SIEMENS

SICAM
Power Monitoring Device and Power Quality Device
SICAM P850/P855 7KG85X Communication

V3.11

Manual

Preface

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E50417-C1040-C482-B1

NOTE

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

Disclaimer of Liability

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Preface

Purpose of the Manual

This manual describes the communication of the SICAM P850/P855 device and the connection to SICAM PQS.

Target Audience

This manual is intended for all engineers configuring, parameterizing, and operating a SICAM P850/P855 device.

Scope

This manual is valid for the Class S Power Quality Instrument and Power Monitoring Device SICAM P850/P855.

Standards

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✧ Comply with all instructions, in order to avoid property damage.



NOTE

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This product includes software developed by the OpenSSL Project for use in OpenSSL Toolkit (*http://www.openssl.org/*).
This product includes software written by Tim Hudson (*tjh@cryptsoft.com*).
This product includes cryptographic software written by Eric Young (*eay@cryptsoft.com*).

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1 User Information

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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 module, an RS485 interface.

Ethernet supports the device parameterization, the transmission of measured data, metered values, load profiles and indications/events, and time synchronization with NTP. Depending on the device model and parameterization, the communication protocols HTTPS, 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 records, and PQDIF by the trend records and measurement records.

1.2 Contents of This System Manual

The system manual covers the following communication options:

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

For the IEC 61850 server, please refer to the following separate manuals:

- SICAM P850/P855 IEC 61850 Logical Nodes and Data Objects
- SICAM P850/P855 PICS, PIXIT, TICS

You can download the manuals at *https://support.industry.siemens.com/cs/search?t=all&search=P85X*.

Additionally, the system manual 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

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2.1 Communication Interfaces

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.

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-Server
- 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:

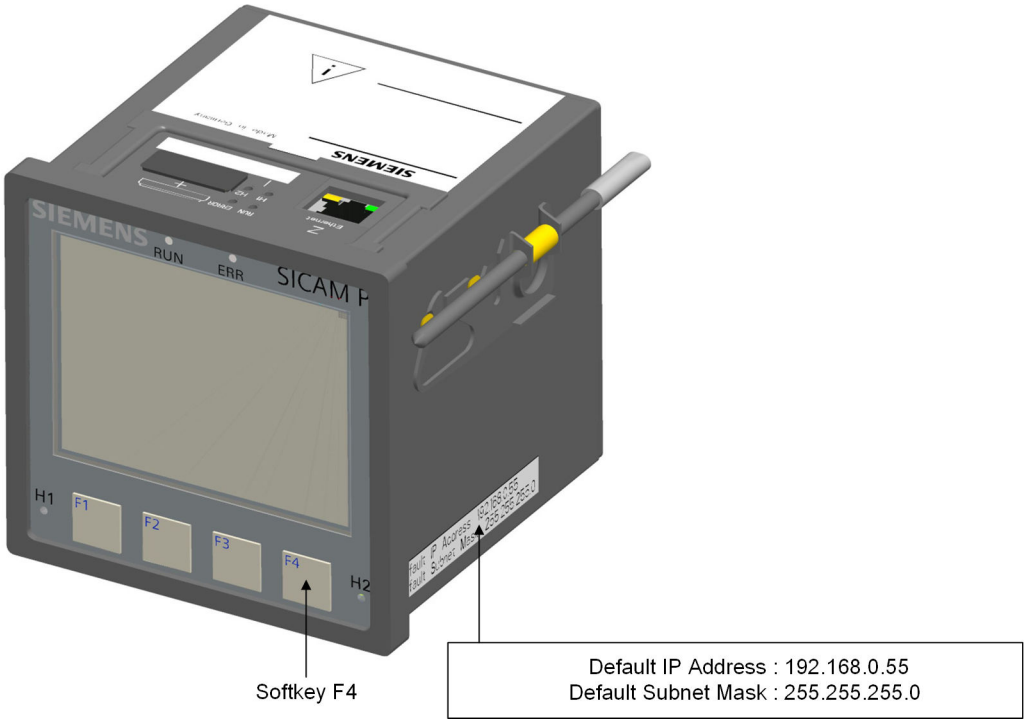
- TCP/IP IPv4
- DHCP client (Dynamic Host Configuration Protocol)
- NTP (Network Time Protocol)
- HTTPS
- SNMPv3 (Simple Network Management Protocol)

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:



[dw_location_key-F4_IP-addr_P85x, 1, en_US]

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 7KG85X). 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) 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

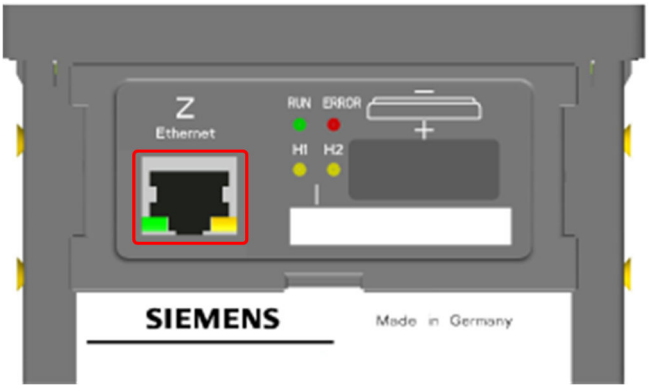
The network configuration can also be obtained from an external server. Using the DHCP protocol, the device is integrated into an already existing network.

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 Description

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.



[le_Q100_3D_oben_ok_03, 2, --_--]

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.

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

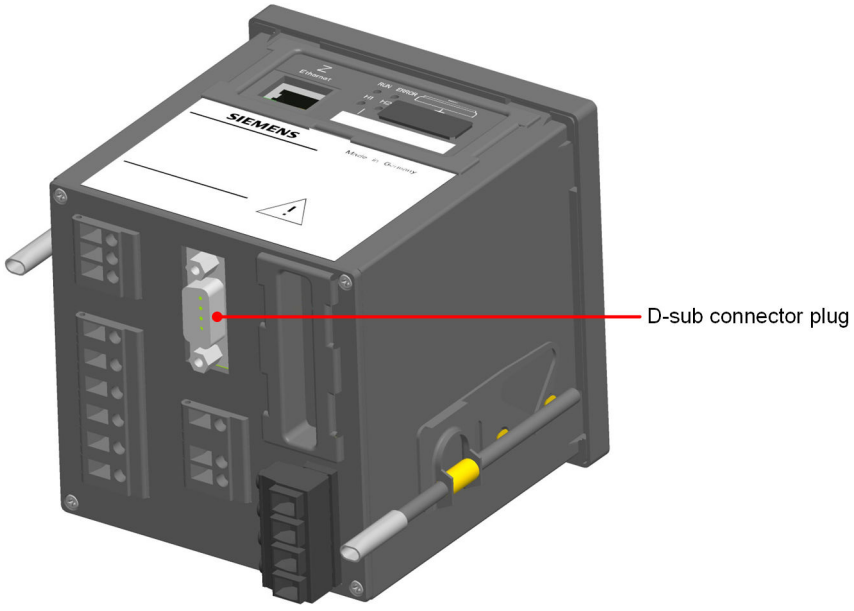
The RS485 interface comes with the following parameters set by the manufacturer:

- 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.

Location of the RS485 Interface on the Device

The RS485 interface is located on the terminal side.



[dw_P85x_behind, 1, en_US]

Figure 2-2 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.

2.2 Modbus

When communicating via Ethernet, the Modbus TCP protocol is used; communication via RS485 relies on the Modbus RTU protocol. The following Modbus specifications with a detailed explanation of the Modbus protocol are provided at *http://www.modbus.org*:

- Modbus over Serial Line
  Specification & Implementation Guide
- Modbus Application Protocol Specification
- Modbus Messaging on TCP/IP Implementation Guide

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

Table 2-1 Supported Modbus TCP Server 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 registers 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 response 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 *2.2.1 Modbus Functions for Modbus TCP Server and Modbus RTU Slave*.

Exception Code 02 – ILLEGAL_DATA_ADDRESS

- An attempt is made to read out or write to a nonexistent Modbus register (see *2.2.7 Data in the Modbus Registers (Data Mapping)*, 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 *2.2.7 Data in the Modbus Registers (Data Mapping)*).

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 Properties and Parameterization of the 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 indication 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):

Table 2-2 Settings for Modbus TCP

Parameter	Default Setting	Setting Range
Standard port number	502	502 Not settable
Access rights	Full	Full Read only
User-defined port 1	no	no yes
Port number[1]	503	503 to 65 535
Access rights[1]	Read only	Full Read only

1 This parameter is available only if **User-defined port 1** is set to **yes**.

Parameter	Default Setting	Setting Range
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

NOTE

The 2 port numbers must be different from each other.

Number of Connections

Up to 4 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

Parameter	Default Setting	Setting Range
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 Numbering of Modbus Registers

2.2.5.1 Modbus Specifications

Generally, we have to differentiate between the following elements in Modbus:

- The register number
- The register address in Modbus messages

Register Number

The register number characterizes a Modbus register using a 5-digit or 6-digit decimal number where the digit with the highest value defines the register type:

- 0 – coil status register
- 1 – input status register
- 3 – input register
- 4 – holding register

Counting of the register number starts at 1 for each register type, for example, for the 5-digit display:

- 00127 = coil status register 127 (alternatively: coil 127)
- 40108 = holding register 108

Register Address

All address data in Modbus messages refer to the value 0. Therefore, register number and register address are related as follows:

- register address = register number - 1

The following applies to the above examples:

- Coil 127 is addressed as 126 ($007E_{hex}$) in a Modbus message to query or describe the coil status register.
- 40108 is addressed as 107 ($006B_{hex}$) in a Modbus message to query or describe the holding register.

2.2.5.2 Mapping Documentation of the SICAM Devices

The Modbus bus mapping documents for the individual SICAM devices use the register number to reference a piece of information in the Modbus register set.

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 indication
- Counter
- String

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):

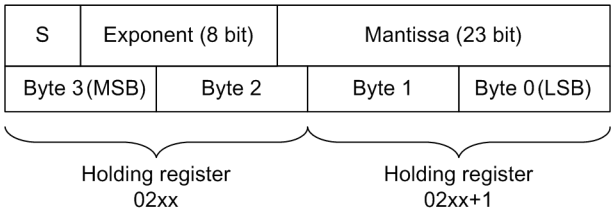
The register with the lowest address contains the most significant byte (MSB), the register with the highest address contains the least significant byte (LSB).

2.2.6.1 Data Type - Measured Value (Read)

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:



[dw_MeasuredValue, 1, en_US]

Figure 2-3 Data Type - Measured Value

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 is 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

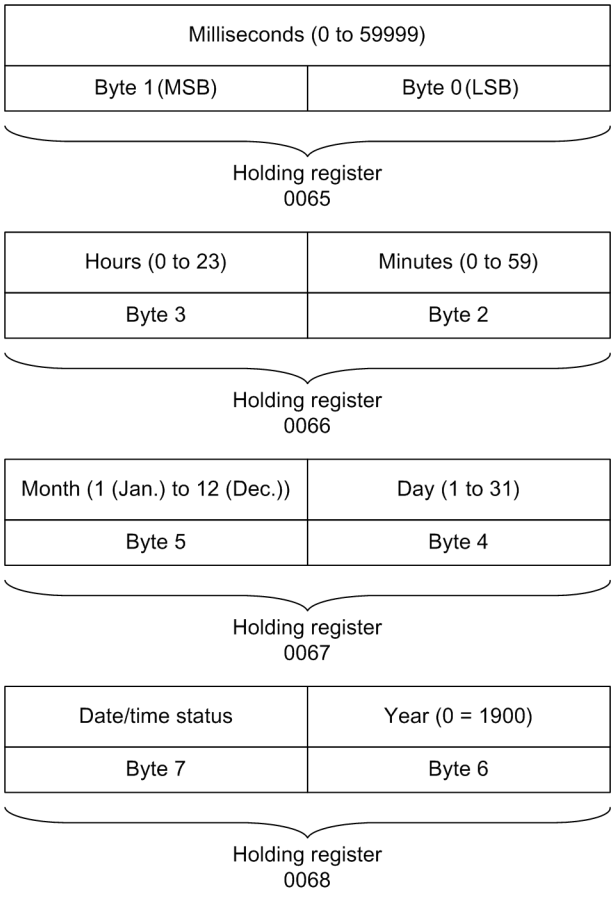
The 32-bit floating-point numbers have a 23-bit mantissa. Integer numbers can be represented in the following ranges without loss of accuracy:

- 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 (Read and Write)

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



[dw_DataTime, 2, en_US]

Figure 2-4 Data Type - Date/Time

Date/Time Status

10H set: Daylight saving time active

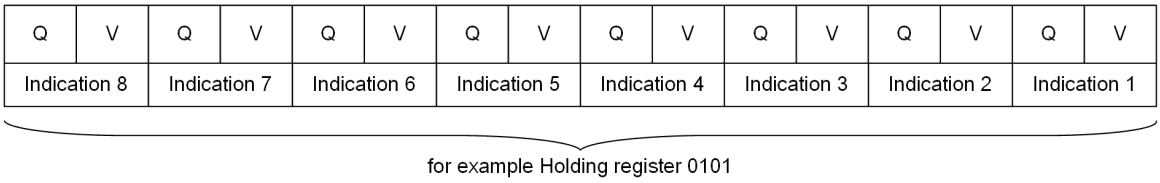
20H set: Date/time error: equivalent to FAIL bit, see Device Manual SICAM P850/P855, Time Synchronization.

NOTE

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

2.2.6.3 Data Type - Indications (Read)

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



[dw_Indications, 2, en_US]

Figure 2-5 Data Type - Indications

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).

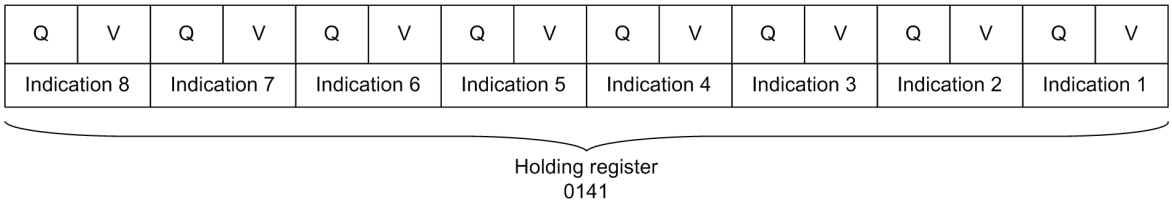
2.2.6.4 Data Type - Controllable Indications (Read and Write)

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



[dw_ControllableIndications_Read, 1, en_US]

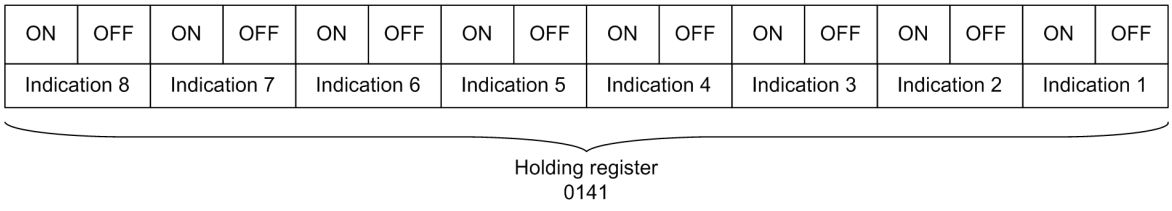
Figure 2-6 Data Type - Controllable Indications - Read Register

Where:

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

See also *2.2.6.3 Data Type - Indications (Read)*.

Use as Write Register



[dw_ControllableIndications_Write, 1, en_US]

Figure 2-7 Data Type - Controllable Indications - 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 (Read)

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 *2.2.6.1 Data Type - Measured Value (Read)*). The primary value is calculated as follows:

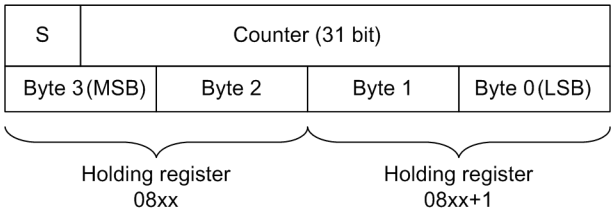
*Primary value = number of counter pulses * energy per counter pulse*

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 *2.2.7.28 Registers 3801 to 3990: Tariff Counters (Read Only)*)

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:



[dw_CounterPulses, 1, en_US]

Figure 2-8 Data Type - Counter - Counter Pulses - Read Register

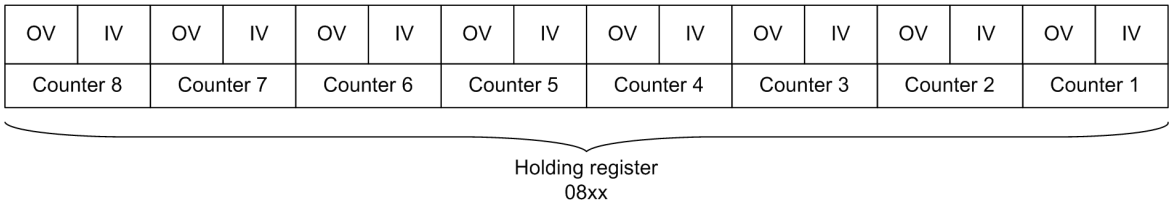
Bit S (Sign)

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.



