-	-	-	-	X
Private Measurands 3-phase, 1. additional	-	X	X	X	X	X
Private Measurands 3-phase, 2. additional	-	-	-	-	-	X
Private Measurands 3-phase, 3. additional	X[3)]	-	-	-	X[3)]	X
Private Measurands 3-phase, 4. additional	X[4)]	X[4)]	X	X	X[4)]	X
Private Measurands 3-phase, 5. additional	X	-	-	-	X	X
Private Measurands 3-phase, 6. additional	-	-	-	-	-	X
Private Measurands 3-phase, 7. additional	-	-	-	-	-	X
Private Measurands 3-phase, 8. additional	X	-	-	-	X	X
Private Measurands 3-phase, 9. additional	-	-	-	-	-	X
Private Measurands 3-phase, 10. additional	-	-	-	-	-	X
Private Measurands 3-phase, 11. additional	X	X	X	X	X	X
Private Measurands 3-phase, 12. additional	-	-	X	X	-	X
Private Measurands 3-phase, 13. additional	-	-	X	X	-	X

Table 2-72 Transmitted Telegrams vs. Network Type (cont.)

	Network Type					
	1-phase Network	3-wire 3-phase			4-wire 3-phase	
		Balanced	Unbalanced 3I	Unbalanced 2I	Balanced	Unbalanced
Private Measurands 3-phase, 14. additional	X	X	X	X	X	X
Private Measurands 3-phase, 15. additional	-	-	X	X	-	X
Private Measurands 3-phase, 16. additional	-	-	X	X	-	X
Private Measurands 3-phase, 17. additional	X[3)]	-	-	-	X[3)]	X
Private Measurands 3-phase, 18. additional	-	X	X	X	-	-

1) The values for 3N as well as phases b and c in the “Compatible Measurands II” telegram which are not available for this network type are indicated as invalid.

2) For 3-wire network configuration following quantities of measurand II are not valid: Van, Vbn, Vcn. Therefore, the relevant measurand invalid bit in “Compatible Measurand II” - ASDU 9 will be set.

3) Measured values for Vb-N and Vc-N may be not available for some connection types and will be marked with invalid in data unit.

4) Measured values for Ib and Ic may be not available for some connection types and will be marked with invalid in data unit.

All telegrams are transferred sequentially. The IEC 60870-5-103 slave sends the next following telegram in the order shown in Table 2-72 and the measurands telegram.

When the last measurands telegram has been sent, transmission of the "Compatible Measurands II" telegram is started again.

The IEC 60870-5-103 Master can retrieve either only one telegram, a part of the telegram or all telegrams supported by the device.

On every class 2 request from the IEC 60870-5-103 master, the current measured values are transmitted. It is the task of the communication master to compare the values of the current and previous request if necessary.

2.4.3 Data Mapping for Commands and Events

The following table contains all available commands and events as well as the information of the modules:

Table 2-73 Commands and Events

#	Designation	Description	Type of Information	Function Type	Information Number	Compatibility	Data Unit	General Interrogation
1	Indication 1 from Remote	Assign to binary output 1 or 2	Event	135	32	No	1	Yes
2	Indication 1 from Remote	Assign to binary output 1 or 2	Command	135	32	No	20	-
3	Indication 2 from Remote	Assign to binary output 1 or 2	Event	135	33	No	1	Yes
4	Indication 2 from Remote	Assign to binary output 1 or 2	Command	135	33	No	20	-
5	BO1	Binary output 1	Event	135	34	No	1	Yes
6	BO2	Binary output 2	Event	135	35	No	1	Yes
7	Limit Violation 1	Limiting value 1	Event	135	49	No	1	Yes
8	Limit Violation 2	Limiting value 2	Event	135	50	No	1	Yes
9	Limit Violation 3	Limiting value 3	Event	135	51	No	1	Yes
10	Limit Violation 4	Limiting value 4	Event	135	52	No	1	Yes
11	Limit Violation 5	Limiting value 5	Event	135	53	No	1	Yes
12	Limit Violation 6	Limiting value 6	Event	135	54	No	1	Yes
13	Limit Violation 7	Limiting value 7	Event	135	55	No	1	Yes
14	Limit Violation 8	Limiting value 8	Event	135	56	No	1	Yes
15	Limit Violation 9	Limiting value 9	Event	135	57	No	1	Yes
16	Limit Violation 10	Limiting value 10	Event	135	58	No	1	Yes
17	Limit Violation 11	Limiting value 11	Event	135	59	No	1	Yes

Table 2-73 Commands and Events (cont.)

#	Designation	Description	Type of Information	Function Type	Information Number	Compatibility	Data Unit	General Interrogation
18	Limit Violation 12	Limiting value 12	Event	135	60	No	1	Yes
19	Limit Violation 13	Limiting value 13	Event	135	61	No	1	Yes
20	Limit Violation 14	Limiting value 14	Event	135	62	No	1	Yes
21	Limit Violation 15	Limiting value 15	Event	135	63	No	1	Yes
22	Limit Violation 16	Limiting value 16	Event	135	64	No	1	Yes
23	Battery fault	Battery fault	Event	135	65	No	1	Yes
24	Device OK	Device OK	Event	135	66	No	1	Yes
25	Reset Energy	Reset energy	Event	135	67	No	1	Yes
26	Reset Energy	Reset energy	Command	135	67	No	20	-
27	Time Synchroni-zation Error	Time synchroni-zation error	Event	135	68	No	1	Yes
28	Settings Load	Parameter load	Event	135	69	No	1	Yes
29	SD card error	SD card status	Event	135	70	No	1	Yes
30	DirectionRotation	Direction of rotation	Event	135	82	No	1	Yes
31	GI1	Group indication 1	Event	135	83	No	1	Yes
32	GI2	Group indication 2	Event	135	84	No	1	Yes
33	GI3	Group indication 3	Event	135	85	No	1	Yes
34	GI4	Group indication 4	Event	135	86	No	1	Yes

2.4.4 Data Mapping for Counters

Metering values (for example kWh) are not defined in the IEC standard and there are no compatible data units available which are suitable for the transmission of metered values. The private data unit 205 has been defined for the transmission of metered values using Class 1 data format.

Only one metering value per data unit is transmitted. There exists a cyclic interval for transmitting the counters which is set fixed to 1 min in SICAM P850/P855.

Table 2-74 Counters

#	Value	Unit	Function Type	Information Number	Compati-bility	Data Unit
1	WPa_sup	Wh	133	51	No	205
2	WPb_sup	Wh	133	52	No	205
3	WPc_sup	Wh	133	53	No	205
4	WP_sup	Wh	133	54	No	205
5	WPa_dmd	Wh	133	55	No	205
6	WPb_dmd	Wh	133	56	No	205
7	WPc_dmd	Wh	133	57	No	205
8	WP_dmd	Wh	133	58	No	205
9	WQa_ind	varh	133	59	No	205
10	WQb_ind	varh	133	60	No	205
11	WQc_ind	varh	133	61	No	205
12	WQ_ind	varh	133	62	No	205
13	WQa_cap	varh	133	63	No	205
14	WQb_cap	varh	133	64	No	205
15	WQc_cap	varh	133	65	No	205
16	WQ_cap	varh	133	66	No	205
17	WSa	VAh	133	67	No	205
18	WSb	VAh	133	68	No	205
19	WSc	VAh	133	69	No	205
20	WS	VAh	133	70	No	205

2.4.5 Diagnosis IEC 60870-5-103

The diagnostics for IEC 60870-5-103 enables analyzing the parameters and the communication and resetting the diagnostics counters. For more information, see the SICAM P850/P855 device manual, chapter 7.3 Configuration of the Device.

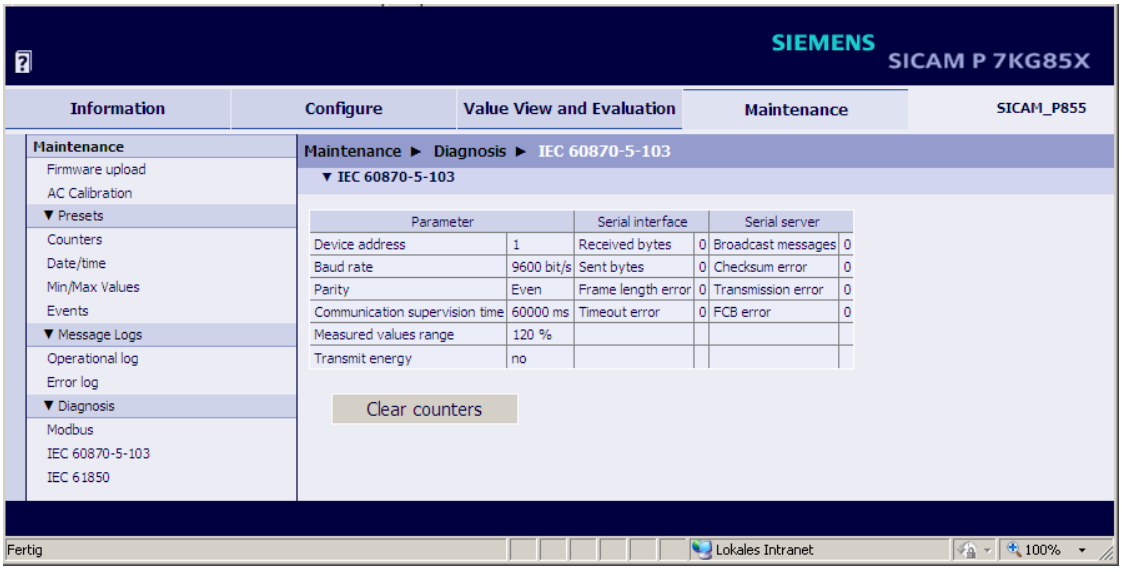


Figure 2-7 Diagnosis IEC 60870-5-103

Parameters

The following parameters are displayed with IEC 60870-5-103:

- Device address: Default setting: 1
- Baud rate: Default setting: 9600 bit/s
- Parity: Even (fixed)
- Communication supervision time: Default setting: 60 000 ms
- Measured value range: 120 %
- Transmit energy: No

Serial Interface

The following parameters are displayed for the serial interface:

- Received bytes: Total numbers of bytes received by serial interface
- Sent bytes: Total numbers of bytes sent to the serial interface
- Frame length error: Total numbers of incoming frame exceeded buffer size (invalid stop bit, for example if the baud rate is wrong)
- Time-out error: Total numbers of intercharacter time-out occurred

Serial Server

The following parameters are displayed for the serial server:

- Broadcast messages: Total numbers of received broadcast telegrams with server address zero
- Checksum error: Total numbers of invalid checksum
- Transmission error: Total numbers of error returned from target transmit routine
- FCB error: Total numbers of received invalid frame count bit (FCB)

3 Connection with SICAM PQS

(Version V8.01 SICAM PAS PQS and Higher)

3.1 General

The data acquired by **SICAM P850/P855** are stored in the internal memory of the device. The data of the measured value recorder, for example mean values, and of the trend recorder are available in the PQDIF data format. The data of measured value recorder is also available in CSV data format. The data of the fault recorder are saved in the COMTRADE data format. This data can be transferred to SICAM PQS using the IEC 61850 Ed.2 protocol.