[dw_CounterQuality, 1, en_US]

Figure 2-9 Data Type - Counter - Quality Information - Read Register

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:

- Registers 0001 to 0048: Device identification (read only)
- Registers 0065 to 0068: Date and time (read and write)
- Registers 0077 to 0088: Version information (read only)
- Registers 0101/0102: Device status indication (read only)
- Registers 0111/0112: Measurand limit violation indications (read only)
- Register 0113: Group indications (read only)
- Register 0114: Power quality events (read only)
- Register 0131: Status of the binary outputs (read only)
- Register 0141: Indications of the communication (read and write)
- Register 0151: Load profiles (write only)
- Register 0152: Load profiles (read only)
- Register 0153: Synchronization of load profile measuring period (read and write)
- Register 0154: Tariffs (read and write)
- Registers 0201 to 0322, and 6401 to 6406: Measured values (read only), without 0281 to 0292
- Registers 0323 to 0358: Flicker (read only)
- Registers 0392 to 0395: Date/Time for last period PQ aggregation (fixed period = 10 s) (read only)
- Registers 0396 to 0399: Date/Time for last period PQ aggregation for frequency (configurable) (read only)
- Registers 0401 to 0510, and 16001 to 16006: PQ aggregation values – average values (read only)
- Registers 0531 to 0640, and 16007 to 16012: PQ aggregation values – minimum values (read only)
- Registers 0651 to 0760, and 16013 to 16018: PQ aggregation values – maximum values (read only)
- Registers 0801 to 0846: Energy counters (read only)
- Registers 1001 to 1280: Harmonics – voltage values (read only)
- Registers 1401 to 1680: Harmonics – current values (read only)
- Registers 1801 to 2080: PQ aggregation for average harmonic voltage values (read only)
- Registers 2201 to 2480: PQ aggregation for max. harmonic voltage values (read only)

- Registers 2601 to 2880: PQ aggregation for average harmonic current values (read only)
- Registers 3001 to 3280: PQ aggregation for max. harmonic current values (read only)
- Registers 3301 to 3756: Tariff float64 values (read only)
- Registers 3801 to 3990: Tariff counters (read only)
- Registers 4761 to 4872: Energy float64 values (read only)
- Registers 4873 to 4984: Energy freeze float64 values (read only)
- Registers 5001 to 5099: Latest 10 dips (read only)
- Registers 5201 to 5299: Latest 10 swells (read only)
- Registers 5401 to 5499: Latest 10 interrupts (read only)
- Registers 5701 to 5797: Latest 10 overfrequency events (read only)
- Registers 5801 to 5897: Latest 10 underfrequency events (read only)
- Registers 5901 to 5997: Latest 10 voltage unbalance events (read only)
- Registers 6001 to 6032: Number of PQ events (read only)
- Registers 6087 to 6100: Load profile – management (read only)
- Registers 6101 to 6158: Load profile – measured values (read only)
- Registers 8601 to 8656: Energy float32 values (read only)
- Registers 8695 to 8756: Energy freeze float32 values (read only)
- Registers 8801 to 8976: Tariff float32 values (read only)

2.2.7.1 Registers 0001 to 0048: Device Identification (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).
Data type: String

Table 2-5 Registers 0001 to 0048: 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 0048	Device serial number (string, max. 16 characters)	Example: BF0704034576

2.2.7.2 Registers 0065 to 0068: Date and Time (Read and Write)

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 Registers 0065 to 0068: Date and Time

Register	Type of Information	Remark
0065	Milliseconds	see *2.2.6.2 Data Type - Date/Time (Read and Write)*
0066	Hours/minutes	
0067	Month/day	
0068	Time status/year	

2.2.7.3 Registers 0077 to 0088: Version Information (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: String

Table 2-7 Registers 0077 to 0088: Version Information

Register	Type of Information	Remark
0077 to 0082	Firmware version (string, max. 12 characters)	Example: V03.10.01
0083 to 0088	Parameter set version (string, max. 12 characters)	Example: V03.10.01

2.2.7.4 Registers 0101 and 0102: Device Status Indication (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: Indication

Table 2-8 Registers 0101 and 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, Operational Indications)
$0101/2^6$	Reserved	= 0
$0101/2^8$	Settings Load	1 = Parameter load is in progress
$0101/2^{10}$	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

2.2.7.5 Registers 0111 and 0112: Measurand Limit Violation Indications (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: Indication

Table 2-9 Registers 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.
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	
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.
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 (Read Only)

This register is write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

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 Events (Read Only)

This register is write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: Indication

Table 2-11 Register 0114: Power Quality Events

Register	Type of Information	Remark
0114/2^0	PQ Volt event	1 = Voltage event exists 0 = Voltage event does not exist
0114/2^2	PQ Freq event	1 = Frequency event exists 0 = Frequency event does not exist

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

NOTE

If a voltage, frequency, or voltage unbalance event happened and ended, the relevant bit of this register will be set to "1" and will be kept until it is reset by using relevant bits in register 141.

2.2.7.8 Register 0131: Status of the Binary Outputs (Read Only)

This register is write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

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 (Read and Write)

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 voltage events, such as dips, swells, and interrupts
0141/2^{10}	Reset PQ Frequency Event	0 → 1: Resets frequency events, such as overfrequency and underfrequency events
0141/2^{12}	Reset PQ VoltUnbal Event	0 → 1: Resets voltage unbalance events
0141/2^{14}	Reset Energy	0 → 1: Resets the energy counters

2.2.7.10 Register 0151: Load Profiles (Write Only)

Data type: Control

Table 2-14 Register 0151: Load Profiles

Register	Type of Information	Remark
0151/2^0	Reset load profile recording	Send binary value "10" to reset the load profile recording.
0151/2^2 to 0151/2^{14}	Reserved	= 0

2.2.7.11 Register 0152: Load Profiles (Read Only)

Data type: Indication

Table 2-15 Register 0152: Load Profiles

Register	Type of Information	Remark
0152/2^0	Sync missing	Synchronization of the periods missing
0152/2^2	Resynchronized	-
0152/2^4	Load Profile Period Closed	Indication for closing a subperiod/measuring period
0152/2^6 to 0152/2^{14}	Reserved	= 0

2.2.7.12 Register 0153: Synchronization of Load Profile Measuring Period (Read and Write)

Data type: Controllable indications

Table 2-16 Register 0153: Synchronization of Load Profile Measuring Period

Register	Type of Information	Remark
0153	Synchronization of load profile measuring period	With writing to this register a resynchronization of the load profile measuring period is executed. The value in the register must equal the parameterized value. Otherwise, an error message is generated.

2.2.7.13 Register 0154: Tariffs (Read and Write)

Data type: Controllable indications

Table 2-17 Register 0154: Tariffs

Register	Type of Information	Remark
0154	Write: the tariff valid from the next measuring period on Read: currently valid tariff	Value corresponds to tariff 1 through 8.

2.2.7.14 Registers 0201 to 0322, and 6401 to 6406: Measured Values (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).
Data type: Measured value

Table 2-18 Registers 0201 to 0322, and 6401 to 6406: 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
0219	Vbc	Voltage b-c	V
0221	Vca	Voltage c-a	V

Register	Type of Information	Remark	Unit
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)
0271	φc	Phase angle c	° (degree)
0273	φ	Phase angle	° (degree)
0275	f	Power frequency	Hz
0277	Vunbal	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)	Voltage a THDS	%
0297	THDS (Vb)	Voltage b THDS	%
0299	THDS (Vc)	Voltage c 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)

Register	Type of Information	Remark	Unit
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
6401	THDS (Vab)	Voltage ab THDS	%
6403	THDS (Vbc)	Voltage bc THDS	%
6405	THDS (Vca)	Voltage ca THDS	%

2.2.7.15 Registers 0323 to 0358: Flicker (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: Measured value

Table 2-19 Registers 0323 to 0358: 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



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, section “Measurands Depending on the Connection Type”.

2.2.7.16 Registers 0392 to 0399: Date/Time for Last Period PQ Aggregation (Read Only)

NOTE

These registers are only valid in SICAM P855.

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Registers 0392 to 0395: Date/Time for Last Period PQ Aggregation

Data type: Date/time

Table 2-20 Registers 0392 to 0395: Date/Time for Last Period PQ Aggregation

Register	Type of Information	Remark
0392	Milliseconds	see *2.2.6.2 Data Type - Date/Time (Read and Write)*
0393	Hours/minutes	
0394	Month/day	
0395	Time status/year	

Registers 0396 to 0399: Date/Time for Last Period PQ Aggregation for Frequency

Date type: Date/time

Table 2-21 Registers 0396 to 0399: Date/Time for Last Period PQ Aggregation for Frequency

Register	Type of Information	Remark
0396	Milliseconds	see *2.2.6.2 Data Type - Date/Time (Read and Write)*
0397	Hours/minutes	
0398	Month/day	
0399	Time status/year	

2.2.7.17 Registers 0401 to 0510, and 16001 to 16006: PQ Aggregation Values – Average Values (Read Only)

NOTE

These registers are only valid in SICAM P855.

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).
The data are calculated within the parameterized time (for example 1 min, 10 min, etc.).
Data type: Measured value

Table 2-22 Registers 0401 to 0510, and 16001 to 16006: PQ Aggregation 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

Register	Type of Information	Remark	Unit
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
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)	Voltage a THDS	-
0485	PQ_THDS (Vb)	Voltage b THDS	-
0487	PQ_THDS (Vc)	Voltage c THDS	-
0489	PQ_THDS (Ia)	Current a THDS	-
0491	PQ_THDS (Ib)	Current b THDS	-
0493	PQ_THDS (Ic)	Current c THDS	-
0495	PQ_Voltage (φ12)	Angle Vab-Vbc	° (degree)

Register	Type of Information	Remark	Unit
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
16001	PQ_THDS (Vab)	Voltage ab THDS	%
16003	PQ_THDS (Vbc)	Voltage bc THDS	%
16005	PQ_THDS (Vca)	Voltage ca THDS	%

2.2.7.18 Registers 0531 to 0640, and 16007 to 16012: PQ Aggregation Values – Minimum Values (Read Only)



NOTE

These registers are only valid in SICAM P855.

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

The data are calculated within the parameterized time (for example 1 min, 10 min, etc.).

Data type: Measured value

Table 2-23 Registers 0531 to 0640, and 16007 to 16012: PQ Aggregation 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

Register	Type of Information	Remark	Unit
0573	PQ_Sa_min	Apparent power a	VA
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)_min	Voltage a THDS	-
0615	PQ_THDS (Vb)_min	Voltage b THDS	-
0617	PQ_THDS (Vc)_min	Voltage c 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	-
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
16007	PQ_THDS (Vab)_min	Voltage ab THDS	%
16009	PQ_THDS (Vbc)_min	Voltage bc THDS	%
16011	PQ_THDS (Vca)_min	Voltage ca THDS	%

2.2.7.19 Registers 0651 to 0760, and 16013 to 16018: PQ Aggregation Values – Maximum Values (Read Only)



NOTE

These registers are only valid in SICAM P855.

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

The data are calculated within the parameterized time (for example 1 min, 10 min, etc.).

Data type: Measured value

Table 2-24 Registers 0651 to 0760, and 16013 to 16018: PQ Aggregation 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
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)

Register	Type of Information	Remark	Unit
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)_max	Voltage a THDS	-
0735	PQ_THDS (Vb)_max	Voltage b THDS	-
0737	PQ_THDS (Vc)_max	Voltage c 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	-
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
16013	PQ_THDS (Vab)_max	Voltage ab THDS	%
16015	PQ_THDS (Vbc)_max	Voltage bc THDS	%
16017	PQ_THDS (Vca)_max	Voltage ca THDS	%

2.2.7.20 Registers 0801 to 0846: Energy Counters (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Registers 0801 to 0802: Energy per Counter Pulse

Data type: Measured value

Table 2-25 Registers 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	Energy_Counters_Status_1	Status of counters WPa_imp	-
0803/2^2	Energy_Counters_Status_2	Status of counters WPb_imp	-
0803/2^4	Energy_Counters_Status_3	Status of counters WPc_imp	-
0803/2^6	Energy_Counters_Status_4	Status of counters WP_imp	-
0803/2^8	Energy_Counters_Status_5	Status of counters WPa_exp	-
0803/2^{10}	Energy_Counters_Status_6	Status of counters WPb_exp	-
0803/2^{12}	Energy_Counters_Status_7	Status of counters WPc_exp	-
0803/2^{14}	Energy_Counters_Status_8	Status of counters WP_exp	-
0804/2^0	Energy_Counters_Status_9	Status of counters WQa_ind	-
0804/2^2	Energy_Counters_Status_10	Status of counters WQb_ind	-
0804/2^4	Energy_Counters_Status_11	Status of counters WQc_ind	-
0804/2^6	Energy_Counters_Status_12	Status of counters WQ_ind	-
0804/2^8	Energy_Counters_Status_13	Status of counters WQa_cap	-
0804/2^{10}	Energy_Counters_Status_14	Status of counters WQb_cap	-
0804/2^{12}	Energy_Counters_Status_15	Status of counters WQc_cap	-
0804/2^{14}	Energy_Counters_Status_16	Status of counters WQ_cap	-
0805/2^0	Energy_Counters_Status_17	Status of counters WSa	-
0805/2^2	Energy_Counters_Status_18	Status of counters WSb	-
0805/2^4	Energy_Counters_Status_19	Status of counters WSc	-
0805/2^6	Energy_Counters_Status_20	Status of counters WS	-
0805/2^8 to 0805/2^{14}	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_imp	Active energy, import, Phase A	Pulse
0809	WPb_imp	Active energy, import, Phase B	Pulse
0811	WPc_imp	Active energy, import, Phase C	Pulse
0813	WP_imp	Active energy, import	Pulse
0815	WPa_exp	Active energy, export, Phase A	Pulse
0817	WPb_exp	Active energy, export, Phase B	Pulse

Register	Type of Information	Remark	Unit
0819	WPc_exp	Active energy, export, Phase C	Pulse
0821	WP_exp	Active energy, export	Pulse
0823	WQa_ind	Reactive energy, inductive, Phase A	Pulse
0825	WQb_ind	Reactive energy, inductive, Phase B	Pulse
0827	WQc_ind	Reactive energy, inductive, Phase C	Pulse
0829	WQ_ind	Reactive energy, inductive	Pulse
0831	WQa_cap	Reactive energy, capacitive, Phase A	Pulse
0833	WQb_cap	Reactive energy, capacitive, Phase B	Pulse
0835	WQc_cap	Reactive energy, capacitive, Phase C	Pulse
0837	WQ_cap	Reactive energy, capacitive	Pulse
0839	WSa	Apparent energy, Phase A	Pulse
0841	WSb	Apparent energy, Phase B	Pulse
0843	WSc	Apparent energy, Phase C	Pulse
0845	WS	Apparent energy	Pulse

2.2.7.21 Registers 1001 to 1280: Harmonics – Voltage Values (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

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

Network types: Harmonic ph-n is available if 4-wire is used, and harmonic ph-ph is available if 3-wire 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	Harmonic, voltage value, a-N, ab (fundamental)	V
1003 to 1080	H_Va-x/H_Vab-x (x = 2 to 40)	Harmonic, voltage value, a-N, ab (2 bytes for each register)	V/%
1101	H_Vb-1/H_Vbc-1	Harmonic, voltage value, b-N, bc (fundamental)	V
1103 to 1180	H_Vb-x/H_Vbc-x (x = 2 to 40)	Harmonic, voltage value, b-N, bc (2 bytes for each register)	V/%
1201	H_Vc-1/H_Vca-1	Harmonic, voltage value, c-N, ca (fundamental)	V
1203 to 1280	H_Vc-x/H_Vca-x (x = 2 to 40)	Harmonic, voltage value, c-N, ca (2 bytes for each register)	V/%

2.2.7.22 Registers 1401 to 1680: Harmonics – Current Values (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

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	Harmonic, current value, a-N (Fundamental)	A
1403 to 1480	H_Ia-x (x = 2 to 40)	Harmonic, current value, a-N (2 bytes for each register)	A
1501	H_Ib-1	Harmonic, current value, b-N (Fundamental)	A
1503 to 1580	H_Ib-x (x = 2 to 40)	Harmonic, current value, b-N (2 bytes for each register)	A
1601	H_Ic-1	Harmonic, current value, c-N (Fundamental)	A
1603 to 1680	H_Ic-x (x = 2 to 40)	Harmonic, current value, c-N (2 bytes for each register)	A

2.2.7.23 Registers 1801 to 2080: PQ Aggregation for Harmonics (Average Values) – Voltage Values (Read Only)

NOTE

These registers are only valid in SICAM P855.

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

The data are calculated within the parameterized time (for example 1 min, 10 min, etc.).

Network types: Harmonic ph-n is available if 4-wire is used, and harmonic ph-ph is available if 3-wire is used.

Data type: Measured value

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

Register	Type of Information	Remark	Unit
1801	H_Va/Vab-1_AVG	Harmonic (average value), voltage value, a-N, ab (Fundamental)	V
1803 to 1880	H_Va/Vab-x_AVG (x = 2 to 40)	Harmonic (average value), voltage value, a-N, ab (2 bytes for each register)	V/%
1901	H_Vb/Vbc-1_AVG	Harmonic (average value), voltage value, b-N, bc (Fundamental)	V
1903 to 1980	H_Vb/Vbc-x_AVG (x = 2 to 40)	Harmonic (average value), voltage value, b-N, bc (2 bytes for each register)	V/%
2001	H_Vc/Vca-1_AVG	Harmonic (average value), voltage value, c-N, ca (Fundamental)	V
2003 to 2080	H_Vc/Vca-x_AVG (x = 2 to 40)	Harmonic (average value), voltage value, c-N, ca (2 bytes for each register)	V/%

2.2.7.24 Registers 2201 to 2480: PQ Aggregation for Harmonics (Maximum Values) – Voltage Values (Read Only)

NOTE

These registers are only valid in SICAM P855.

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).
The data are calculated within the parameterized time (for example 1 min, 10 min, etc.).
Data type: Measured value

Table 2-31 Registers 2201 to 2498: PQ Aggregation for Harmonics (Maximum Values) – Voltage Values

Register	Type of Information	Remark	Unit
2201	H_Va/Vab-1_MAX	Harmonic (maximum value), voltage value, a-N, ab (Fundamental)	V
2203 to 2280	H_Va/Vab-x_MAX (x = 2 to 40)	Harmonic (maximum value), voltage value, a-N, ab (2 bytes for each register)	V/%
2301	H_Vb/Vbc-1_MAX	Harmonic (maximum value), voltage value, b-N, bc (Fundamental)	V
2303 to 2380	H_Vb/Vbc-x_MAX (x = 2 to 40)	Harmonic (maximum value), voltage value, b-N, bc (2 bytes for each register)	V/%
2401	H_Vc/Vca-1_MAX	Harmonic (maximum value), voltage value, c-N, ca (Fundamental)	V
2403 to 2480	H_Vc/Vca-x_MAX (x = 2 to 40)	Harmonic (maximum value), voltage value, c-N, ca (2 bytes for each register)	V/%

2.2.7.25 Registers 2601 to 2880: PQ Aggregration for Harmonics (Average Values) – Current Values (Read Only)

NOTE

These registers are only valid in SICAM P855.

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).
The data are calculated within the parameterized time (for example 1 min, 10 min, etc.).
Data type: Measured value

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

Register	Type of Information	Remark	Unit
2601	H_Ia-1_AVG	Harmonic (average value), current value, a-N (Fundamental)	A
2603 to 2680	H_Ia-x_AVG (x = 2 to 40)	Harmonic (average value), current value, a-N (2 bytes for each register)	A
2701	H_Ib-1_AVG	Harmonic (average value), current value, b-N (Fundamental)	A
2703 to 2780	H_Ib-x_AVG (x = 2 to 40)	Harmonic (average value), current value, b-N (2 bytes for each register)	A
2801	H_Ic-1_AVG	Harmonic (average value), current value, c-N (Fundamental)	A
2803 to 2880	H_Ic-x_AVG (x = 2 to 40)	Harmonic (average value), current value, c-N (2 bytes for each register)	A

2.2.7.26 Registers 3001 to 3280: PQ Aggregation for Harmonics (Maximum Values) – Current Values (Read Only)

NOTE

These registers are only valid in SICAM P855.

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

The data are calculated within the parameterized time (for example 1 min, 10 min, etc.).

Data type: Measured value

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

Register	Type of Information	Remark	Unit
3001	H_Ia-1_MAX	Harmonic (maximum value), current value, a-N (Fundamental)	A
3003 to 3080	H_Ia-x_MAX (x = 2 to 40)	Harmonic (maximum value), current value, a-N (2 bytes for each register)	A
3101	H_Ib-1_MAX	Harmonic (maximum value), current value, b-N (Fundamental)	A
3103 to 3180	H_Ib-x_MAX (x = 2 to 40)	Harmonic (maximum value), current value, b-N (2 bytes for each register)	A
3201	H_Ic-1_MAX	Harmonic (maximum value), current value, c-N (Fundamental)	A
3203 to 3280	H_Ic-x_MAX (x = 2 to 40)	Harmonic (maximum value), current value, c-N (2 bytes for each register)	A

2.2.7.27 Registers 3301 to 3756: Tariff Float64 Values (Read Only)

Data type: Measured value (64-bit floating-point format)

The following table shows the general information (3301 to 3304) and values for tariff 1 (3405 to 3448). The values of the other 7 tariffs (3449 to 3756) are in the same structure.

Table 2-34 Registers 3301 to 3448: Float64 Values of Tariff 1

Register	Type of Information	Remark	Unit
3301	Milliseconds	see *2.2.6.2 Data Type - Date/Time (Read and Write)*	-
3302	Hours/minutes		-
3303	Month/day		-
3304	Time status/year		-
3405	WP_exp_tariff_value_1	Active energy, export, float64 values, tariff 1	Wh
3409	WP_imp_tariff_value_1	Active energy, import, float64 values, tariff 1	Wh
3413	WQ_ind_imp_tariff_value_1	Reactive energy, inductive, import, float64 values, tariff 1	varh
3417	WQ_cap_exp_tariff_value_1	Reactive energy, capacitive, export, float64 values, tariff 1	varh
3421	WQ_ind_exp_tariff_value_1	Reactive energy, inductive, export, float64 values, tariff 1	varh
3425	WQ_cap_imp_tariff_value_1	Reactive energy, capacitive, import, float64 values, tariff 1	varh
3429	WQ_ind_tariff_value_1	Reactive energy, inductive, float64 values, tariff 1	varh
3433	WQ_cap_tariff_value_1	Reactive energy, capacitive, float64 values, tariff 1	varh

Register	Type of Information	Remark	Unit
3437	WQ_imp_tariff_value_1	Reactive energy, import, float64 values, tariff 1	varh
3441	WQ_exp_tariff_value_1	Reactive energy, export, float64 values, tariff 1	varh
3445	WS_tariff_value_1	Apparent energy, float64 values, tariff 1	VAh

2.2.7.28 Registers 3801 to 3990: Tariff Counters (Read Only)

Data type: Indication, 2 bits each with 0 = OK, 1 = invalid, 2 = overflow

Table 2-35 Registers 3801 to 3990: Tariff Counters

Register	Value	Type of Information	Remark
3801		CntPuQty	Tariff counter pulse quantity conversion factor
3803	2^0	WP_IMP_TARIFF_1	Status of active energy, import, tariff 1
	2^2	WP_EXP_TARIFF_1	Status of active energy, export, tariff 1
	2^4	WQ_IMP_TARIFF_1	Status of reactive energy, import, tariff 1
	2^6	WQ_EXP_TARIFF_1	Status of reactive energy, export, tariff 1
	2^8	WQ_IND_TARIFF_1	Status of reactive energy, inductive, tariff 1
	2^{10}	WQ_CAP_TARIFF_1	Status of reactive energy, capacitive, tariff 1
	2^{12}	WQ_IND_IMP_TARIFF_1	Status of reactive energy, inductive, import, tariff 1
	2^{14}	WQ_CAP_IMP_TARIFF_1	Status of reactive energy, capacitive, import, tariff 1
3804	2^0	WQ_IND_EXP_TARIFF_1	Status of reactive energy, inductive, export, tariff 1
	2^2	WQ_CAP_EXP_TARIFF_1	Status of reactive energy, capacitive, export, tariff 1
	2^4	WS_TARIFF_1	Status of apparent energy, tariff 1
	2^6	WP_IMP_TARIFF_2	Status of active energy, import, tariff 2
	2^8	WP_EXP_TARIFF_2	Status of active energy, export, tariff 2
	2^{10}	WQ_IMP_TARIFF_2	Status of reactive energy, import, tariff 2
	2^{12}	WQ_EXP_TARIFF_2	Status of reactive energy, export, tariff 2
	2^{14}	WQ_IND_TARIFF_2	Status of reactive energy, inductive, tariff 2
3805	2^0	WQ_CAP_TARIFF_2	Status of reactive energy, capacitive, tariff 2
	2^2	WQ_IND_IMP_TARIFF_2	Status of reactive energy, inductive, import, tariff 2
	2^4	WQ_CAP_IMP_TARIFF_2	Status of reactive energy, capacitive, import, tariff 2
	2^6	WQ_IND_EXP_TARIFF_2	Status of reactive energy, inductive, export, tariff 2
	2^8	WQ_CAP_EXP_TARIFF_2	Status of reactive energy, capacitive, export, tariff 2
	2^{10}	WS_TARIFF_2	Status of apparent energy, tariff 2
	2^{12}	WP_IMP_TARIFF_3	Status of active energy, import, tariff 3
	2^{14}	WP_EXP_TARIFF_3	Status of active energy, export, tariff 3
3806	2^0	WQ_IMP_TARIFF_3	Status of reactive energy, import, tariff 3
	2^2	WQ_EXP_TARIFF_3	Status of reactive energy, export, tariff 3
	2^4	WQ_IND_TARIFF_3	Status of reactive energy, inductive, tariff 3
	2^6	WQ_CAP_TARIFF_3	Status of reactive energy, capacitive, tariff 3
	2^8	WQ_IND_IMP_TARIFF_3	Status of reactive energy, inductive, import, tariff 3
	2^{10}	WQ_CAP_IMP_TARIFF_3	Status of reactive energy, capacitive, import, tariff 3
	2^{12}	WQ_IND_EXP_TARIFF_3	Status of reactive energy, inductive, export, tariff 3
	2^{14}	WQ_CAP_EXP_TARIFF_3	Status of reactive energy, capacitive, export, tariff 3

Register	Value	Type of Information	Remark
3807	2^0	WS_TARIFF_3	Status of apparent energy, tariff 3
	2^2	WP_IMP_TARIFF_4	Status of active energy, import, tariff 4
	2^4	WP_EXP_TARIFF_4	Status of active energy, export, tariff 4
	2^6	WQ_IMP_TARIFF_4	Status of reactive energy, import, tariff 4
	2^8	WQ_EXP_TARIFF_4	Status of reactive energy, export, tariff 4
	2^{10}	WQ_IND_TARIFF_4	Status of reactive energy, inductive, tariff 4
	2^{12}	WQ_CAP_TARIFF_4	Status of reactive energy, capacitive, tariff 4
	2^{14}	WQ_IND_IMP_TARIFF_4	Status of reactive energy, inductive, import, tariff 4
3808	2^0	WQ_CAP_IMP_TARIFF_4	Status of reactive energy, capacitive, import, tariff 4
	2^2	WQ_IND_EXP_TARIFF_4	Status of reactive energy, inductive, export, tariff 4
	2^4	WQ_CAP_EXP_TARIFF_4	Status of reactive energy, capacitive, export, tariff 4
	2^6	WS_TARIFF_4	Status of apparent energy, tariff 4
	2^8	WP_IMP_TARIFF_5	Status of active energy, import, tariff 5
	2^{10}	WP_EXP_TARIFF_5	Status of active energy, export, tariff 5
	2^{12}	WQ_IMP_TARIFF_5	Status of reactive energy, import, tariff 5
	2^{14}	WQ_EXP_TARIFF_5	Status of reactive energy, export, tariff 5
3809	2^0	WQ_IND_TARIFF_5	Status of reactive energy, inductive, tariff 5
	2^2	WQ_CAP_TARIFF_5	Status of reactive energy, capacitive, tariff 5
	2^4	WQ_IND_IMP_TARIFF_5	Status of reactive energy, inductive, import, tariff 5
	2^6	WQ_CAP_IMP_TARIFF_5	Status of reactive energy, capacitive, import, tariff 5
	2^8	WQ_IND_EXP_TARIFF_5	Status of reactive energy, inductive, export, tariff 5
	2^{10}	WQ_CAP_EXP_TARIFF_5	Status of reactive energy, capacitive, export, tariff 5
	2^{12}	WS_TARIFF_5	Status of apparent energy, tariff 5
	2^{14}	WP_IMP_TARIFF_6	Status of active energy, import, tariff 6
3810	2^0	WP_EXP_TARIFF_6	Status of active energy, export, tariff 6
	2^2	WQ_IMP_TARIFF_6	Status of reactive energy, import, tariff 6
	2^4	WQ_EXP_TARIFF_6	Status of reactive energy, export, tariff 6
	2^6	WQ_IND_TARIFF_6	Status of reactive energy, inductive, tariff 6
	2^8	WQ_CAP_TARIFF_6	Status of reactive energy, capacitive, tariff 6
	2^{10}	WQ_IND_IMP_TARIFF_6	Status of reactive energy, inductive, import, tariff 6
	2^{12}	WQ_CAP_IMP_TARIFF_6	Status of reactive energy, capacitive, import, tariff 6
	2^{14}	WQ_IND_EXP_TARIFF_6	Status of reactive energy, inductive, export, tariff 6
3811	2^0	WQ_CAP_EXP_TARIFF_6	Status of reactive energy, capacitive, export, tariff 6
	2^2	WS_TARIFF_6	Status of apparent energy, tariff 6
	2^4	WP_IMP_TARIFF_7	Status of active energy, import, tariff 7
	2^6	WP_EXP_TARIFF_7	Status of active energy, export, tariff 7
	2^8	WQ_IMP_TARIFF_7	Status of reactive energy, import, tariff 7
	2^{10}	WQ_EXP_TARIFF_7	Status of reactive energy, export, tariff 7
	2^{12}	WQ_IND_TARIFF_7	Status of reactive energy, inductive, tariff 7
	2^{14}	WQ_CAP_TARIFF_7	Status of reactive energy, capacitive, tariff 7

Register	Value	Type of Information	Remark
3812	2^0	WQ_IND_IMP_TARIFF_7	Status of reactive energy, inductive, import, tariff 7
	2^2	WQ_CAP_IMP_TARIFF_7	Status of reactive energy, capacitive, import, tariff 7
	2^4	WQ_IND_EXP_TARIFF_7	Status of reactive energy, inductive, export, tariff 7
	2^6	WQ_CAP_EXP_TARIFF_7	Status of reactive energy, capacitive, export, tariff 7
	2^8	WS_TARIFF_7	Status of apparent energy, tariff 7
	2^{10}	WP_IMP_TARIFF_8	Status of active energy, import, tariff 8
	2^{12}	WP_EXP_TARIFF_8	Status of active energy, export, tariff 8
	2^{14}	WQ_IMP_TARIFF_8	Status of reactive energy, import, tariff 8
3813	2^0	WQ_EXP_TARIFF_8	Status of reactive energy, export, tariff 8
	2^2	WQ_IND_TARIFF_8	Status of reactive energy, inductive, tariff 8
	2^4	WQ_CAP_TARIFF_8	Status of reactive energy, capacitive, tariff 8
	2^6	WQ_IND_IMP_TARIFF_8	Status of reactive energy, inductive, import, tariff 8
	2^8	WQ_CAP_IMP_TARIFF_8	Status of reactive energy, capacitive, import, tariff 8
	2^{10}	WQ_IND_EXP_TARIFF_8	Status of reactive energy, inductive, export, tariff 8
	2^{12}	WQ_CAP_EXP_TARIFF_8	Status of reactive energy, capacitive, export, tariff 8
	2^{14}	WS_TARIFF_8	Status of apparent energy, tariff 8

Table 2-36 Tariff Counters: Counter Pulses

Register	Type of Information	Remark	Unit
3815	WP_IMP_TARIFF_1	Active energy, import, tariff 1	Pulse
3817	WP_EXP_TARIFF_1	Active energy, export, tariff 1	Pulse
3819	WQ_IMP_TARIFF_1	Reactive energy, import, tariff 1	Pulse
3821	WQ_EXP_TARIFF_1	Reactive energy, export, tariff 1	Pulse
3823	WQ_IND_TARIFF_1	Reactive energy, inductive, tariff 1	Pulse
3825	WQ_CAP_TARIFF_1	Reactive energy, capacitive, tariff 1	Pulse
3827	WQ_IND_IMP_TARIFF_1	Reactive energy, inductive, import, tariff 1	Pulse
3829	WQ_CAP_IMP_TARIFF_1	Reactive energy, capacitive, import, tariff 1	Pulse
3831	WQ_IND_EXP_TARIFF_1	Reactive energy, inductive, export, tariff 1	Pulse
3833	WQ_CAP_EXP_TARIFF_1	Reactive energy, capacitive, export, tariff 1	Pulse
3835	WS_TARIFF_1	Apparent energy, tariff 1	Pulse
3837	WP_IMP_TARIFF_2	Active energy, import, tariff 2	Pulse
3839	WP_EXP_TARIFF_2	Active energy, export, tariff 2	Pulse
3841	WQ_IMP_TARIFF_2	Reactive energy, import, tariff 2	Pulse
3843	WQ_EXP_TARIFF_2	Reactive energy, export, tariff 2	Pulse
3845	WQ_IND_TARIFF_2	Reactive energy, inductive, tariff 2	Pulse
3847	WQ_CAP_TARIFF_2	Reactive energy, capacitive, tariff 2	Pulse
3849	WQ_IND_IMP_TARIFF_2	Reactive energy, inductive, import, tariff 2	Pulse
3851	WQ_CAP_IMP_TARIFF_2	Reactive energy, capacitive, import, tariff 2	Pulse
3853	WQ_IND_EXP_TARIFF_2	Reactive energy, inductive, export, tariff 2	Pulse
3855	WQ_CAP_EXP_TARIFF_2	Reactive energy, capacitive, export, tariff 2	Pulse
3857	WS_TARIFF_2	Apparent energy, tariff 2	Pulse
3859	WP_IMP_TARIFF_3	Active energy, import, tariff 3	Pulse
3861	WP_EXP_TARIFF_3	Active energy, export, tariff 3	Pulse
3863	WQ_IMP_TARIFF_3	Reactive energy, import, tariff 3	Pulse
3865	WQ_EXP_TARIFF_3	Reactive energy, export, tariff 3	Pulse