The SICAM PQS software, version V8.02 and higher, allows importing the data into the SICAM PQS archive. Once the data has been transferred into the SICAM PQS archive, it can be used for further evaluations such as reporting, export, etc.

SICAM PQ Analyzer or SIGRA allow displaying the data in graphical or numerical form and analyzing them. For example, evaluations of the records and reports can be performed according to the EN 50160 standard or other grid codes.

The following diagram shows the sequence of the parameterization and the analysis:

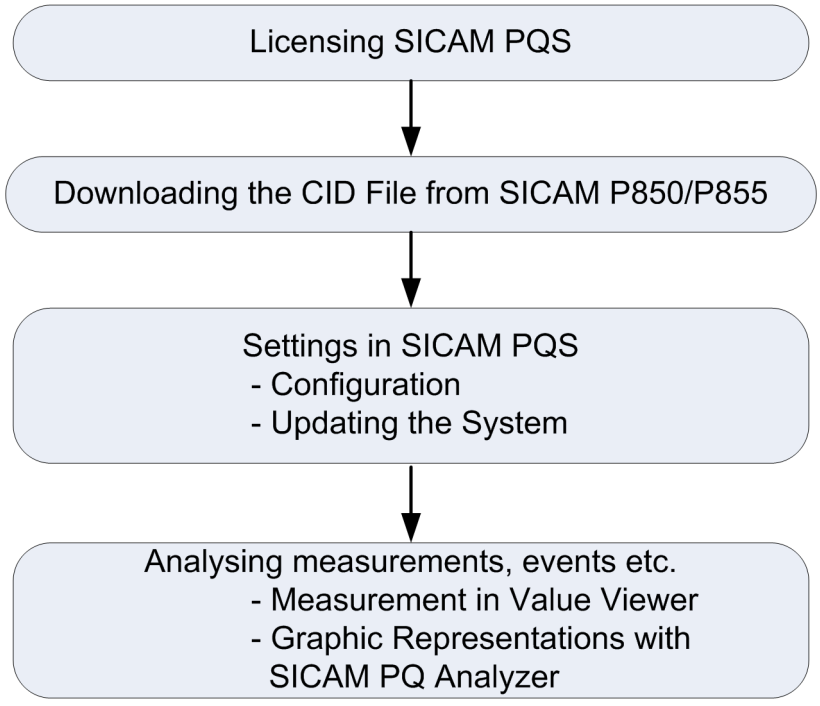


Figure 3-1 Workflow

NOTE

For SICAM P850 V2.20 or higher, file extension *.cid is changed to *.iid.

3.2 Licensing SICAM PQS

After installing SICAM PQS, execute the **Feature Enabler** application:

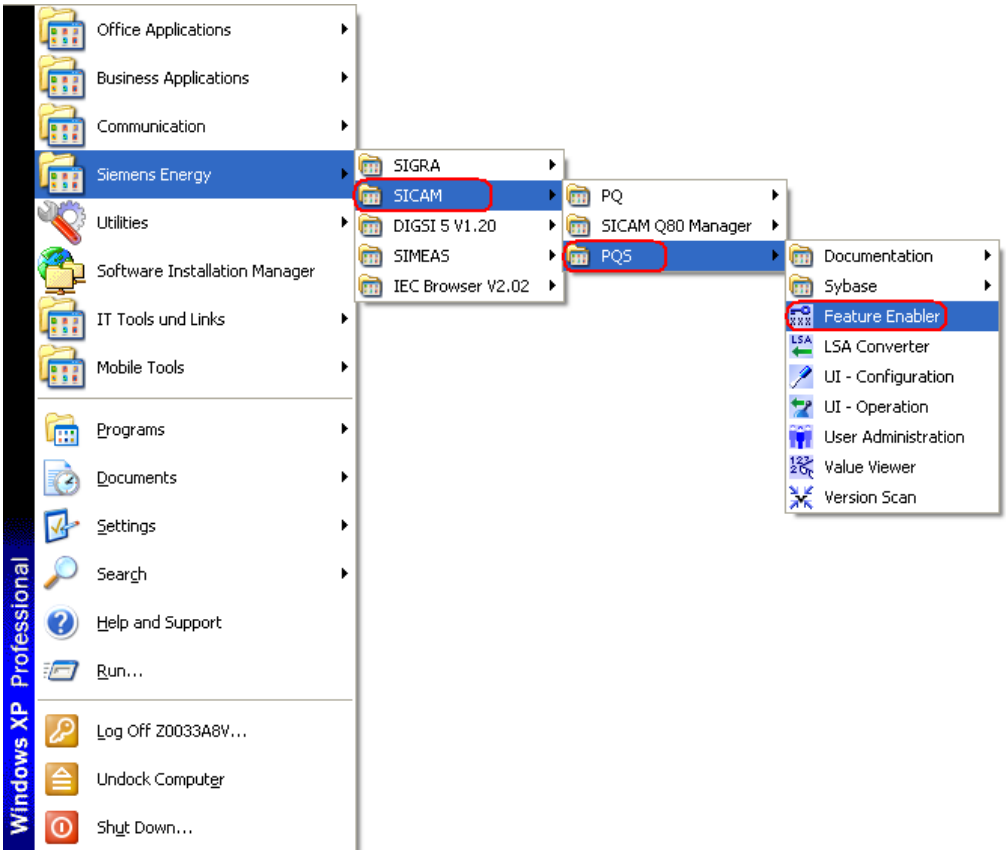


Figure 3-2 Start Feature Enabler

✧ Enter all license keys for your application and click **Install**.

Licenses

On the configuration computer:

- Configuration Large/Medium: depending on the number of equipment

On the runtime computer:

- Runtime Large/Medium/Small: depending on the number of equipment
- IEC 61850 Client or IEC 61850 Client Monitor

When required:

- PQS Scheduled Reporting
- PQS Grid Code Evaluation
- PQS Fault Locator
- PQS Notification
- PQS Automatic COMTRADE Export
- PQS Automatic PQDIF Export
- PQS Automatic REPORT Export

3.3 Downloading the CID File

Before configuring SICAM PQS, download the CID file of SICAM P850/P855 to a folder on your local PC. Proceed as follows:

- ✧ In SICAM P850/P855 open the **Configure** tab → **Communication Ethernet** (see Device Manual, Chapter 7).
- ✧ Click **Download CID file**.

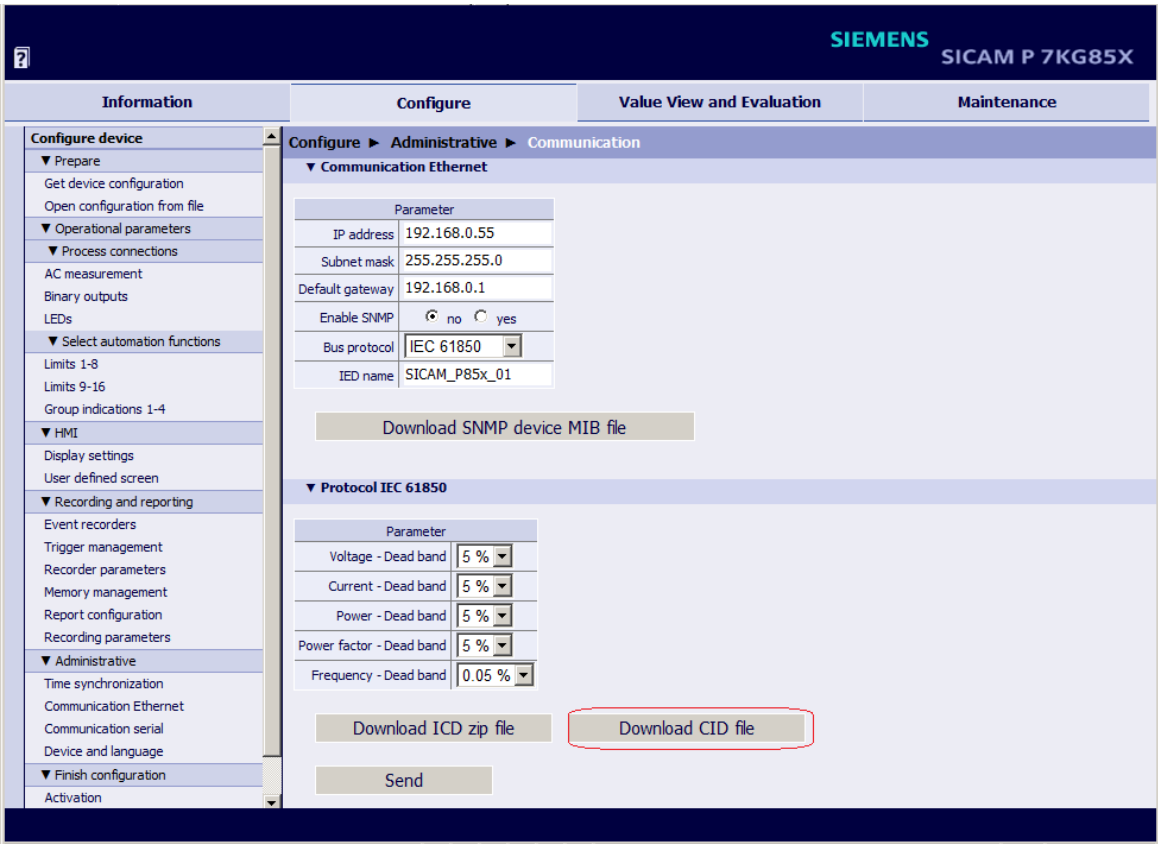


Figure 3-3 Configuration Tab, Communication Ethernet

- ✧ Save the CID file in a folder.

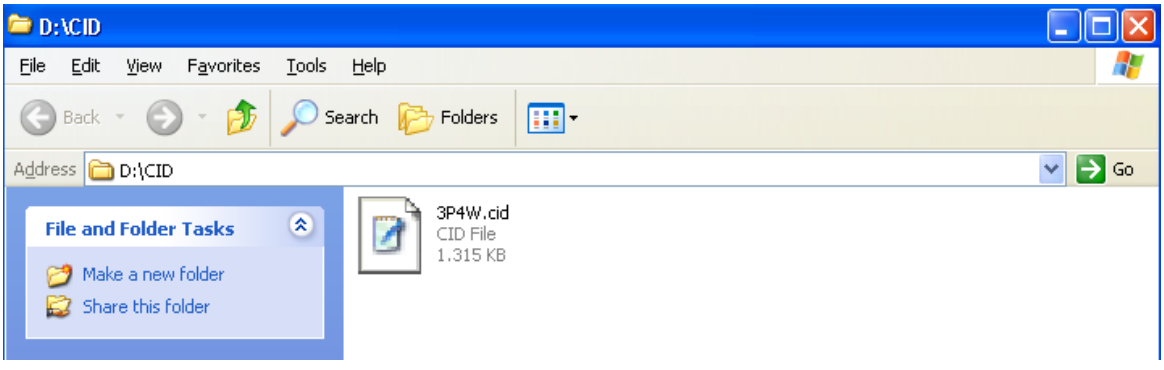


Figure 3-4 Saved CID File

NOTE

For SICAM P850 V2.20 or higher, file extension *.cid is changed to *.iid.