Register	Type of Information	Remark	Unit
3867	WQ_IND_TARIFF_3	Reactive energy, inductive, tariff 3	Pulse
3869	WQ_CAP_TARIFF_3	Reactive energy, capacitive, tariff 3	Pulse
3871	WQ_IND_IMP_TARIFF_3	Reactive energy, inductive, import, tariff 3	Pulse
3873	WQ_CAP_IMP_TARIFF_3	Reactive energy, capacitive, import, tariff 3	Pulse
3875	WQ_IND_EXP_TARIFF_3	Reactive energy, inductive, export, tariff 3	Pulse
3877	WQ_CAP_EXP_TARIFF_3	Reactive energy, capacitive, export, tariff 3	Pulse
3879	WS_TARIFF_3	Apparent energy, tariff 3	Pulse
3881	WP_IMP_TARIFF_4	Active energy, import, tariff 4	Pulse
3883	WP_EXP_TARIFF_4	Active energy, export, tariff 4	Pulse
3885	WQ_IMP_TARIFF_4	Reactive energy, import, tariff 4	Pulse
3887	WQ_EXP_TARIFF_4	Reactive energy, export, tariff 4	Pulse
3889	WQ_IND_TARIFF_4	Reactive energy, inductive, tariff 4	Pulse
3891	WQ_CAP_TARIFF_4	Reactive energy, capacitive, tariff 4	Pulse
3893	WQ_IND_IMP_TARIFF_4	Reactive energy, inductive, import, tariff 4	Pulse
3895	WQ_CAP_IMP_TARIFF_4	Reactive energy, capacitive, import, tariff 4	Pulse
3897	WQ_IND_EXP_TARIFF_4	Reactive energy, inductive, export, tariff 4	Pulse
3899	WQ_CAP_EXP_TARIFF_4	Reactive energy, capacitive, export, tariff 4	Pulse
3901	WS_TARIFF_4	Apparent energy, tariff 4	Pulse
3903	WP_IMP_TARIFF_5	Active energy, import, tariff 5	Pulse
3905	WP_EXP_TARIFF_5	Active energy, export, tariff 5	Pulse
3907	WQ_IMP_TARIFF_5	Reactive energy, import, tariff 5	Pulse
3909	WQ_EXP_TARIFF_5	Reactive energy, export, tariff 5	Pulse
3911	WQ_IND_TARIFF_5	Reactive energy, inductive, tariff 5	Pulse
3913	WQ_CAP_TARIFF_5	Reactive energy, capacitive, tariff 5	Pulse
3915	WQ_IND_IMP_TARIFF_5	Reactive energy, inductive, import, tariff 5	Pulse
3917	WQ_CAP_IMP_TARIFF_5	Reactive energy, capacitive, import, tariff 5	Pulse
3919	WQ_IND_EXP_TARIFF_5	Reactive energy, inductive, export, tariff 5	Pulse
3921	WQ_CAP_EXP_TARIFF_5	Reactive energy, capacitive, export, tariff 5	Pulse
3923	WS_TARIFF_5	Apparent energy, tariff 5	Pulse
3925	WP_IMP_TARIFF_6	Active energy, import, tariff 6	Pulse
3927	WP_EXP_TARIFF_6	Active energy, export, tariff 6	Pulse
3929	WQ_IMP_TARIFF_6	Reactive energy, import, tariff 6	Pulse
3931	WQ_EXP_TARIFF_6	Reactive energy, export, tariff 6	Pulse
3933	WQ_IND_TARIFF_6	Reactive energy, inductive, tariff 6	Pulse
3935	WQ_CAP_TARIFF_6	Reactive energy, capacitive, tariff 6	Pulse
3937	WQ_IND_IMP_TARIFF_6	Reactive energy, inductive, import, tariff 6	Pulse
3939	WQ_CAP_IMP_TARIFF_6	Reactive energy, capacitive, import, tariff 6	Pulse
3941	WQ_IND_EXP_TARIFF_6	Reactive energy, inductive, export, tariff 6	Pulse
3943	WQ_CAP_EXP_TARIFF_6	Reactive energy, capacitive, export, tariff 6	Pulse
3945	WS_TARIFF_6	Apparent energy, tariff 6	Pulse
3947	WP_IMP_TARIFF_7	Active energy, import, tariff 7	Pulse
3949	WP_EXP_TARIFF_7	Active energy, export, tariff 7	Pulse
3951	WQ_IMP_TARIFF_7	Reactive energy, import, tariff 7	Pulse
3953	WQ_EXP_TARIFF_7	Reactive energy, export, tariff 7	Pulse
3955	WQ_IND_TARIFF_7	Reactive energy, inductive, tariff 7	Pulse
3957	WQ_CAP_TARIFF_7	Reactive energy, capacitive, tariff 7	Pulse
3959	WQ_IND_IMP_TARIFF_7	Reactive energy, inductive, import, tariff 7	Pulse

Register	Type of Information	Remark	Unit
3961	WQ_CAP_IMP_TARIFF_7	Reactive energy, capacitive, import, tariff 7	Pulse
3963	WQ_IND_EXP_TARIFF_7	Reactive energy, inductive, export, tariff 7	Pulse
3965	WQ_CAP_EXP_TARIFF_7	Reactive energy, capacitive, export, tariff 7	Pulse
3967	WS_TARIFF_7	Apparent energy, tariff 7	Pulse
3969	WP_IMP_TARIFF_8	Active energy, import, tariff 8	Pulse
3971	WP_EXP_TARIFF_8	Active energy, export, tariff 8	Pulse
3973	WQ_IMP_TARIFF_8	Reactive energy, import, tariff 8	Pulse
3975	WQ_EXP_TARIFF_8	Reactive energy, export, tariff 8	Pulse
3977	WQ_IND_TARIFF_8	Reactive energy, inductive, tariff 8	Pulse
3979	WQ_CAP_TARIFF_8	Reactive energy, capacitive, tariff 8	Pulse
3981	WQ_IND_IMP_TARIFF_8	Reactive energy, inductive, import, tariff 8	Pulse
3983	WQ_CAP_IMP_TARIFF_8	Reactive energy, capacitive, import, tariff 8	Pulse
3985	WQ_IND_EXP_TARIFF_8	Reactive energy, inductive, export, tariff 8	Pulse
3987	WQ_CAP_EXP_TARIFF_8	Reactive energy, capacitive, export, tariff 8	Pulse
3989	WS_TARIFF_8	Apparent energy, tariff 8	Pulse

2.2.7.29 Registers 4761 to 4872: Energy Float64 Values (Read Only)

Data type: Measured value (64-bit floating-point format)

Table 2-37 Registers 4761 to 4872: Energy Float64 Values

Register	Type of Information	Remark	Unit
4761	WPa_imp	Active energy, import, Phase A, energy float64 values	Wh
4765	WPb_imp	Active energy, import, Phase B, energy float64 values	Wh
4769	WPc_imp	Active energy, import, Phase C, energy float64 values	Wh
4773	WP_imp	Active energy, import, energy float64 values	Wh
4777	WPa_exp	Active energy, export, Phase A, energy float64 values	Wh
4781	WPb_exp	Active energy, export, Phase B, energy float64 values	Wh
4785	WPc_exp	Active energy, export, Phase C, energy float64 values	Wh
4789	WP_exp	Active energy, export, energy float64 values	Wh
4793	WQa_imp	Reactive energy, import, Phase A, energy float64 values	varh
4797	WQb_imp	Reactive energy, import, Phase B, energy float64 values	varh
4801	WQc_imp	Reactive energy, import, Phase C, energy float64 values	varh
4805	WQ_imp	Reactive energy, import, energy float64 values	varh
4809	WQa_exp	Reactive energy, export, Phase A, energy float64 values	varh
4813	WQb_exp	Reactive energy, export, Phase B, energy float64 values	varh
4817	WQc_exp	Reactive energy, export, Phase C, energy float64 values	varh
4821	WQ_exp	Reactive energy, export, energy float64 values	varh
4825	WQa_ind	Reactive energy, inductive, Phase A, energy float64 values	varh
4829	WQb_ind	Reactive energy, inductive, Phase B, energy float64 values	varh
4833	WQc_ind	Reactive energy, inductive, Phase C, energy float64 values	varh
4837	WQ_ind	Reactive energy, inductive, energy float64 values	varh
4841	WQa_cap	Reactive energy, capacitive, Phase A, energy float64 values	varh
4845	WQb_cap	Reactive energy, capacitive, Phase B, energy float64 values	varh
4849	WQc_cap	Reactive energy, capacitive, Phase C, energy float64 values	varh
4853	WQ_cap	Reactive energy, capacitive, energy float64 values	varh
4857	WSa	Apparent energy, Phase A, energy float64 values	VAh
4861	WSb	Apparent energy, Phase B, energy float64 values	VAh

Register	Type of Information	Remark	Unit
4865	WSc	Apparent energy, Phase C, energy float64 values	VAh
4869	WS	Apparent energy, energy float64 values	VAh

2.2.7.30 Registers 4873 to 4984: Energy Freeze Float64 Values (Read Only)

Data type: Measured value (64-bit floating-point format)
The date/time information is stored in registers 8695 to 8698 (see *Table 2-50*).

Table 2-38 Registers 4873 to 4984: Energy Freeze Float64 Values

Register	Type of Information	Remark	Unit
4873	WPa_imp	Active energy, import, Phase A, energy freeze float64 values	Wh
4877	WPb_imp	Active energy, import, Phase B, energy freeze float64 values	Wh
4881	WPc_imp	Active energy, import, Phase C, energy freeze float64 values	Wh
4885	WP_imp	Active energy, import, energy freeze float64 values	Wh
4889	WPa_exp	Active energy, export, Phase A, energy freeze float64 values	Wh
4893	WPb_exp	Active energy, export, Phase B, energy freeze float64 values	Wh
4897	WPc_exp	Active energy, export, Phase C, energy freeze float64 values	Wh
4901	WP_exp	Active energy, export, energy freeze float64 values	Wh
4905	WQa_imp	Reactive energy, import, Phase A, energy freeze float64 values	varh
4909	WQb_imp	Reactive energy, import, Phase B, energy freeze float64 values	varh
4913	WQc_imp	Reactive energy, import, Phase C, energy freeze float64 values	varh
4917	WQ_imp	Reactive energy, import, energy freeze float64 values	varh
4921	WQa_exp	Reactive energy, export, Phase A, energy freeze float64 values	varh
4925	WQb_exp	Reactive energy, export, Phase B, energy freeze float64 values	varh
4929	WQc_exp	Reactive energy, export, Phase C, energy freeze float64 values	varh
4933	WQ_exp	Reactive energy, export, energy freeze float64 values	varh
4937	WQa_ind	Reactive energy, inductive, Phase A, energy freeze float64 values	varh
4941	WQb_ind	Reactive energy, inductive, Phase B, energy freeze float64 values	varh
4945	WQc_ind	Reactive energy, inductive, Phase C, energy freeze float64 values	varh
4949	WQ_ind	Reactive energy, inductive, energy freeze float64 values	varh
4953	WQa_cap	Reactive energy, capacitive, Phase A, energy freeze float64 values	varh
4957	WQb_cap	Reactive energy, capacitive, Phase B, energy freeze float64 values	varh
4961	WQc_cap	Reactive energy, capacitive, Phase C, energy freeze float64 values	varh

Register	Type of Information	Remark	Unit
4965	WQ_cap	Reactive energy, capacitive, energy freeze float64 values	varh
4969	WSa	Apparent energy, Phase A, energy freeze float64 values	VAh
4973	WSb	Apparent energy, Phase B, energy freeze float64 values	VAh
4977	WSc	Apparent energy, Phase C, energy freeze float64 values	VAh
4981	WS	Apparent energy, energy freeze float64 values	VAh

2.2.7.31 Registers 5001 to 5099: Latest 10 Dips (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: Measured value + Date/time

The following table shows the information for the latest dip (5001 to 5009). The information of the other 9 dips (5011 to 5099) is in the same structure.

Table 2-39 Registers 5001 to 5009: The Latest Dip

Register	Type of Information	Unit	Remark
5001	Milliseconds	Start time of dip For data format, see *2.2.6.2 Data Type - Date/Time (Read and Write)*	
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, it means the corresponding phase is influenced

2.2.7.32 Registers 5201 to 5299: Latest 10 Swells (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: Measured value + Date/time

The following table shows the information for the latest swell (5201 to 5209). The information of the other 9 swells (5211 to 5299) is in the same structure.

Table 2-40 Registers 5201 to 5209: The Latest Swell

Register	Type of Information	Unit	Remark
5201	Milliseconds	Start time of swell For data format, see *2.2.6.2 Data Type - Date/Time (Read and Write)*	
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, it means the corresponding phase is influenced

2.2.7.33 Registers 5401 to 5499: Latest 10 Voltage Interrupts (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: Measured value + Date/time

The following table shows the information for the latest voltage interrupt (5401 to 5409). The information of the other 9 voltage interrupts (5411 to 5499) is in the same structure.

Table 2-41 Registers 5401 to 5409: The Latest Voltage Interrupt

Register	Type of Information	Unit	Remark
5401	Milliseconds	Start time of interrupt For data format, see *2.2.6.2 Data Type - Date/Time (Read and Write)*	
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, it means the corresponding phase is influenced

2.2.7.34 Registers 5701 to 5797: Latest 10 Overfrequency Events (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: Measured value + Date/time

The following table shows the information for the latest overfrequency event (5701 to 5707). The information of the other 9 overfrequency events (5711 to 5797) is in the same structure.

Table 2-42 Registers 5701 to 5707: The Latest Overfrequency Event

Register	Type of Information	Unit	Remark
5701	Milliseconds	Start time of the overfrequency event For data format, see *2.2.6.2 Data Type - Date/Time (Read and Write)*	
5702	Hours/minutes		
5703	Month/day		
5704	Time status/year		
5705	Value	Hz	Maximum frequency value during overfrequency event 1
5707	Time duration	s	Overfrequency event 1 time duration

2.2.7.35 Registers 5801 to 5897: Latest 10 Underfrequency Events (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: Measured value + Date/time

The following table shows the information for the latest underfrequency event (5801 to 5807). The information of the other 9 underfrequency events (5811 to 5897) is in the same structure.

Table 2-43 Registers 5801 to 5807: The Latest Underfrequency Event

Register	Type of Information	Unit	Remark
5801	Milliseconds	Start time of the underfrequency event For data format, see *2.2.6.2 Data Type - Date/Time (Read and Write)*	
5802	Hours/minutes		
5803	Month/day		
5804	Time status/year		
5805	Value	Hz	Minimum frequency value during under-frequency event 1
5807	Time duration	s	Underfrequency event 1 time duration

2.2.7.36 Registers 5901 to 5997: Latest 10 Voltage Unbalance Events (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: Measured value + Date/time

The following table shows the information for the latest voltage unbalance event (5901 to 5907). The information of the other 9 voltage unbalance events (5911 to 5997) is in the same structure.