3.4 Settings in SICAM PQS

3.4.1 Configuration

✧ In SICAM PQS start the **UI - Configuration**.

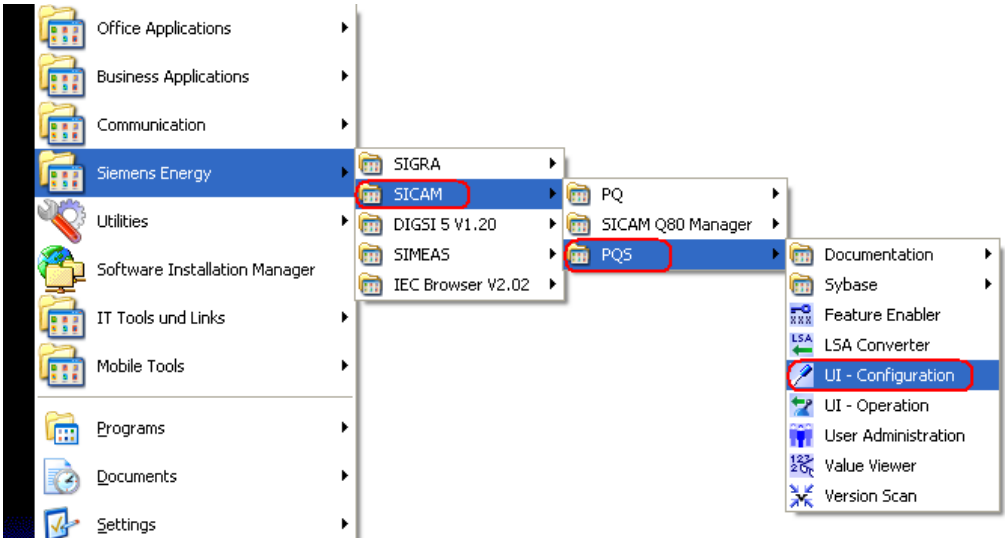


Figure 3-5 Start UI - Configuration

✧ Select the **Configuration** tab.

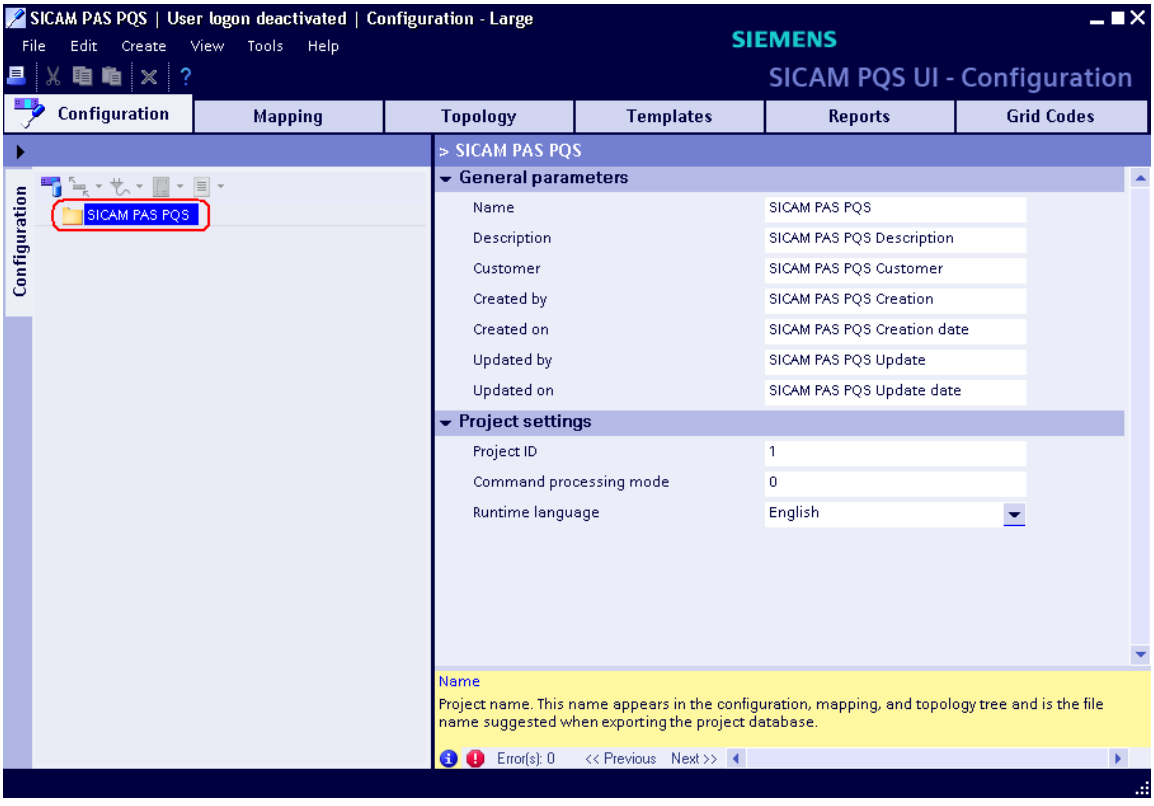


Figure 3-6 Configuration Tab

✧ Select the project and add its system from the context menu.

Your own PC will be automatically inserted as the first system and as the full server.

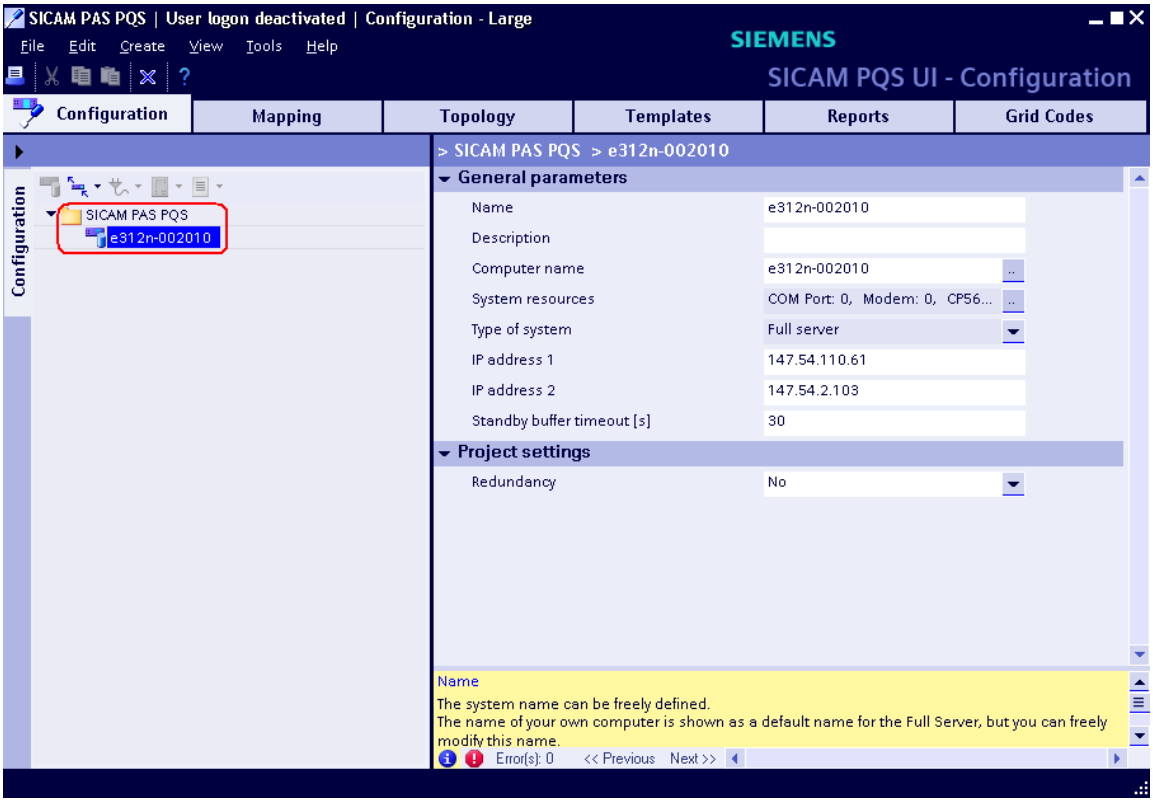


Figure 3-7 Inserting the System

✧ In the navigation window right-click **SICAM PAS PQS** → **Computer name** (in the example e312n-002010) → **Application** → **Archive**.

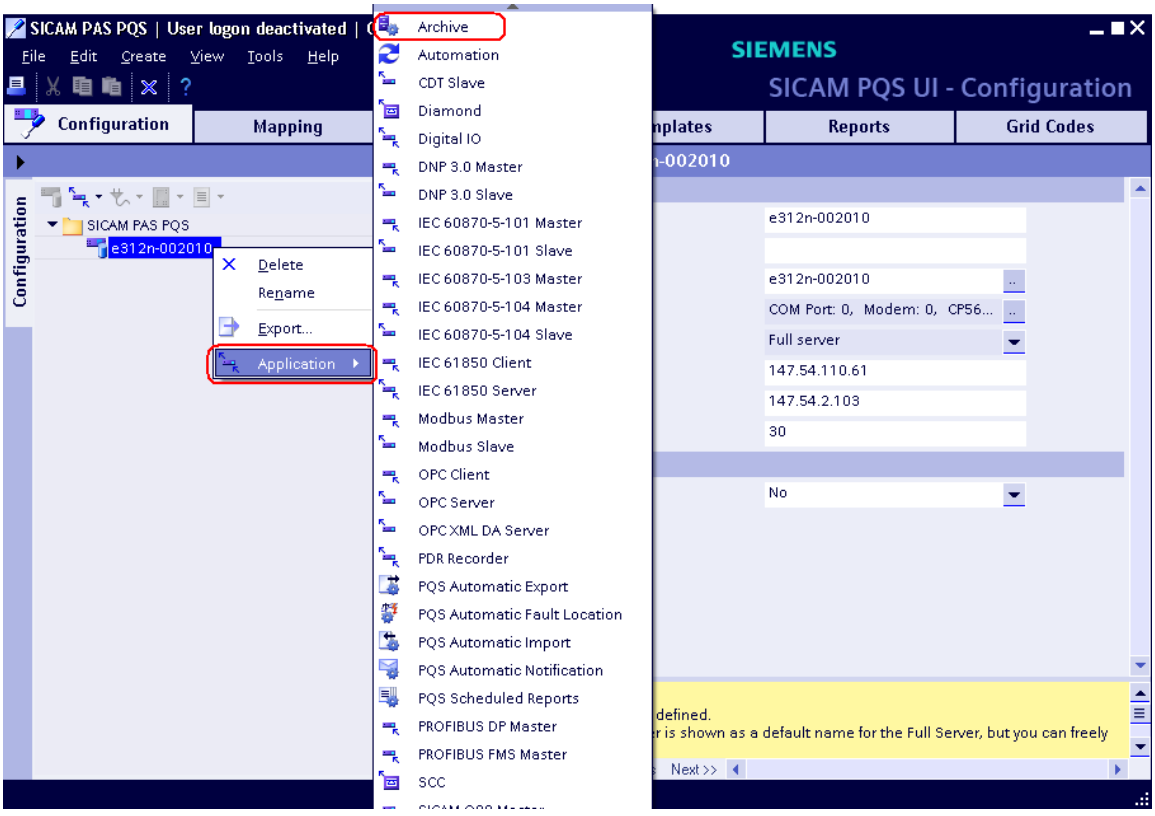


Figure 3-8 Selecting the Archive

✧ Create a path for the archive.

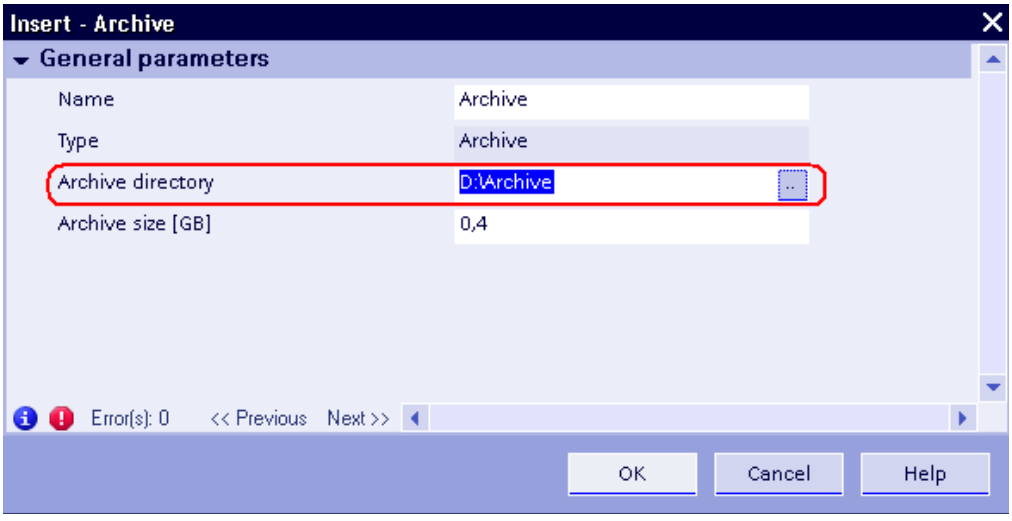


Figure 3-9 Creating the Archive Folder

✧ Click **OK**.

NOTE

The **archive** is needed to store measurements recorded by CID which enables SICAM PQ Analyzer to present them.

✧ In the navigation window right-click **SICAM PAS PQS** → **Computer name** (in the example: e312n-002010) → **Application** → **IEC 61850 Client**.

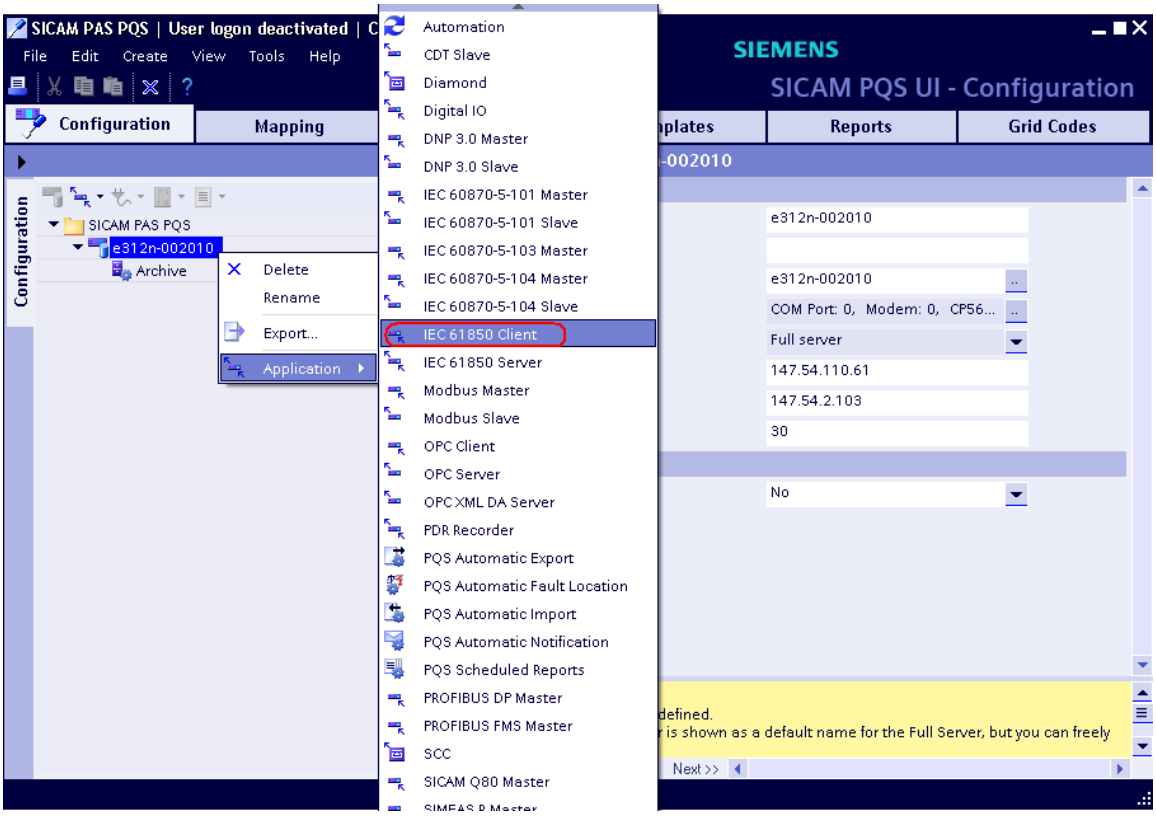


Figure 3-10 Selection of the IEC 61850 Client

✧ If necessary, change the name of the IEC 61850 client in the **General Parameters** window.

✧ In the navigation window right-click **SICAM PAS PQS** → **Computer name** (in the example: e312n-002010) → **IEC 61850 Client** → **Interface**.

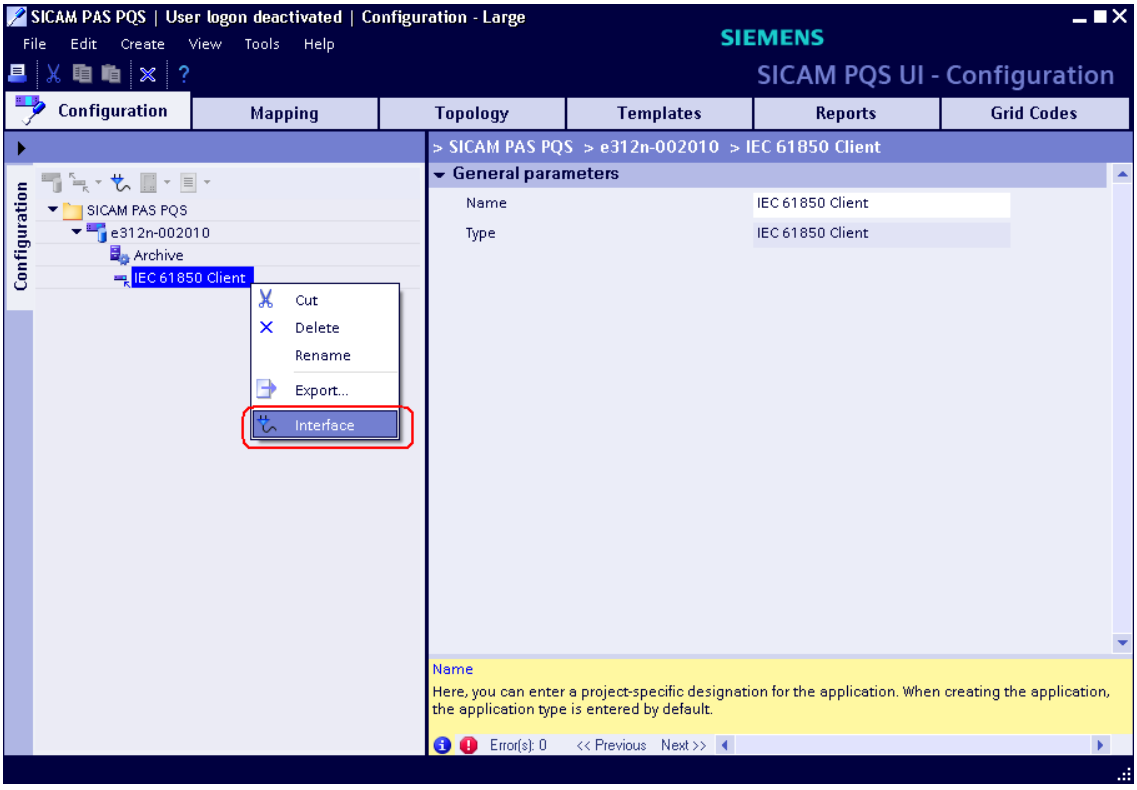


Figure 3-11 Selecting the Interface

✧ In the **Interface** window enter a **Name**.