Table 2-44 Registers 5901 to 5907: The Latest Voltage Unbalance Event

Register	Type of Information	Unit	Remark
5901	Milliseconds	Start time of the voltage unbalance event For data format, see *2.2.6.2 Data Type - Date/Time (Read and Write)*	
5902	Hours/minutes		
5903	Month/day		
5904	Time status/year		
5905	Value	%	Maximum unbalance value during voltage unbalance event 1
5907	Time duration	s	Voltage unbalance event 1 time duration

2.2.7.37 Registers 6001 to 6032: Number of PQ Events (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Table 2-45 Registers 6001 to 6032: Number of PQ Events

Register	Type of Information	Remark
6001	PQ_Event_Number	Total number of PQ voltage events
6003	PQ_Event_Lnumber	Number of PQ voltage events since last polling
6005	Dip_Event_Number	Total number of PQ dip events
6007	Dip_Event_Lnumber	Number of PQ dip events since last polling
6009	Swell_Event_Number	Total number of PQ swell events
6011	Swell_Event_Lnumber	Number of PQ swell events since last polling
6013	Interrupt_Event_Number	Total number of PQ interrupt events
6015	Interrupt_Event_Lnumber	Number of PQ interrupt events since last polling
6025	Volunb_Event_Number	Total number of PQ voltage-unbalanced events
6027	Volunb_Event_Lnumber	Number of PQ voltage-unbalanced events since last polling

Register	Type of Information	Remark
6029	Freq_Event_Number	Total number of PQ frequency events
6031	Freq_Event_Lnumber	Number of PQ frequency events since last polling

2.2.7.38 Registers 6087 to 6100: Load Profile – Management (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: Unsigned, long

Table 2-46 Registers 6087 to 6100: Load Profile – Management

Register	Type of Information	Remark
6087 to 6088	Timestamp of last terminated period	Seconds since 1970-01-01 00:00
6089 to 6090		Fractional seconds (not used, always = 0)
6091 to 6092	Momentary record ID (RecID)	Value of the momentary load profile identifier
6093 to 6094	Length of last terminated period	Unit: s
6095 to 6096	Time since begin of momentary period	Unit: s
6097 to 6098	Duration of subinterval	Unit: ms
6099 to 6100	Last period information	Meaning of the flags: see following table

Table 2-47 Last period information – Flags

Type of Flags	Flag	Remark
LOADPROFILE_FLAG_CURRENT_TARIFF_1	0x**00**000000	Current tariff = tariff 1
LOADPROFILE_FLAG_CURRENT_TARIFF_2	0x**01**000000	Current tariff = tariff 2
LOADPROFILE_FLAG_CURRENT_TARIFF_3	0x**02**000000	Current tariff = tariff 3
LOADPROFILE_FLAG_CURRENT_TARIFF_4	0x**03**000000	Current tariff = tariff 4
LOADPROFILE_FLAG_CURRENT_TARIFF_5	0x**04**000000	Current tariff = tariff 5
LOADPROFILE_FLAG_CURRENT_TARIFF_6	0x**05**000000	Current tariff = tariff 6
LOADPROFILE_FLAG_CURRENT_TARIFF_7	0x**06**000000	Current tariff = tariff 7
LOADPROFILE_FLAG_CURRENT_TARIFF_8	0x**07**000000	Current tariff = tariff 8
LOADPROFILE_FLAG_QUALITY_UNSECURE	0x00**8000**00	Power values not exact because of overflow of at least one current or voltage value
LOADPROFILE_FLAG_QUALITY_AUXPOWER_FAIL	0x00**4000**00	Power supply failure
LOADPROFILE_FLAG_QUALITY_SYNC	0x00**2000**00	Time synchronization may not be accurate, for example, because the time has not been updated yet.
LOADPROFILE_FLAG_MISSUB	0x00**1000**00	Flag "missing subinterval" for modbus communication
LOADPROFILE_FLAG_QUALITY_PERIOD_TO_SHORT	0x00**0100**00	Resynch → period is shorter than parameterized
LOADPROFILE_TEMP_SYNCED	0x00**0001**00	The flag is set if the period was synchronized internally; the external synchronization (binary inputs, communication) has not been received yet.
LOADPROFILE_FLAG_QN	0x00000**80**	Reactive Power = Qn
LOADPROFILE_FLAG_Q1	0x00000**40**	Reactive power = Q1

Type of Flags	Flag	Remark
LOADPROFILE_FLAG_QTOT	0x00000**20**	Reactive power = Qtot
LOADPROFILE_FLAG_QMIXED	0x00000**10**	Reactive power was changed in subperiod

2.2.7.39 Registers 6101 to 6158: Load Profile – Measured Values (Read Only)

These registers are write-protected. A write attempt will be rejected with exception code 02 (ILLEGAL_DATA_ADDRESS).

Data type: Measured value

Table 2-48 Registers 6101 to 6158: Load Profile – Measured Values

Register	Type of Information	Unit
6101	Total power factor import (previous period)	-
6103	Total power factor export (previous period)	-
6105	Average active power import (previous period)	W
6107	Average active power export (previous period)	W
6109	Average reactive power import (previous period)	var
6111	Average reactive power export (previous period)	var
6113	Average apparent power (previous period)	VA
6115	Cumulated active power import (previous period)	W
6117	Cumulated active power export (previous period)	W
6119	Cumulated reactive power import (previous period)	var
6121	Cumulated reactive power export (previous period)	var
6123	Cumulated apparent power (previous period)	VA
6125	Maximum active power (previous period)	W
6127	Minimum active power (previous period)	W
6129	Maximum reactive power (previous period)	var
6131	Minimum reactive power (previous period)	var
6133	Maximum apparent power (previous period)	VA
6135	Minimum apparent power (previous period)	VA
6137	Cumulated active power import (current period)	W
6139	Cumulated active power export (current period)	W
6141	Cumulated reactive power import (current period)	var
6143	Cumulated reactive power export (current period)	var
6145	Cumulated apparent power (current period)	VA
6147	Maximum active power (current period)	W
6149	Minimum active power (current period)	W
6151	Maximum reactive power (current period)	var
6153	Minimum reactive power (current period)	var
6155	Maximum apparent power (current period)	VA
6157	Minimum apparent power (current period)	VA

2.2.7.40 Registers 8601 to 8656: Energy Float32 Values (Read Only)

Data type: Measured value (32-bit floating-point format)

Table 2-49 Registers 8601 to 8656: Energy Float32 Values

Register	Type of Information	Remark	Unit
8601	WPa_imp	Active energy, import, Phase A, energy float32 values	Wh
8603	WPb_imp	Active energy, import, Phase B, energy float32 values	Wh
8605	WPc_imp	Active energy, import, Phase C, energy float32 values	Wh
8607	WP_imp	Active energy, import, energy float32 values	Wh
8609	WPa_exp	Active energy, export, Phase A, energy float32 values	Wh
8611	WPb_exp	Active energy, export, Phase B, energy float32 values	Wh
8613	WPc_exp	Active energy, export, Phase C, energy float32 values	Wh
8615	WP_exp	Active energy, export, energy float32 values	Wh
8617	WQa_imp	Reactive energy, import, Phase A, energy float32 values	varh
8619	WQb_imp	Reactive energy, import, Phase B, energy float32 values	varh
8621	WQc_imp	Reactive energy, import, Phase C, energy float32 values	varh
8623	WQ_imp	Reactive energy, import, energy float32 values	varh
8625	WQa_exp	Reactive energy, export, Phase A, energy float32 values	varh
8627	WQb_exp	Reactive energy, export, Phase B, energy float32 values	varh
8629	WQc_exp	Reactive energy, export, Phase C, energy float32 values	varh
8631	WQ_exp	Reactive energy, export, energy float32 values	varh
8633	WQa_ind	Reactive energy, inductive, Phase A, energy float32 values	varh
8635	WQb_ind	Reactive energy, inductive, Phase B, energy float32 values	varh
8637	WQc_ind	Reactive energy, inductive, Phase C, energy float32 values	varh
8639	WQ_ind	Reactive energy, inductive, energy float32 values	varh
8641	WQa_cap	Reactive energy, capacitive, Phase A, energy float32 values	varh
8643	WQb_cap	Reactive energy, capacitive, Phase B, energy float32 values	varh
8645	WQc_cap	Reactive energy, capacitive, Phase C, energy float32 values	varh
8647	WQ_cap	Reactive energy, capacitive, energy float32 values	varh
8649	WSa	Apparent energy, Phase A, energy float32 values	VAh
8651	WSb	Apparent energy, Phase B, energy float32 values	VAh
8653	WSc	Apparent energy, Phase C, energy float32 values	VAh
8655	WS	Apparent energy, energy float32 values	VAh

2.2.7.41 Registers 8695 to 8756: Energy Freeze Float32 Values (Read Only)

Data type: Measured value (32-bit floating-point format)

Table 2-50 Registers 8695 to 8756: Energy Freeze Float32 Values

Register	Type of Information	Remark	Unit
8695	Milliseconds	see *2.2.6.2 Data Type - Date/Time (Read and Write)*	-
8696	Hours/minutes		-
8697	Month/day		-
8698	Time status/year		-
8701	WPa_imp	Active energy, import, Phase A, energy freeze float32 values	Wh
8703	WPb_imp	Active energy, import, Phase B, energy freeze float32 values	Wh
8705	WPc_imp	Active energy, import, Phase C, energy freeze float32 values	Wh
8707	WP_imp	Active energy, import, energy freeze float32 values	Wh

Register	Type of Information	Remark	Unit
8709	WPa_exp	Active energy, export, Phase A, energy freeze float32 values	Wh
8711	WPb_exp	Active energy, export, Phase B, energy freeze float32 values	Wh
8713	WPc_exp	Active energy, export, Phase C, energy freeze float32 values	Wh
8715	WP_exp	Active energy, export, energy freeze float32 values	Wh
8717	WQa_imp	Reactive energy, import, Phase A, energy freeze float32 values	varh
8719	WQb_imp	Reactive energy, import, Phase B, energy freeze float32 values	varh
8721	WQc_imp	Reactive energy, import, Phase C, energy freeze float32 values	varh
8723	WQ_imp	Reactive energy, import, energy freeze float32 values	varh
8725	WQa_exp	Reactive energy, export, Phase A, energy freeze float32 values	varh
8727	WQb_exp	Reactive energy, export, Phase B, energy freeze float32 values	varh
8729	WQc_exp	Reactive energy, export, Phase C, energy freeze float32 values	varh
8731	WQ_exp	Reactive energy, export, energy freeze float32 values	varh
8733	WQa_ind	Reactive energy, inductive, Phase A, energy freeze float32 values	varh
8735	WQb_ind	Reactive energy, inductive, Phase B, energy freeze float32 values	varh
8737	WQc_ind	Reactive energy, inductive, Phase C, energy freeze float32 values	varh
8739	WQ_ind	Reactive energy, inductive, energy freeze float32 values	varh
8741	WQa_cap	Reactive energy, capacitive, Phase A, energy freeze float32 values	varh
8743	WQb_cap	Reactive energy, capacitive, Phase B, energy freeze float32 values	varh
8745	WQc_cap	Reactive energy, capacitive, Phase C, energy freeze float32 values	varh
8747	WQ_cap	Reactive energy, capacitive, energy freeze float32 values	varh
8749	WSa	Apparent energy, Phase A, energy freeze float32 values	VAh
8751	WSb	Apparent energy, Phase B, energy freeze float32 values	VAh
8753	WSc	Apparent energy, Phase C, energy freeze float32 values	VAh
8755	WS	Apparent energy, energy freeze float32 values	VAh

2.2.7.42 Registers 8801 to 8976: Tariff Float32 Values (Read Only)

Data type: Measured value (32-bit floating-point format)

The following table shows the values for tariff 1 (8801 to 8822). The values of the other 7 tariffs (8823 to 8976) are in the same structure.

The date/time information is stored in registers 3301 to 3304 (see *Table 2-34*).

Table 2-51 Registers 8801 to 8822: Float32 Values of Tariff 1

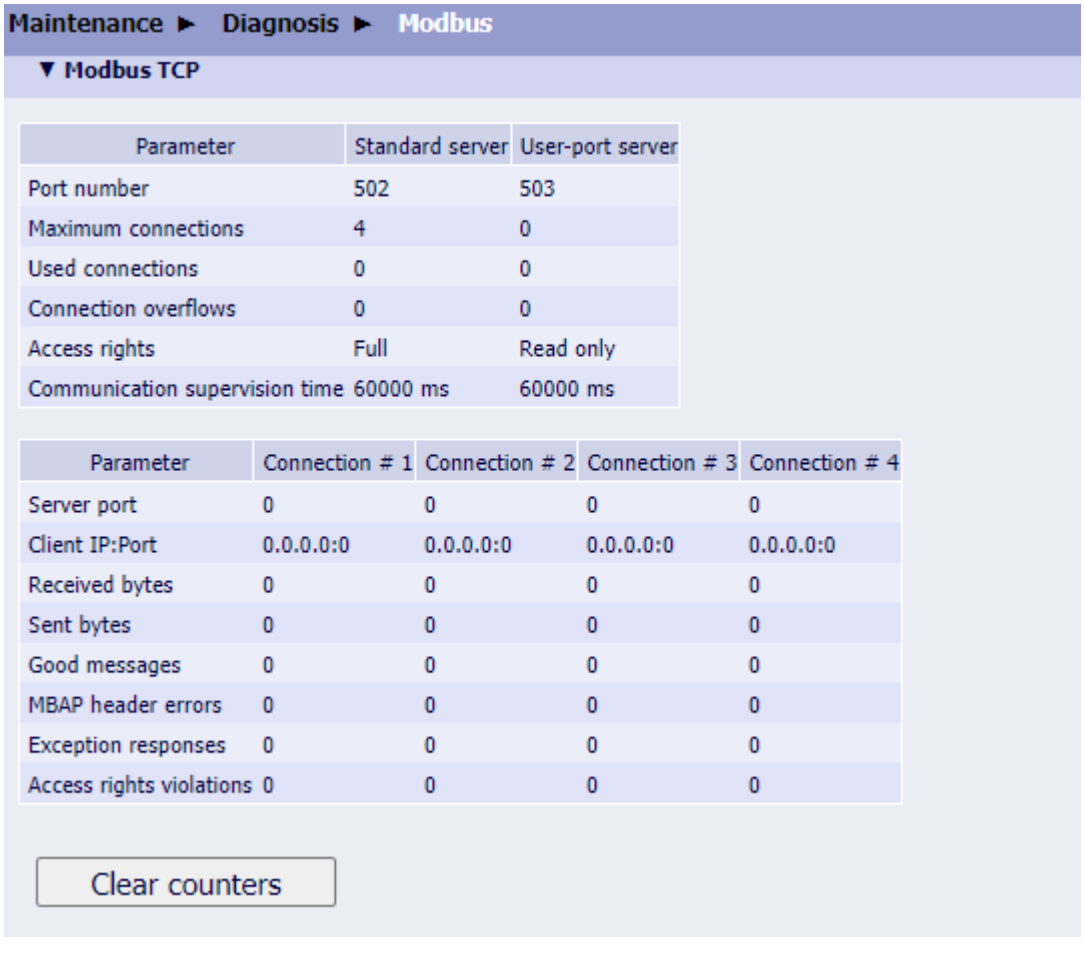
Register	Type of Information	Remark	Unit
8801	WP_imp	Active energy, import, float32 values, tariff 1	Wh
8803	WP_exp	Active energy, export, float32 values, tariff 1	Wh

Register	Type of Information	Remark	Unit
8805	WQ_ind_imp	Reactive energy, inductive, import, float32 values, tariff 1	varh
8807	WQ_cap_exp	Reactive energy, capacitive, export, float32 values, tariff 1	varh
8809	WQ_ind_exp	Reactive energy, inductive, export, float32 values, tariff 1	varh
8811	WQ_cap_imp	Reactive energy, capacitive, import, float32 values, tariff 1	varh
8813	WQ_ind	Reactive energy, inductive, float32 values, tariff 1	varh
8815	WQ_cap	Reactive energy, capacitive, float32 values, tariff 1	varh
8817	WQ_imp	Reactive energy, import, float32 values, tariff 1	varh
8819	WQ_exp	Reactive energy, export, float32 values, tariff 1	varh
8821	WS	Apparent energy, float32 values, tariff 1	VAh

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, Configuration of the Device.

2.2.8.1 Modbus TCP Diagnosis



[sc_Modbus_TCP_diagnosis, 1, en_US]

Figure 2-10 Modbus TCP Diagnosis

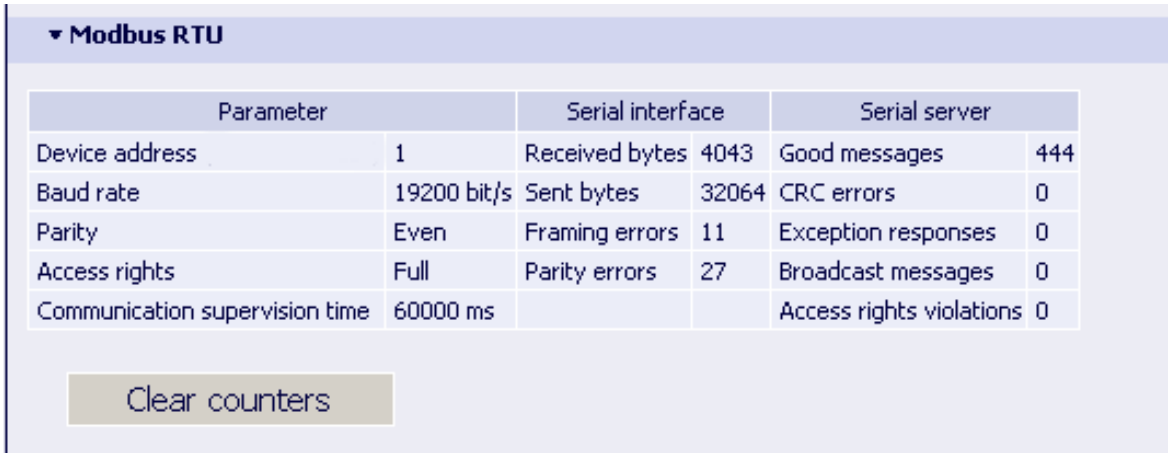
Parameter for Standard Server and User-port Server

- Port number:
  Standard port 502 and configured user port
- Maximum connections:
  - 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
- 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: ≥ 4 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: As configured
- Communication supervision time: As configured

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 *2.2.2 Exception Responses for Modbus TCP Server and Modbus RTU Slave*)
- 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, Ethernet Communication.