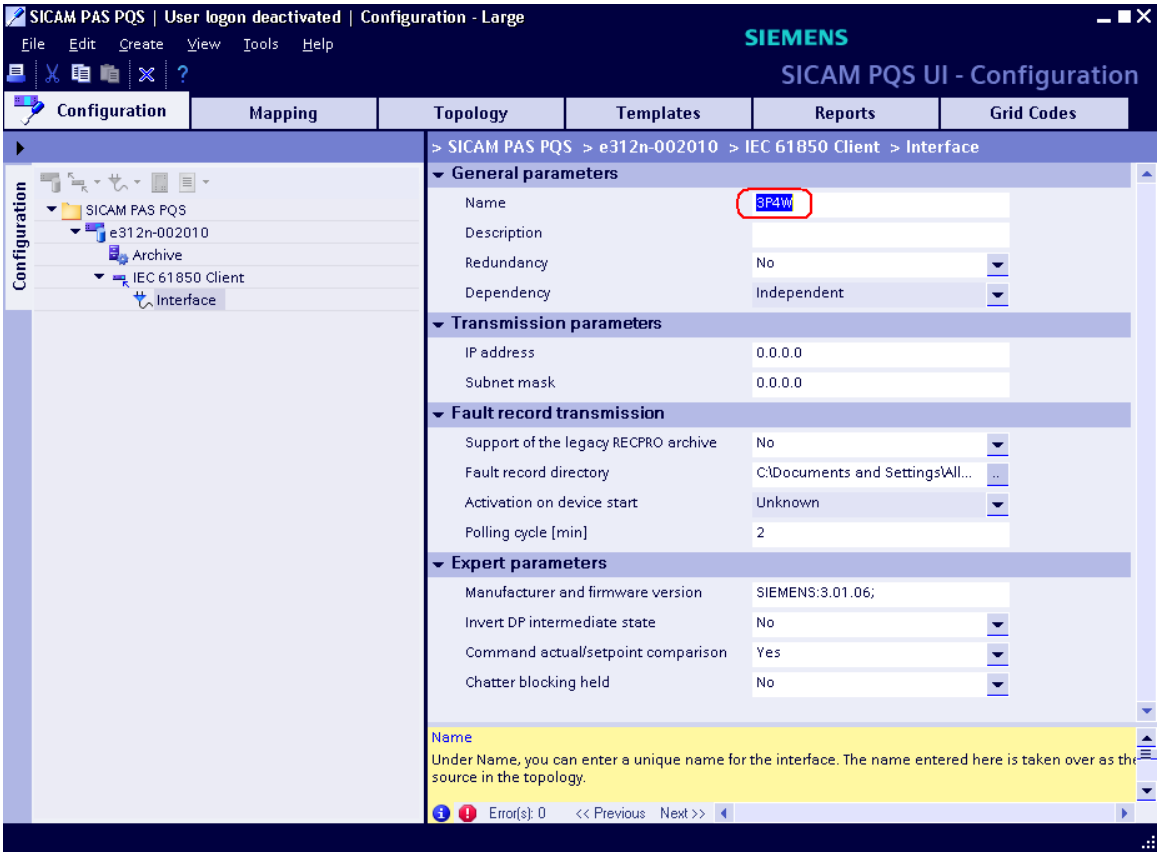


Figure 3-12 Interface Parameters

✧ In the navigation window right-click **SICAM PAS PQS** → **Computer name** (in the example: e312n-002010) → **IEC 61850 Client** → **Interface** (in the example: interface designation **3P4W**) → **Import...**.

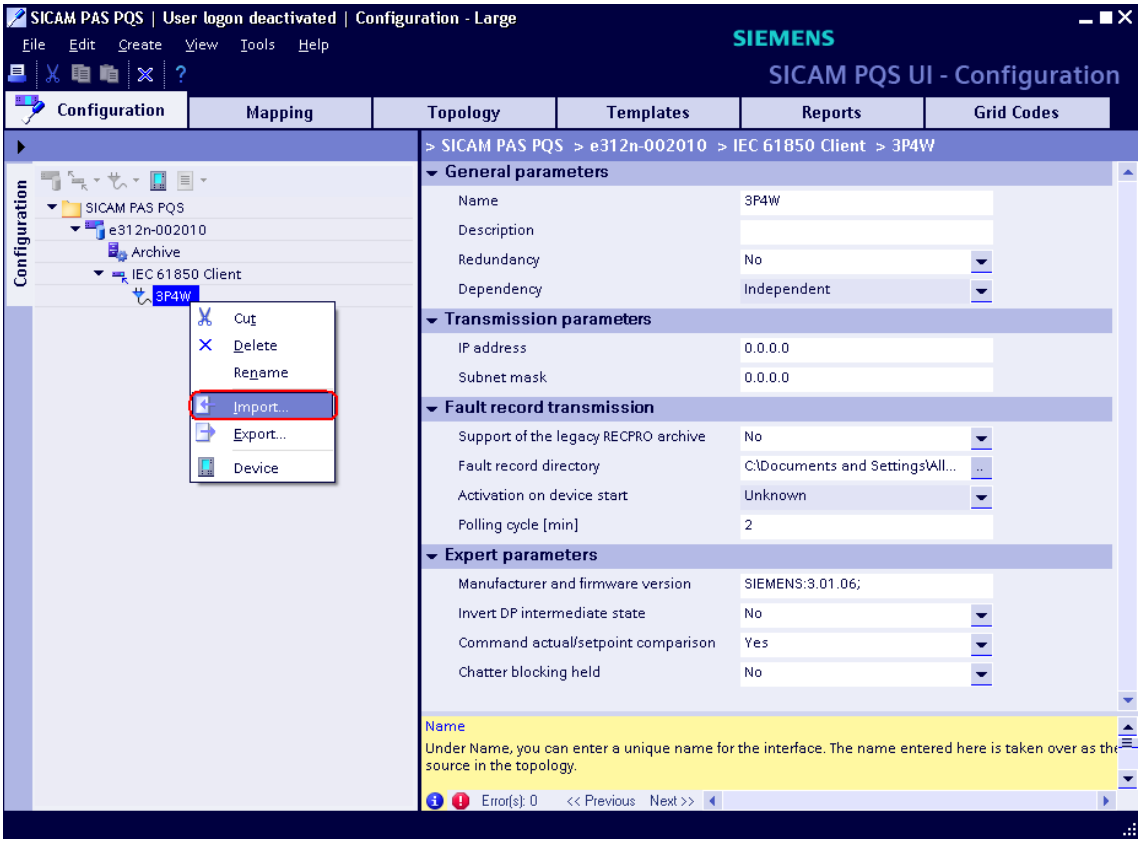


Figure 3-13 Import

✧ In the folder select the file previously downloaded from device (in the example and then click **Open**.

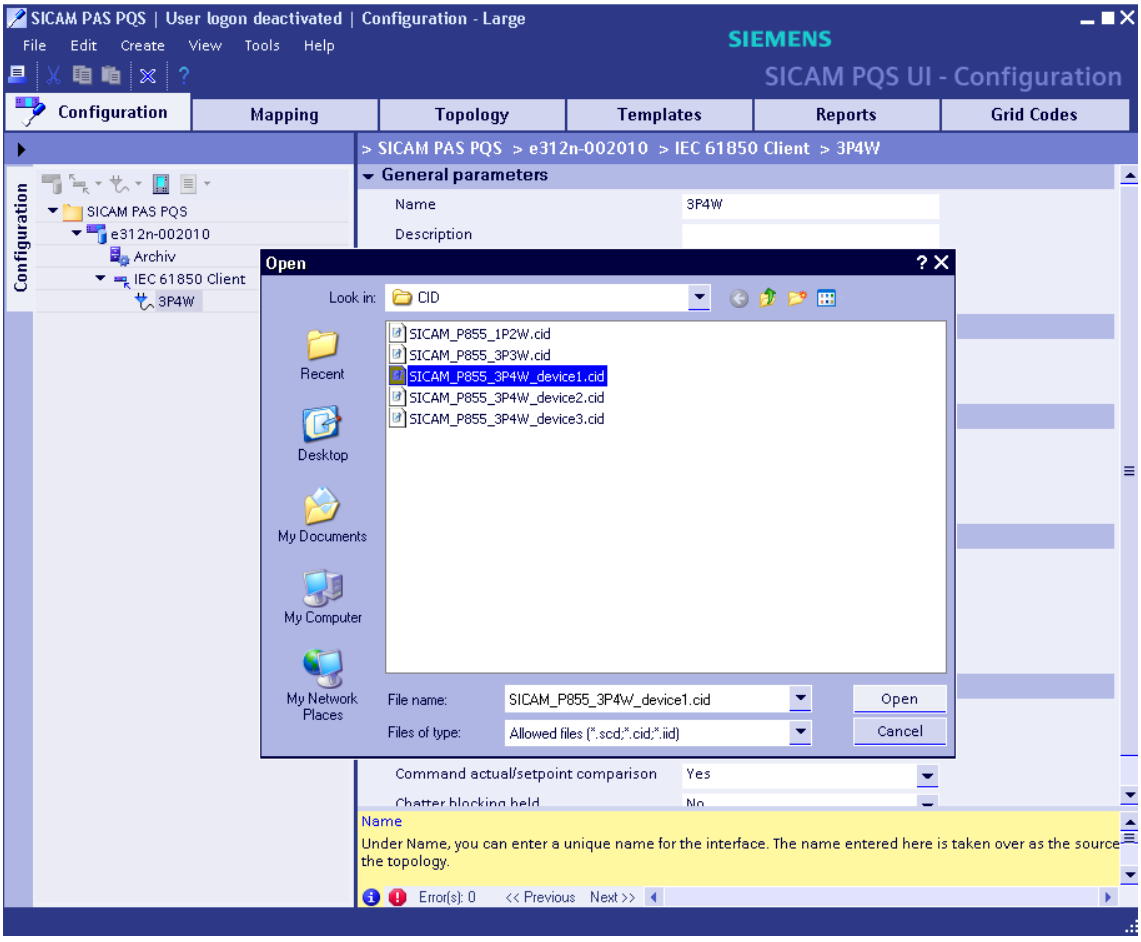


Figure 3-14 Importing the CID File

✧ Select the desired element in the next window (in the example: SICAMP_00001) by checking the **Select** column.

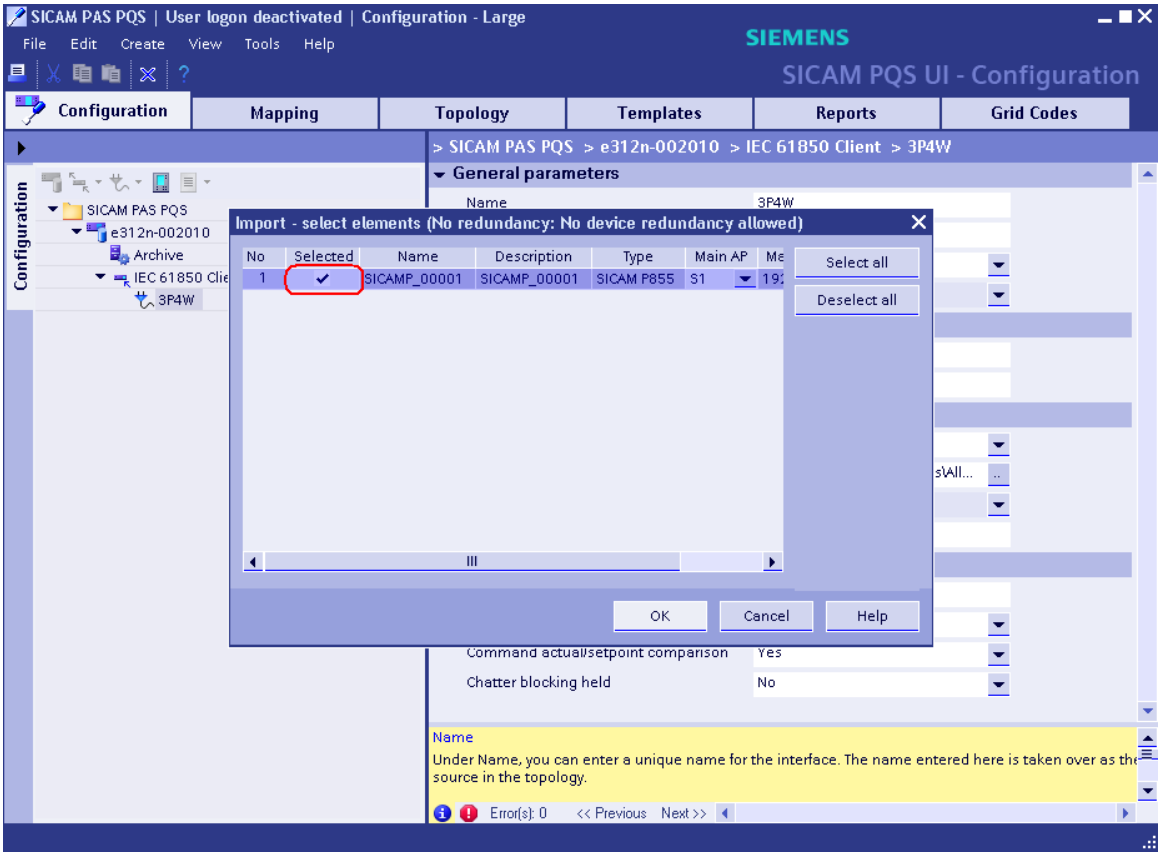


Figure 3-15 Selecting an Element

✧ Click **OK**.