2.2.8.2 Modbus RTU Diagnosis



[sc_Diagnose_Modbus_RTU, 1, en_US]

Figure 2-11 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

- 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 the device manual, Serial Communication)

2.3 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”.

2.3.1 Function Ranges

2.3.1.1 Basic Application Functions

Table 2-52 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	-

2.3.1.2 Standard ASDUs in Monitoring Direction

Table 2-53 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 “ (8th character = space)

#	Designation	Supported by SICAM P850/ P855	Remark
ASDU 6	Time synchronization	Yes	-
ASDU 8	General interrogation termination	Yes	-
ASDU 9	Measurands II	Yes	Refer to *2.3.2.2 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	-

2.3.1.3 Standard ASDUs in Control Direction

Table 2-54 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	-

2.3.1.4 Private ASDU in Monitoring Direction

Table 2-55 Private ASDU in Monitoring Direction

#	Designation	Supported by SICAM P850/ P855	Remark
ASDU 205[2]	Counters	Yes	Energy 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 Definition acc. to SIPROTEC for energy and pulse counters

2.3.2 Data Mapping and Telegrams for Measured Values

2.3.2.1 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 2-56*). All measured values are transferred as per-unit values. The column "100 % corresponds to" in *Table 2-56* 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 $V_{ph\text{-}ph}$).

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 2-56 Measured Value Mapping

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

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

#	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
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

2.3.2.2 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.

Function Type FUN

Each telegram from the slave device to the master device contains 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 measurand 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

2.3.2.3 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 2-57 Transmitted Telegrams vs. Network Type

	Network Type					
	1-phase Network	3-wire 3-phase			4-wire 3-phase	
		Balanced	Unbalanced 3I	Unbalanced 2I	Balanced	Unbalanced
Compatible Measurands II	X[3]	X[4]	X[4]	X[4]	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[5]	-	-	-	X[5]	X
Private Measurands 3-phase, 4. additional	X[6]	X[6]	X	X	X[6]	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
Private Measurands 3-phase, 14. additional	X	X	X	X	X	X
Private Measurands 3-phase, 15. additional	-	-	X	X	-	X

3 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.

4 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.

5 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.

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

	Network Type					
	1-phase Network	3-wire 3-phase			4-wire 3-phase	
		Balanced	Unbalanced 3I	Unbalanced 2I	Balanced	Unbalanced
Private Measurands 3-phase, 16. additional	-	-	X	X	-	X
Private Measurands 3-phase, 17. additional	X[5]	-	-	-	X[5]	X
Private Measurands 3-phase, 18. additional	-	X	X	X	-	-

All telegrams are transferred sequentially. The IEC 60870-5-103 slave sends the next following telegram in the order shown in *Table 2-57* 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.

2.3.3 Data Mapping for Commands and Events

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

Table 2-58 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

#	Designation	Description	Type of Information	Function Type	Information Number	Compatibility	Data Unit	General Interrogation
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
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 Synchronization Error	Time synchronization 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	Direction Rotation	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

2.3.4 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.

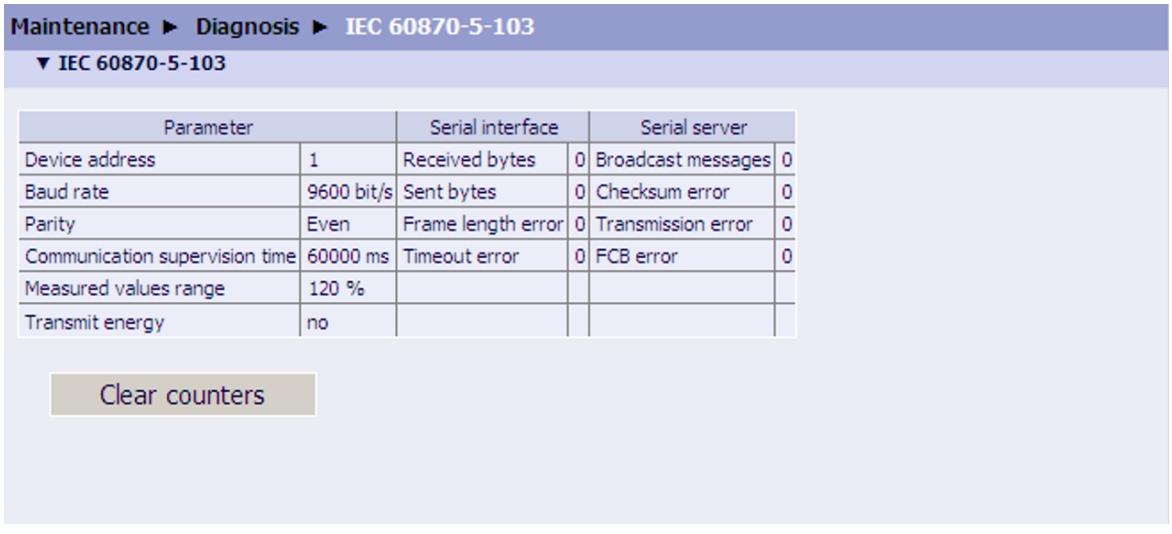
Table 2-59 Counters

#	Value	Unit	Function Type	Information Number	Compati- bility	Data Unit
1	WPa_exp	Wh	133	51	No	205
2	WPb_exp	Wh	133	52	No	205
3	WPc_exp	Wh	133	53	No	205
4	WP_exp	Wh	133	54	No	205

#	Value	Unit	Function Type	Information Number	Compati- bility	Data Unit
5	WPa_imp	Wh	133	55	No	205
6	WPb_imp	Wh	133	56	No	205
7	WPc_imp	Wh	133	57	No	205
8	WP_imp	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

2.3.5 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, Configuration of the Device.



[sc_diagnosis_IEC 60870-5-103, 1, en_US]

Figure 2-12 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

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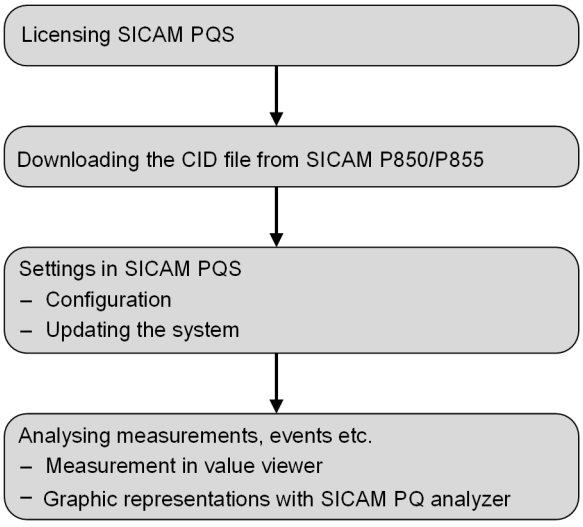
3.1 General

The data acquired by SICAM P850/P855 are stored in the internal memory of the device. The measured values, for example mean values, and the trend records are available in the PGDIF data format. The fault records 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 V8.03 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 allows 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:



[dw_workflow-P85x-settings-for-SICAM_PQS, 1, en_US]

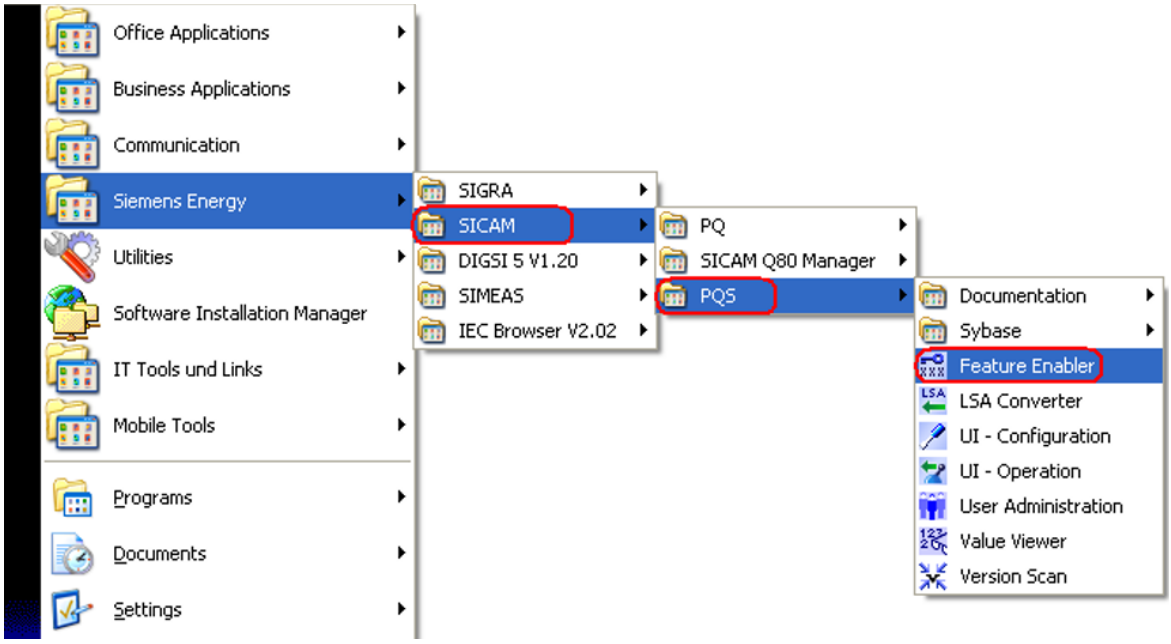
Figure 3-1 Workflow

NOTE

For SICAM P850 V2.20 or higher, this is an IID file.

3.2 Licensing SICAM PQS

After installing SICAM PQS, execute the Feature Enabler application:



[sc_SICAM_PQS_Feature_Enabler, 1, en_US]

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

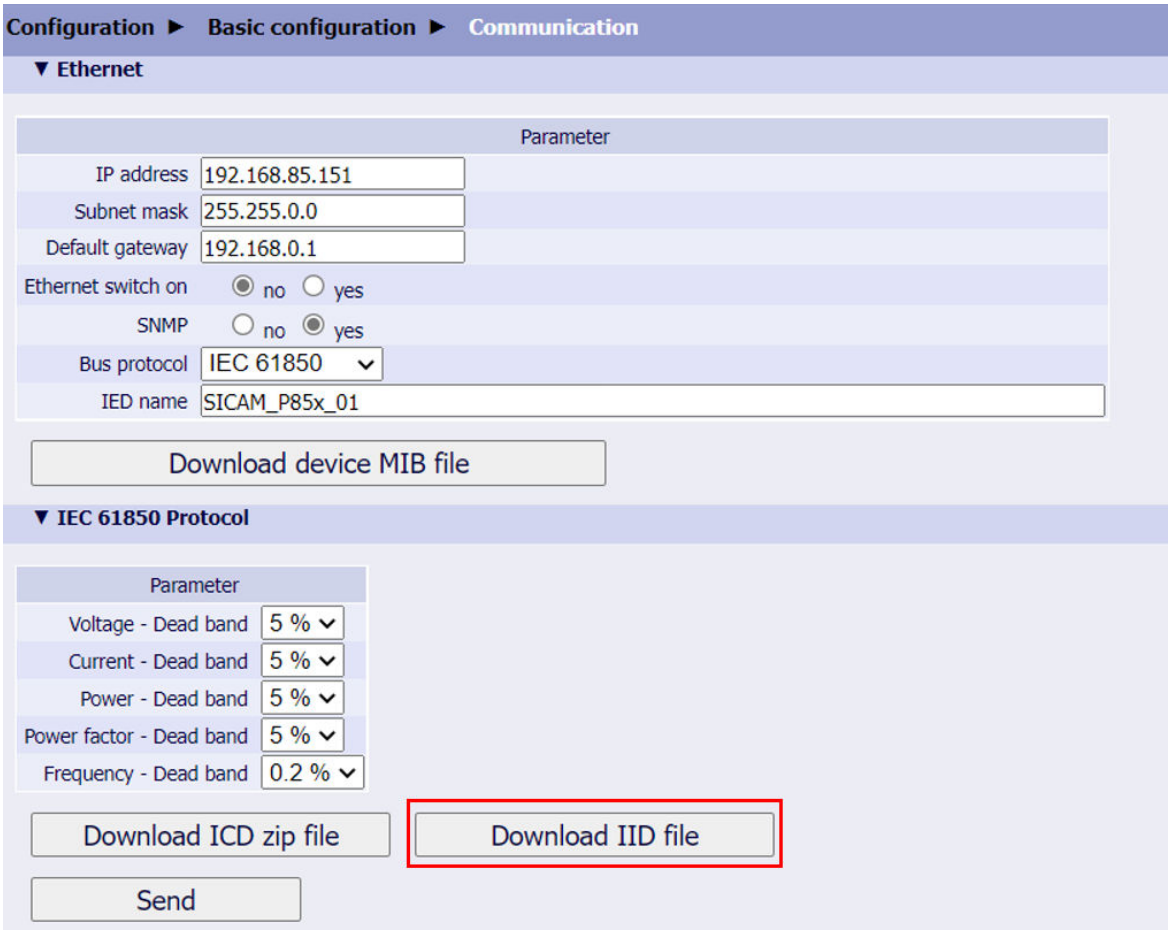
When required:

- 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 IID/CID Files

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

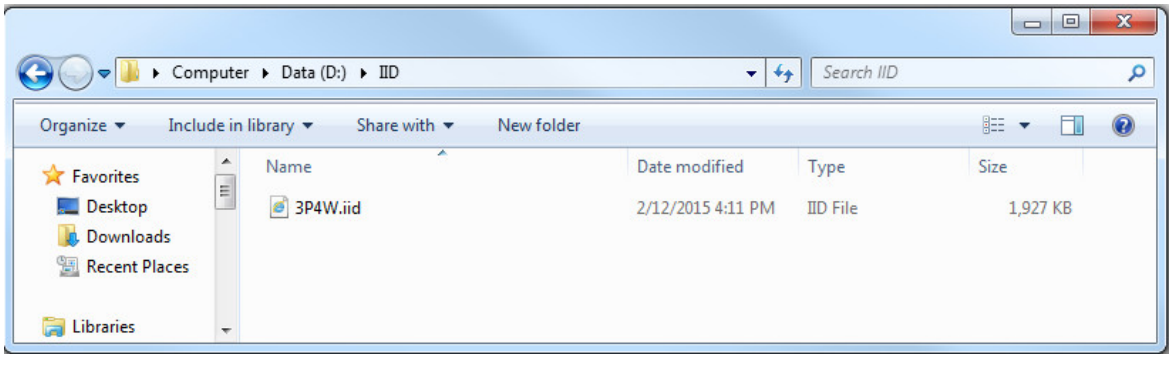
- In SICAM P850/P855 open the **Configuration** tab→ **Communication Ethernet**.
- Click **Download IID file**.



[sc_configure_comm_IEC61850_P85x, 1, en_US]

Figure 3-3 Configuration Tab, Communication Ethernet

- Save the IID/CID file in a folder.



[sc_Figure 3-4, 1, en_US]

Figure 3-4 Saved IID/CID File

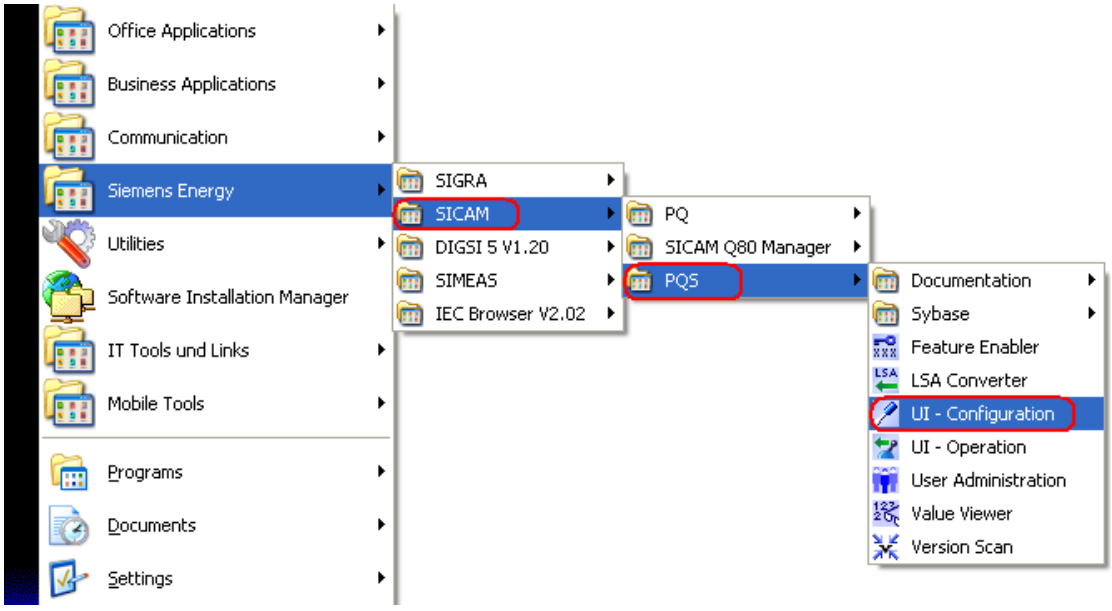
NOTE

For SICAM P850 V2.20 or higher, this is an IID file.