- ✧ If you wish a fault record transmission (COMTRADE files), select **Yes** in the list box under **Fault record transmission** → **Activation on device start.**
- ✧ To transfer PQDIF data of the measured value recorder or trend recorder, select **Yes** in the list box under **PQDIF data transmission** ® **Transfer PQDIF data**.

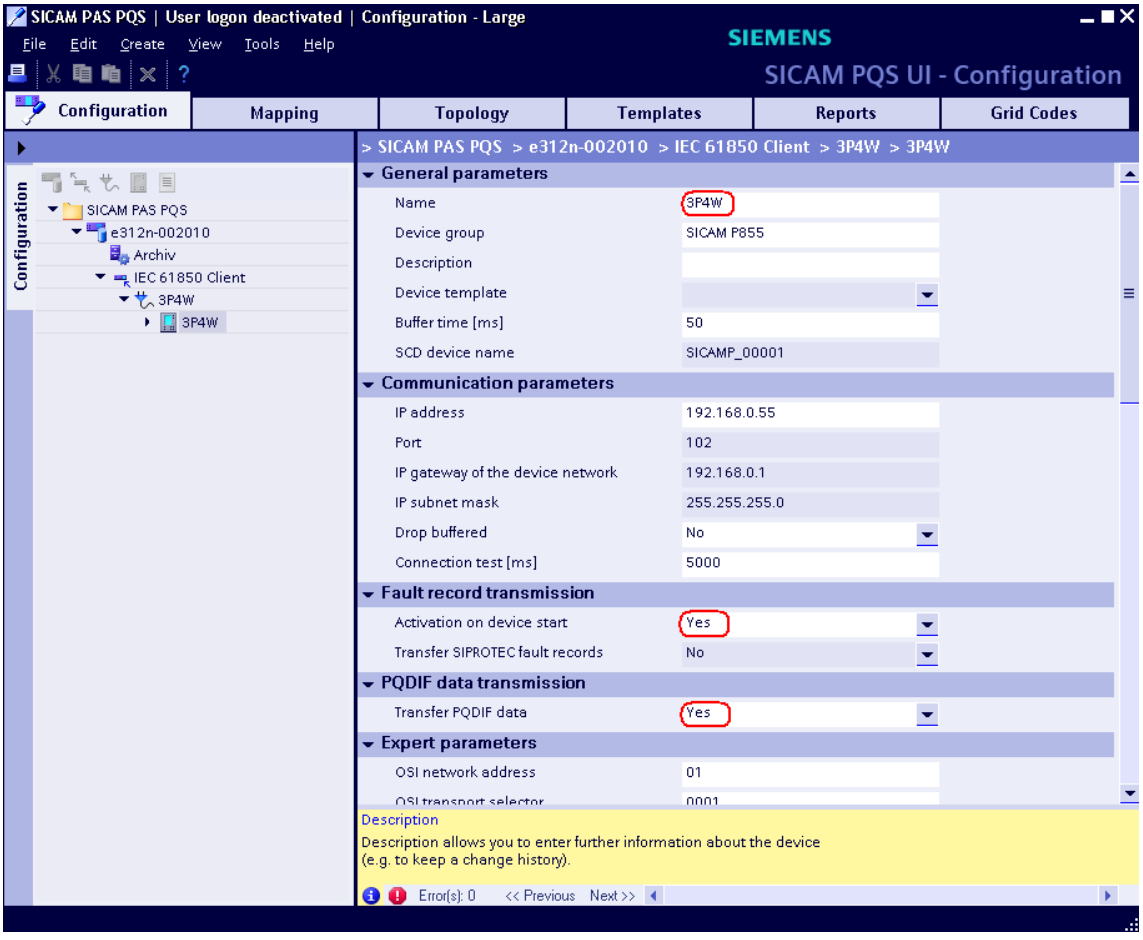


Figure 3-16 Entries

NOTE

The fault records can be displayed in PQ Analyzer. Additionally, fault records can be forwarded via **PQS Automatic Export** and **PQS Notification** and displayed by SICAM Diamond.

3.4.2 Updating the System

✧ Start the **UI - Operation** updating interface in SICAM PQS.

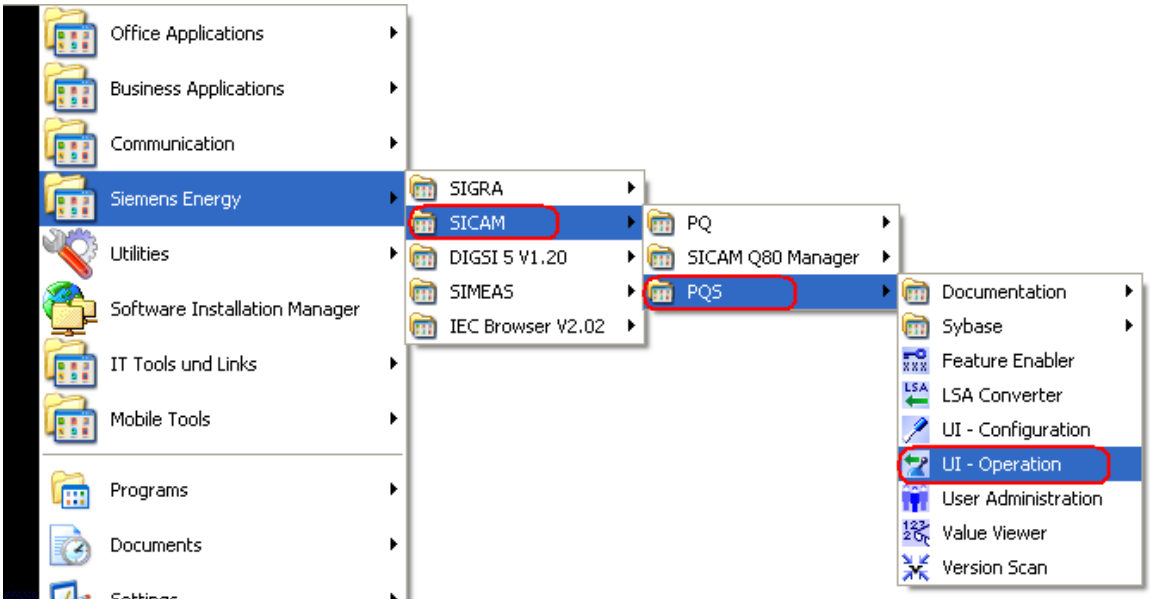


Figure 3-17 Start UI - Operation

✧ Click **Update system**.

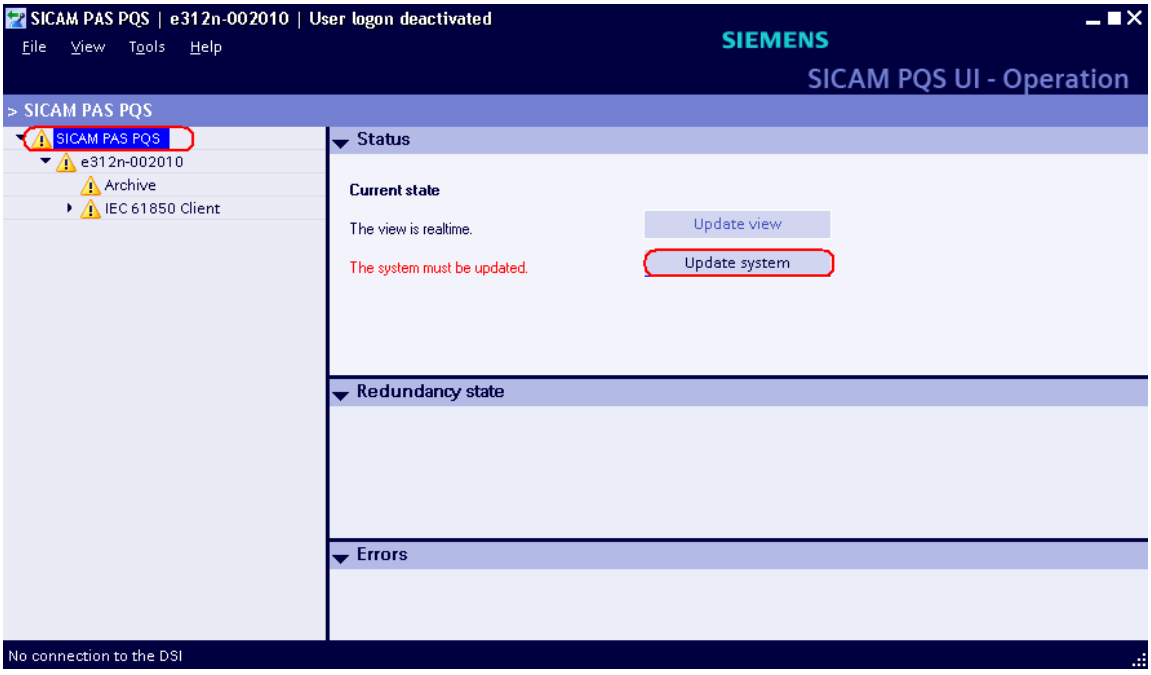


Figure 3-18 Updating the System

NOTE

After the update has been completed successfully, the entries in the navigation window are displayed with a blue icon.

✧ In the navigation window right-click your **Computer name** and subsequently **Start all**.

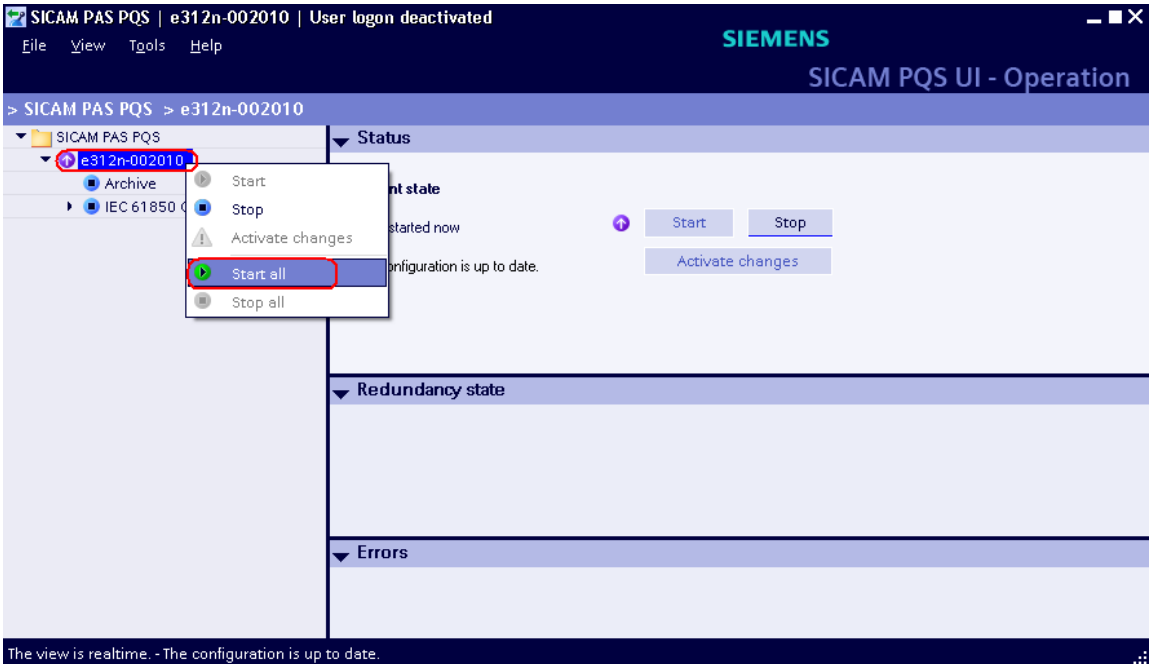


Figure 3-19 Starting the System

The current system status is displayed in the following window.

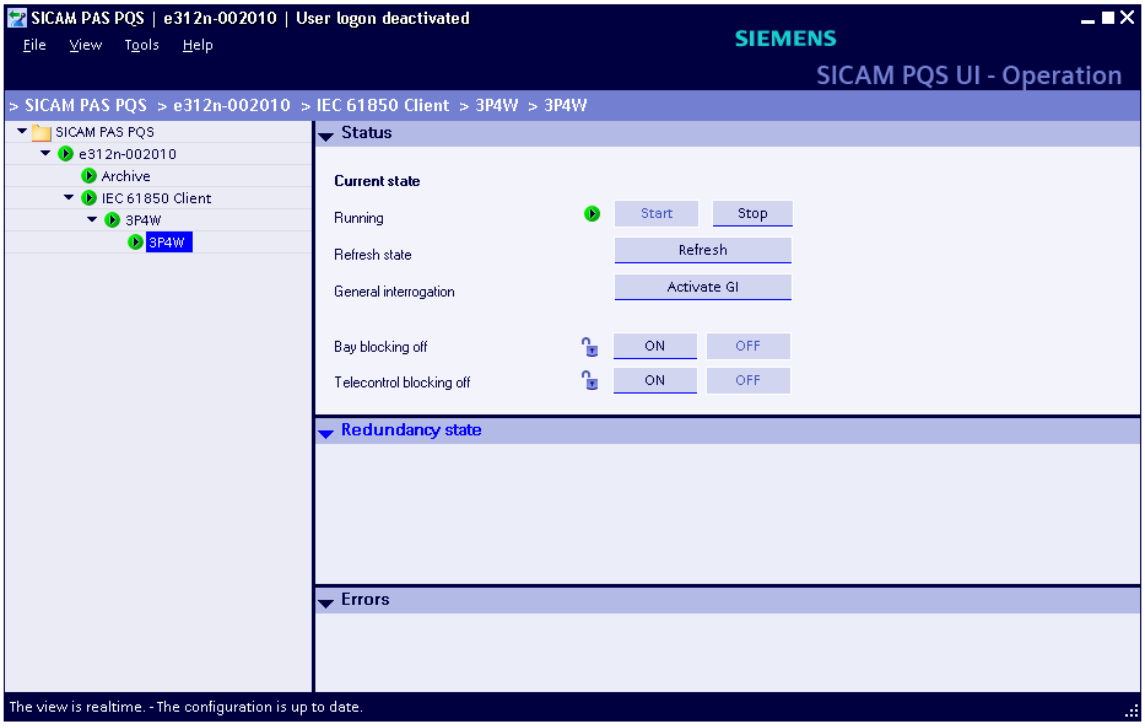


Figure 3-20 Current System Status

3.5 Viewing Measured Values in Value Viewer

✧ Start the **Value Viewer** in **SICAM PQS**.

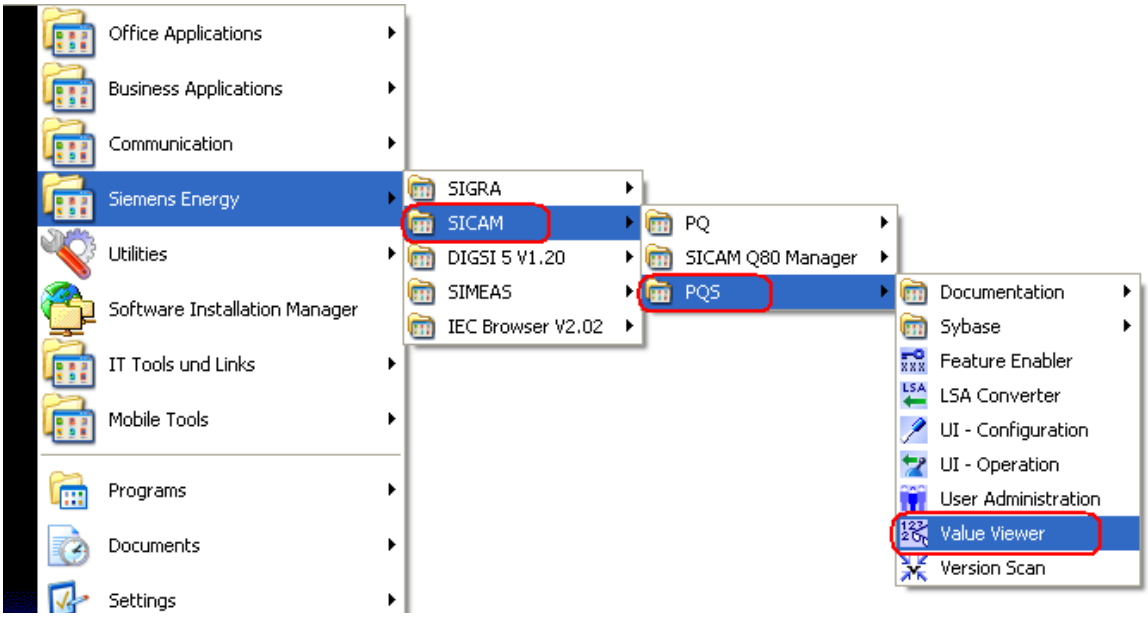


Figure 3-21 Selecting Value Viewer

After starting the **Value Viewer**, the up-to-date measured values are displayed in a table.

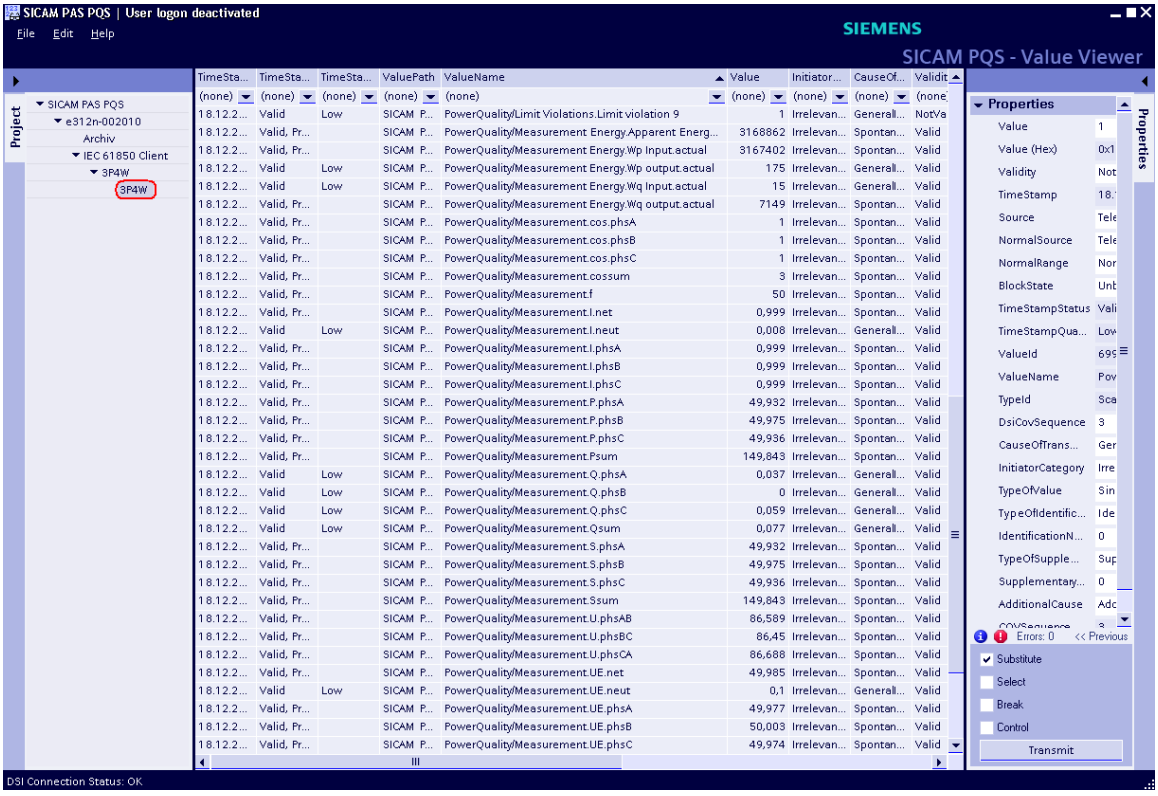


Figure 3-22 Measured Values Display in Value Viewer

3.6 Graphic Display in PQ Analyzer

To display records graphically, you require the PQ Analyzer in **SICAM PQ**.

NOTE

You receive detailed information about the PQ Analyzer in the manual of the PQ Analyzer.