3.4 Settings in SICAM PQS

3.4.1 Configuration

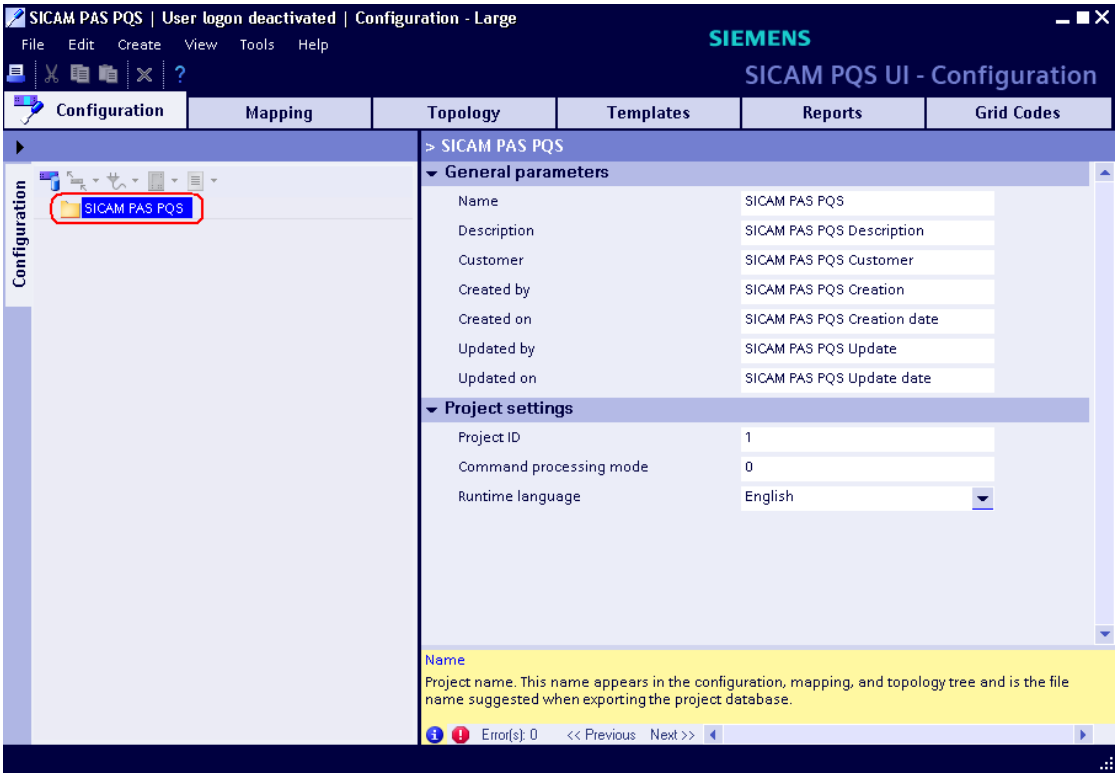
- In SICAM PQS start the **UI - Configuration**.



[sc_SICAM_PQS_UI-Configuration, 1, en_US]

Figure 3-5 Start UI - Configuration

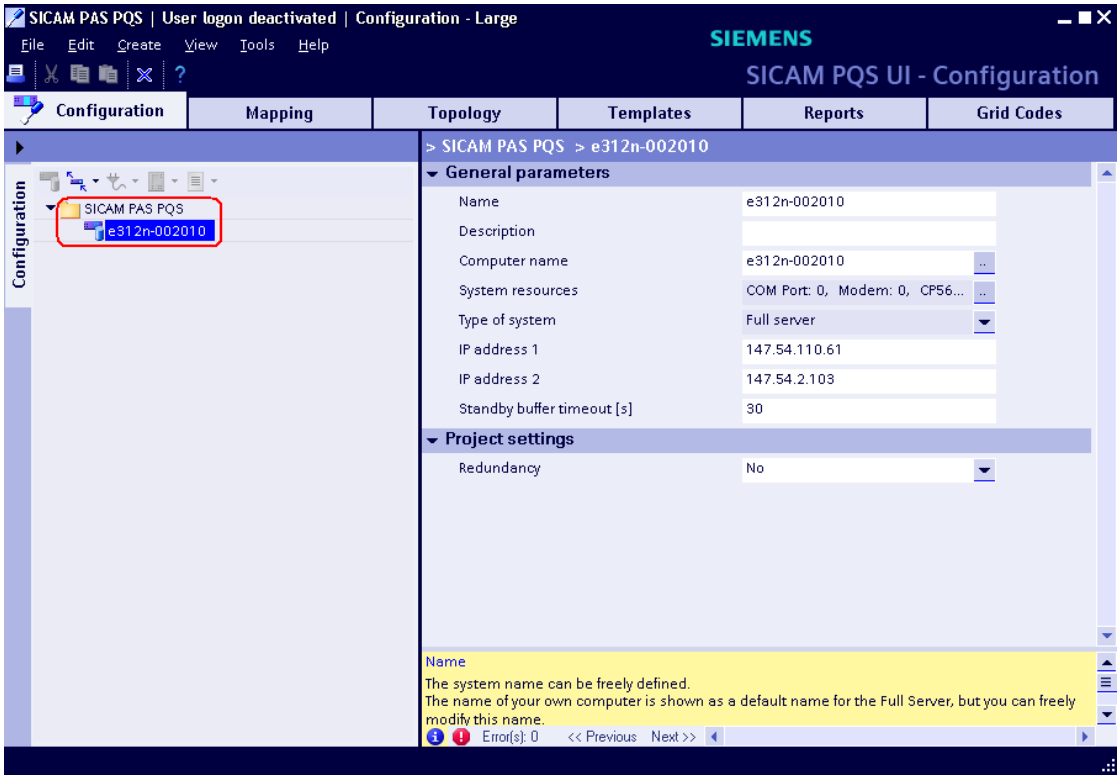
- Select the **Configuration** tab.



[sc_01_PQS_Config, 1, en_US]

Figure 3-6 Configuration Tab

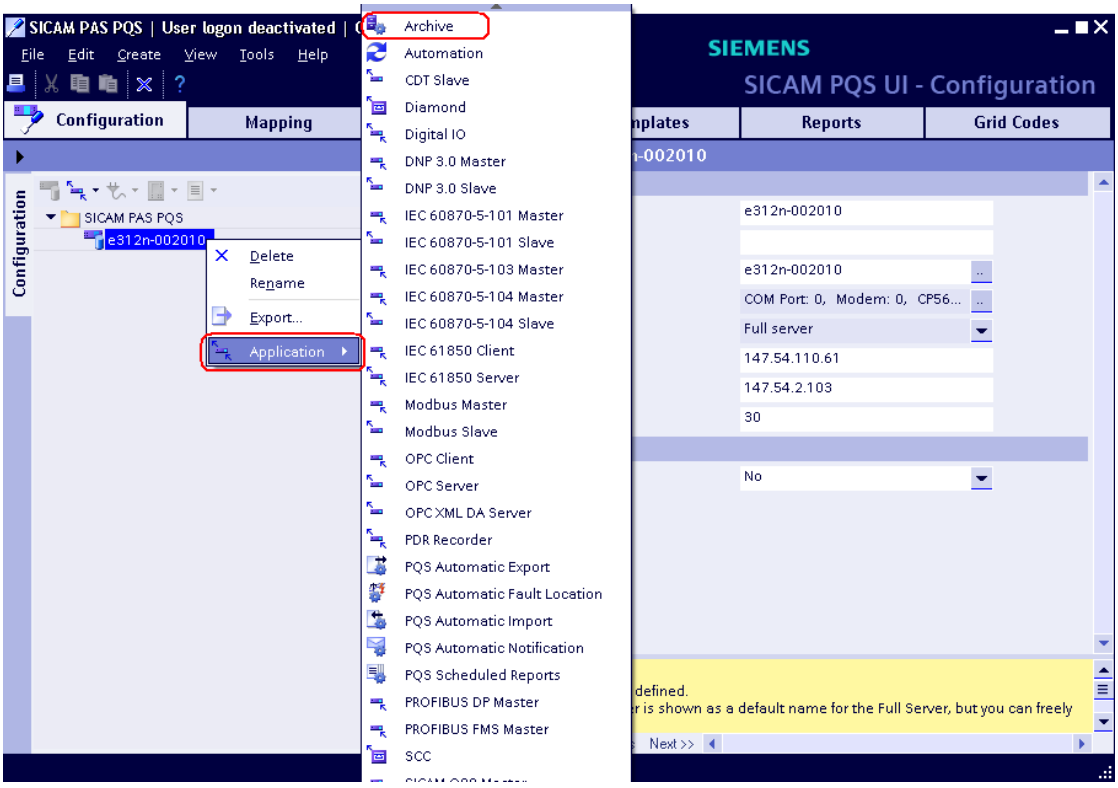
- Select the project and add its system from the context menu.
  Your own PC will be automatically inserted as the first system and as the full server.



[sc_SICAM_PQS_System_insert, 1, en_US]

Figure 3-7 Inserting the System

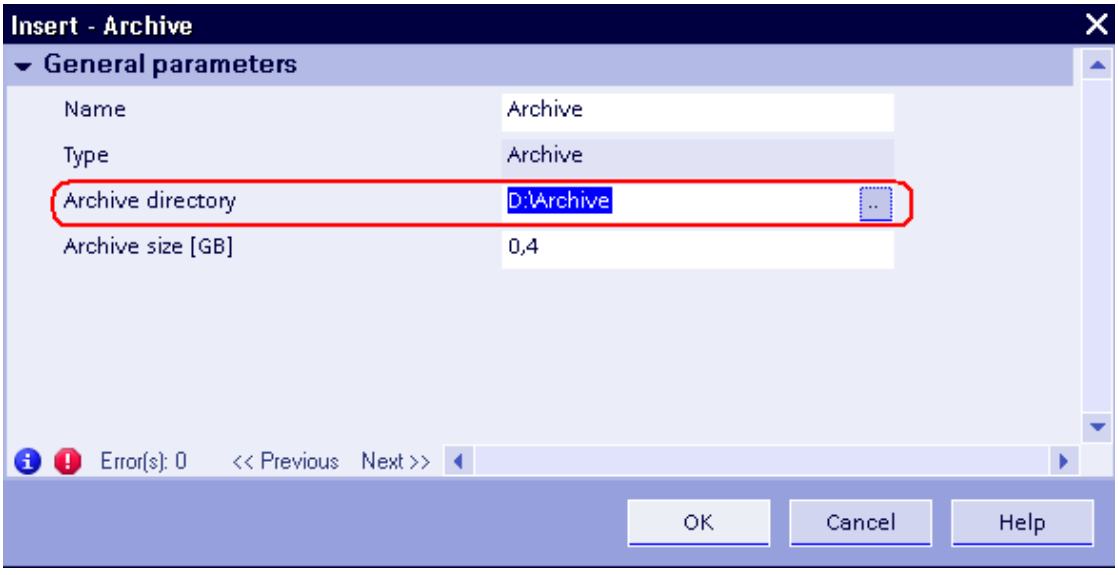
- In the navigation window right-click **SICAM PAS PQS** → **Computer name** (in the example e312n-002010) → **Application** → **Archive**.



[sc_02_PQS_Archive_create, 1, en_US]

Figure 3-8 Selecting the Archive

- Create a path for the archive.



[sc_03_Archive_path, 1, en_US]

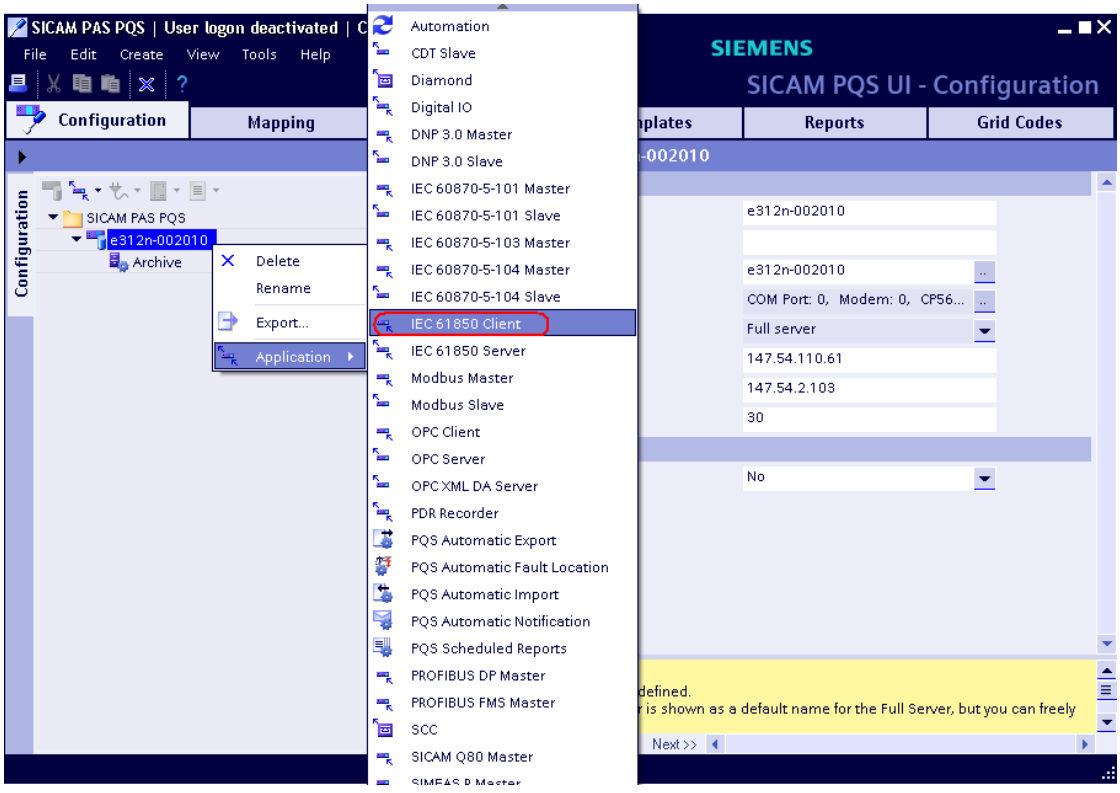
Figure 3-9 Creating the Archive Folder

- Click **OK**.

NOTE

The **archive** is needed to store measurements recorded by SICAM P850/P855 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**.