✧ Start the **PQ Analyzer** in **SICAM PQ** as follows:

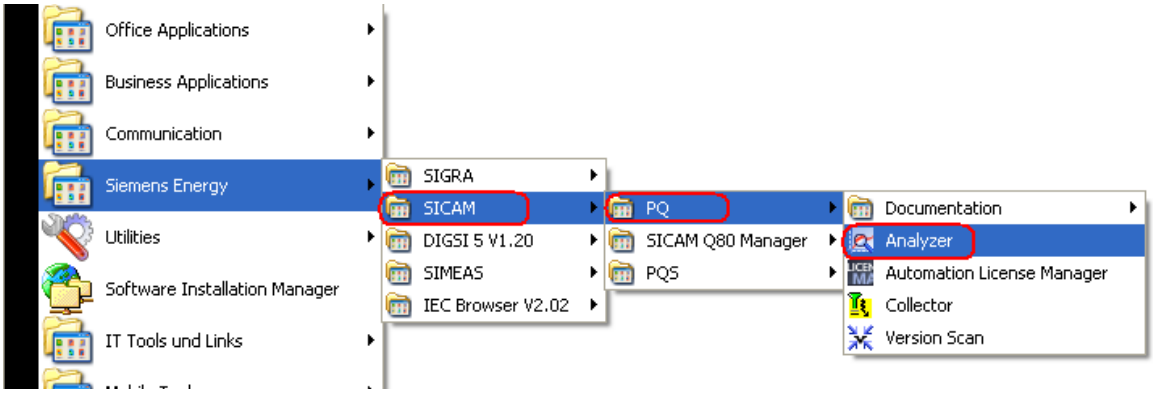


Figure 3-23 Starting PQ Analyzer

Example of Displaying Fault Records

The PQ Analyzer window opens with a list of the COMTRADE data.

✧ Select the fault record you want to display graphically and click **open**.

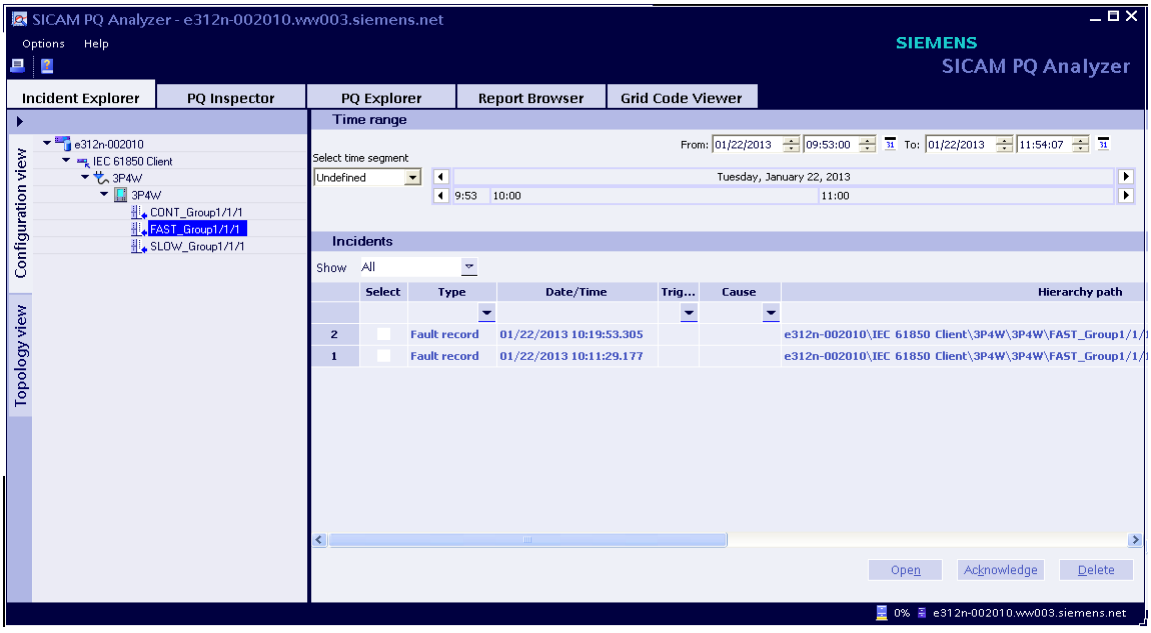


Figure 3-24 Window of the PQ Analyzer

✧ Click **Open**.

The selected fault record is displayed.

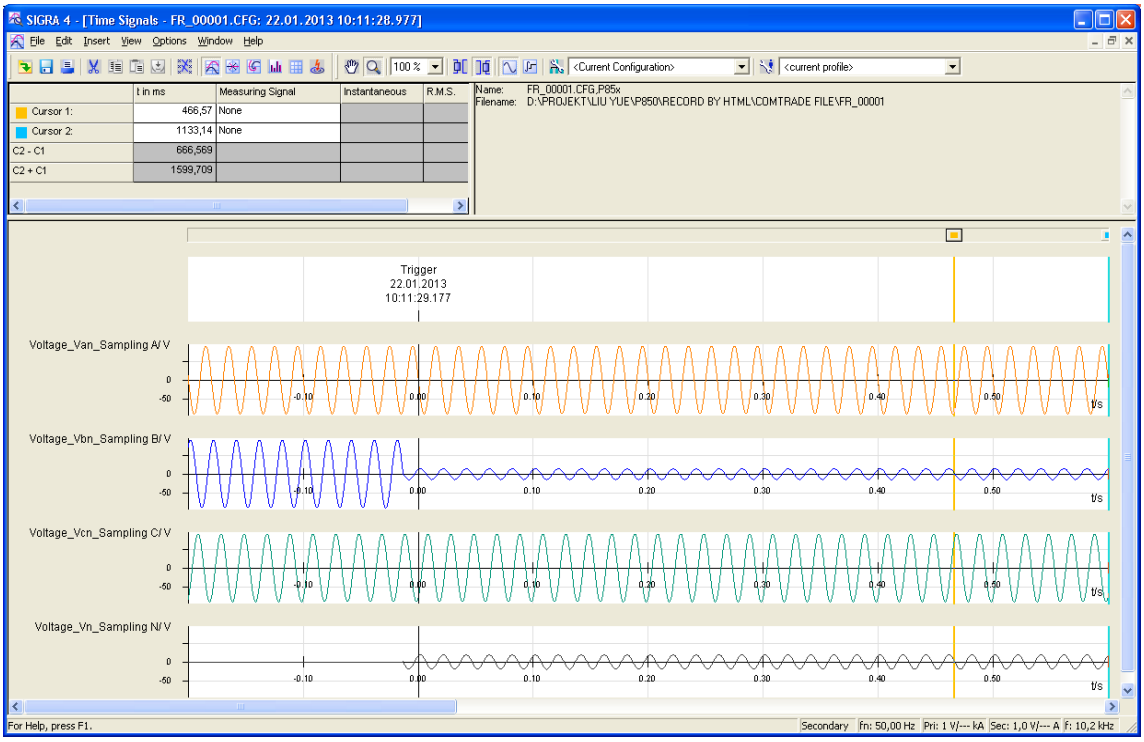


Figure 3-25 Display of a Fault Record

Glossary

A

AC	**A**lternating **C**urrent
ARP	**A**ddress **R**esolution **P**rotocol: Network protocol
ASDU	**A**pplication **S**ervice **D**ata **U**nit

B

Big-Endian format	The most significant byte is stored first, that is at the memory location with the lowest address.
Broadcast message	Message in the network where data packets are transmitted to all devices on the network from one point

C

CDC	**C**ommon **D**ata **C**lass (IEC 61850)
CRC error	**C**yclic **R**edundancy **C**heck: The cyclic redundancy check is a method of determining a test value for data (for example for data transmission in computer networks) with the purpose to detect errors during the transmission or duplication of data.
COMTRADE	COMmon format for TRAnsient Data Exchange

D

DC	**D**irect **C**urrent
DHCP	**D**ynamic **H**ost **C**onfiguration **P**rotocol enables the network configuration to be assigned to the devices by a DHCP server
DST	**D**aylight **S**aving **T**ime

E

Ethernet	Cable-based data network technology for local data networks

F

FW	**F**irm**w**are: Program code for execution in a microcontroller

G

Gateway	Enables networks based on different protocols to communicate with each other

H

Holding register	Area for representing data in Modbus communication

I

ICD file	**I**ED **C**apability **D**escription: Contains the standardized description of the device configuration
IEC	**I**nternational **E**lectrotechnical **C**ommission, standardization body; Communication standard for substations and protection equipment
IEC 60870-5-103	Type of protocol to the data transmission via serial networks (for example RS485)
IEC 61850	Type of protocol to the data transmission via Ethernet
IED	**I**ntelligent **E**lectronic **D**evice
+Inf	Stands for *Infinity* and denotes a counter overflow. Extremely large number or infinitely positive number
IP	**I**nternet **P**rotocol
IP address	Addresses in computer networks based on the Internet protocol

K

KeepAlive	KeepAlive on TCP level is a feature intended to verify the availability and functioning of the communication partner (client) and to maintain a TCP network link if the network is inactive. The server sends KeepAlive messages (TCP packets without data) to the client in regular intervals (KeepAlive time) while the network is inactive, and the client responds to these messages. If the client does not respond to a KeepAlive message, the server assumes that the link is down or the client is inactive and closes the TCP link.

L

LED	**L**ight-**E**mitting **D**iode
Limit violation	A value exceeding or falling under a parameterized limiting value.
LSB	**L**east **S**ignificant **B**it

M

MAC-Address	**M**edia **A**ccess **C**ontrol address: Hardware address that clearly identifies the device on the network.
MBAP	**M**od**b**us **A**pplication **P**rotocol
MBAP Header	Header of a Modbus TCP message consisting of these 4 parts: Transaction identifier (2 bytes), protocol identifier (2 bytes), length (2 bytes), unit identifier (1 byte).
Modbus	The Modbus protocol is a communication protocol based on a client-server architecture.
Modbus RTU	Modbus **R**emote **T**erminal **U**nit: Modbus protocol type for transmitting data over serial networks (for example RS485)

Modbus TCP	Modbus **T**ransmission **C**ontrol **P**rotocol: Modbus protocol type for transmitting data as TCP/IP packets; TCP port 502 is reserved for Modbus TCP.
MSB	**M**ost **S**ignificant **B**it

N

NaN	**N**ot **a** **N**umber means "invalid": Result of an invalid computing operation
NTP	**N**etwork **T**ime **P**rotocol: Standard for synchronizing clocks in computer systems using packet-based communication networks

R

RJ45	Ethernet plug connector
RS485	Interface standard for digital, wire-based, differential, serial data transmission
RTC	**R**eal-**T**ime **C**lock
RTU	See Modbus **R**emote **T**erminal **U**nit

S

Server	Sends data upon request by the client
SNMP	**S**imple **N**etwork **M**anagement **P**rotocol: Serves for monitoring and controlling network elements of a central station
SNTP	**S**imple **N**etwork **T**ime **P**rotocol: Simplified version of the NTP
SW	**S**oft**w**are: Program executed on a computer
STP	**S**hielded **t**wisted-**p**air is the cable for 100Base-T (Ethernet)
Subnet mask	Bit mask in the network protocol that defines how many IP addresses the computer network encompasses. Together with the IP address of a device, the subnet mask defines which IP addresses the device searches in its own network and which IP addresses it tries to reach via routers in other networks.

T

TCP/IP	**T**ransmission **C**ontrol **P**rotocol/**I**nternet **P**rotocol: Family of network protocols

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