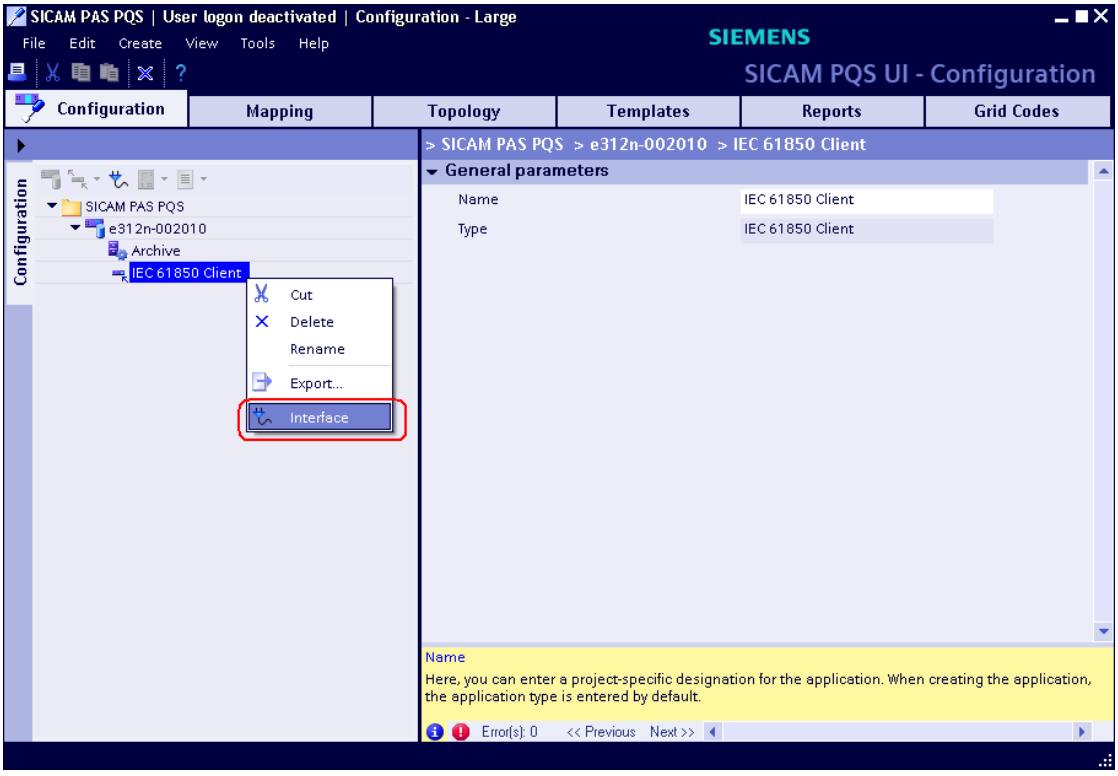


[sc_04_IEC61850_Client, 1, en_US]

Figure 3-10 Selection of the IEC 61850 Client

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

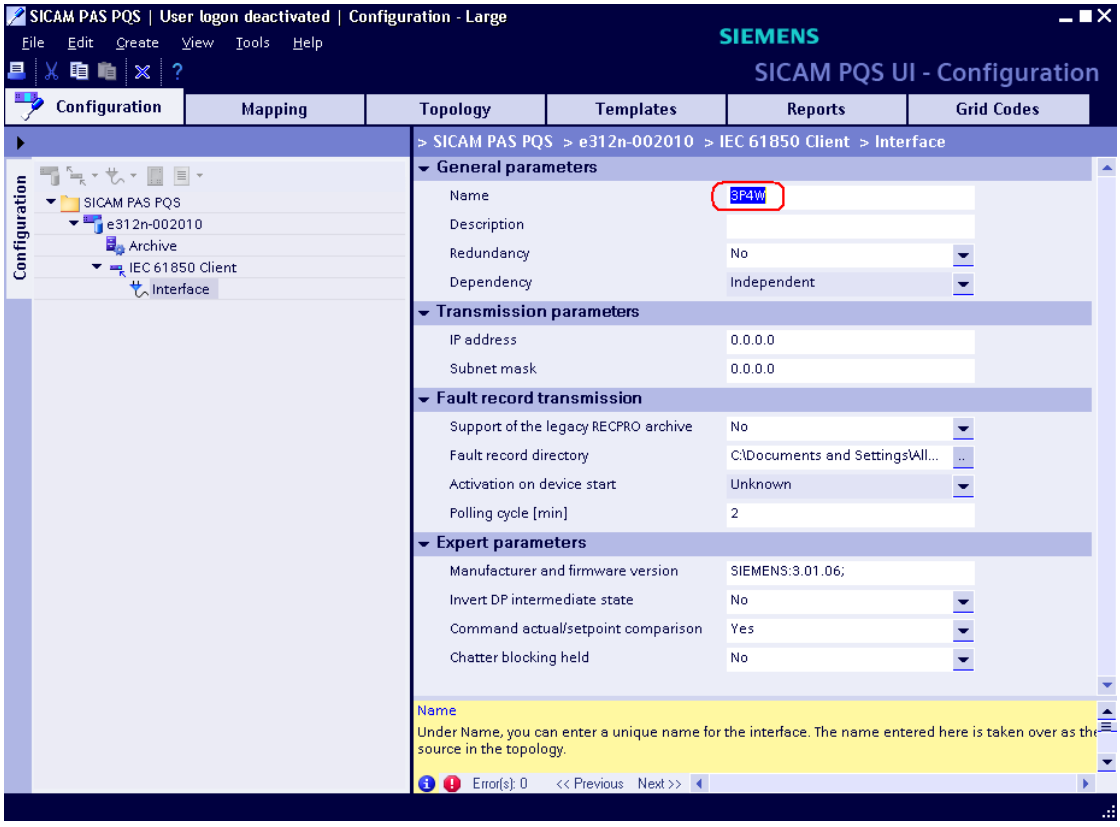
- In the navigation window right-click **SICAM PAS PQS** → **Computer name** (in the example: e312n-002010) → **IEC 61850 Client** → **Interface**.



[sc_06_Interface, 1, en_US]

Figure 3-11 Selecting the Interface

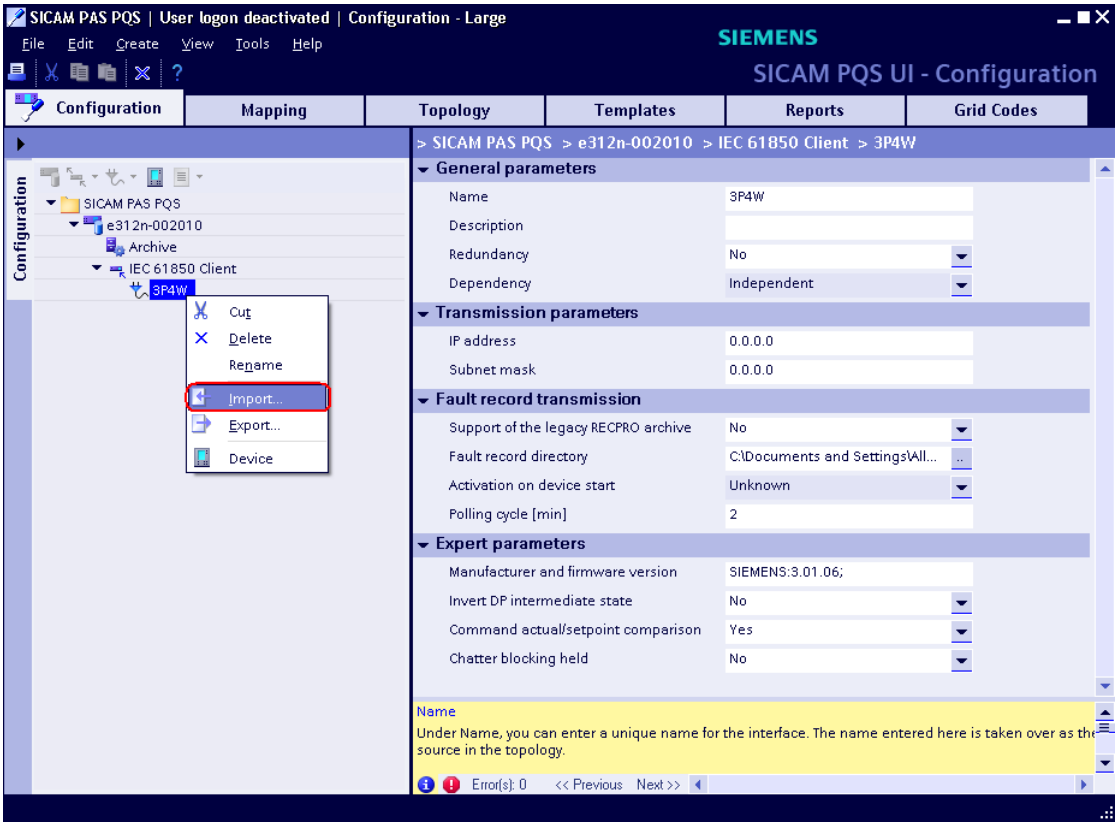
- In the **Interface** window enter a **Name**.



[sc_07_Setting_Interface, 1, en_US]

Figure 3-12 Interface Parameters

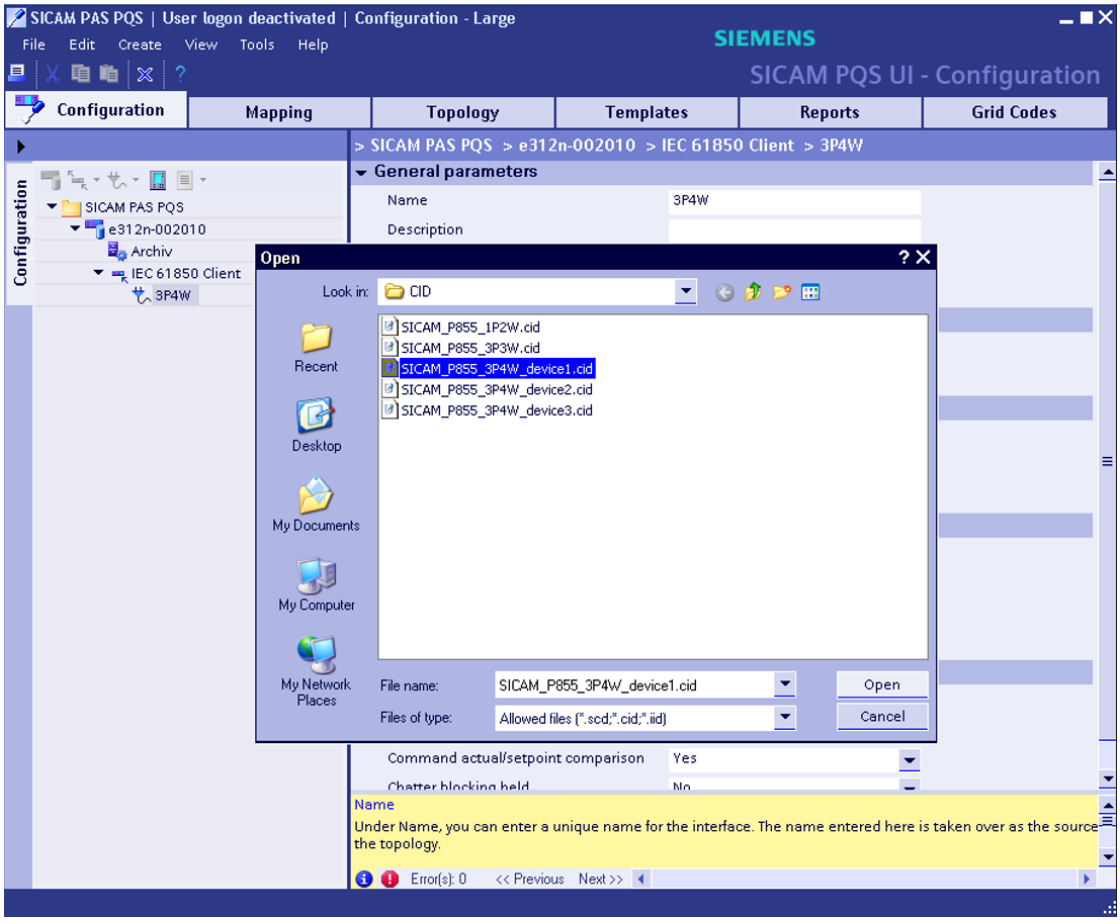
- In the navigation window right-click **SICAM PAS PQS** → **Computer name** (in the example: e312n-002010) → **IEC 61850 Client** → **Interface** (in the example: interface designation 3P4W) → **Import...**.



[sc_08_Import_in_interface, 1, en_US]

Figure 3-13 Import

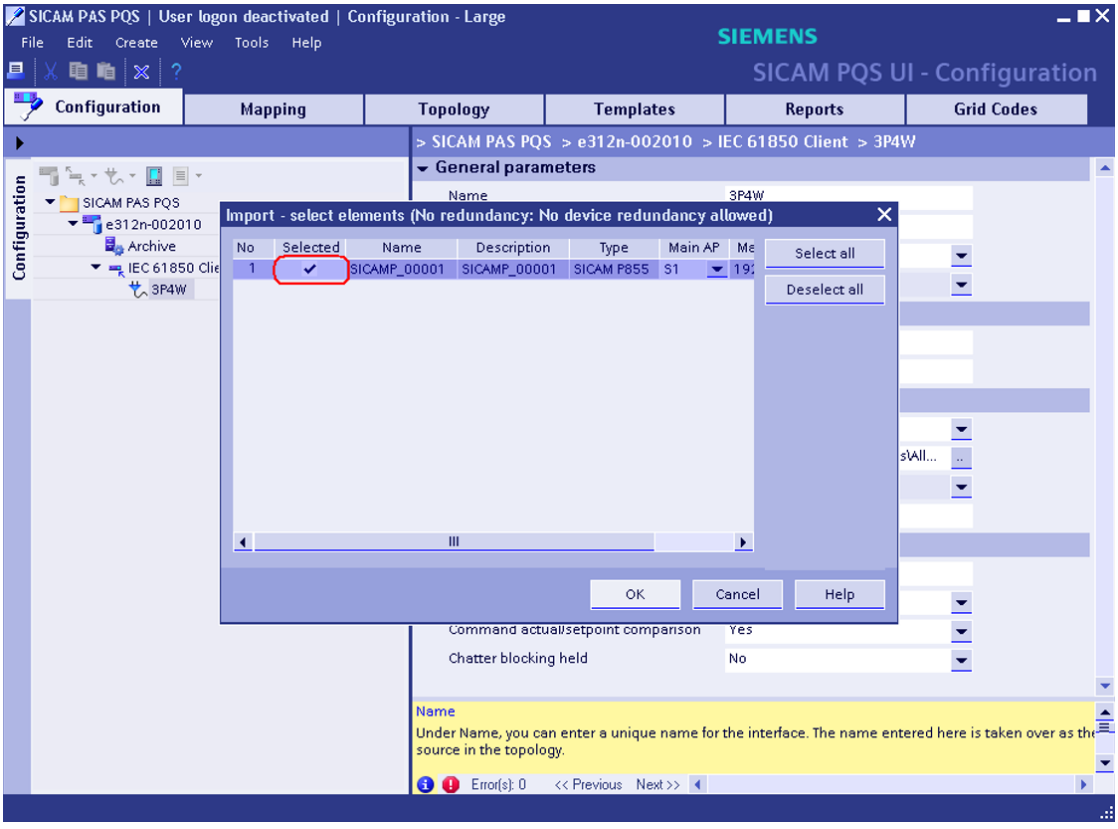
- In the folder select the file previously downloaded from device and then click **Open**.



[sc_importing_CID_file, 1, en_US]

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.

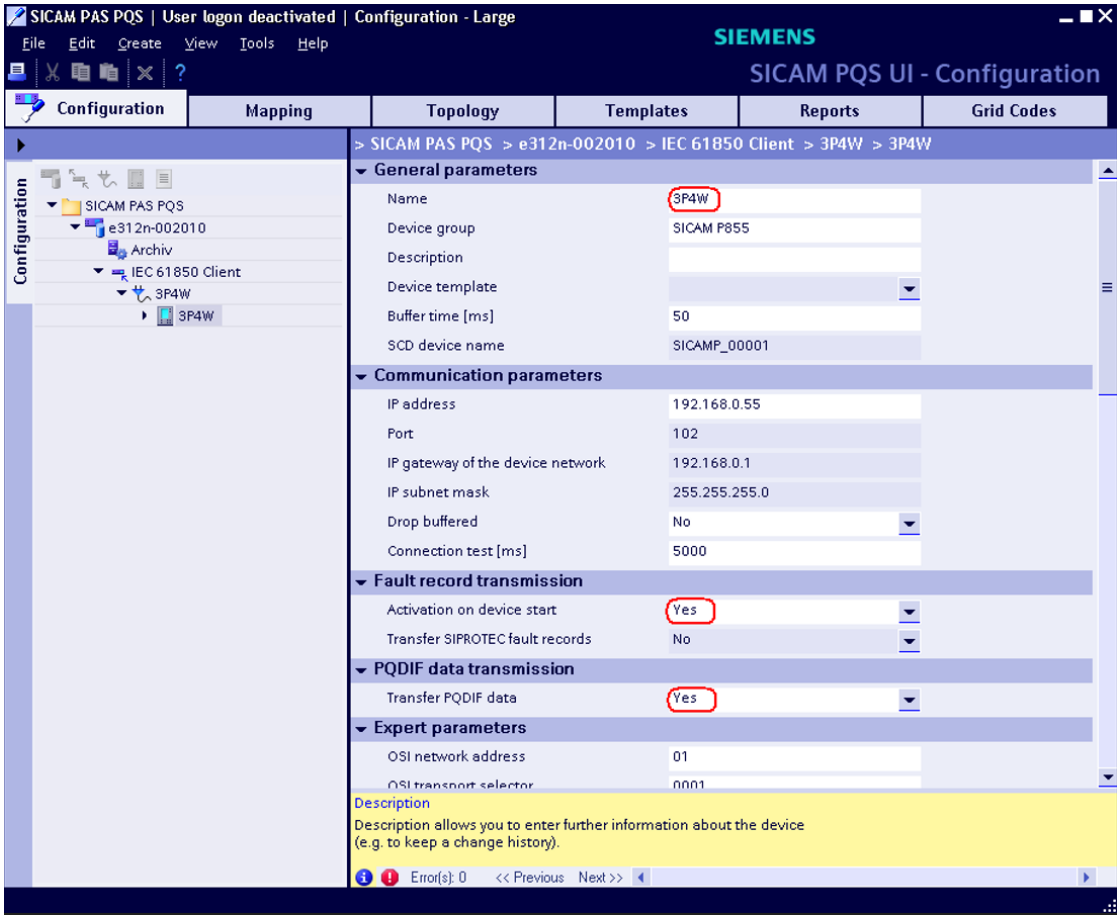


[sc_select_elements_P85x, 1, en_US]

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 values or trend records, select **Yes** in the list box under **PQDIF data transmission → Transfer PQDIF data**.



[sc_SICAM PAS PQS_entries, 1, en_US]

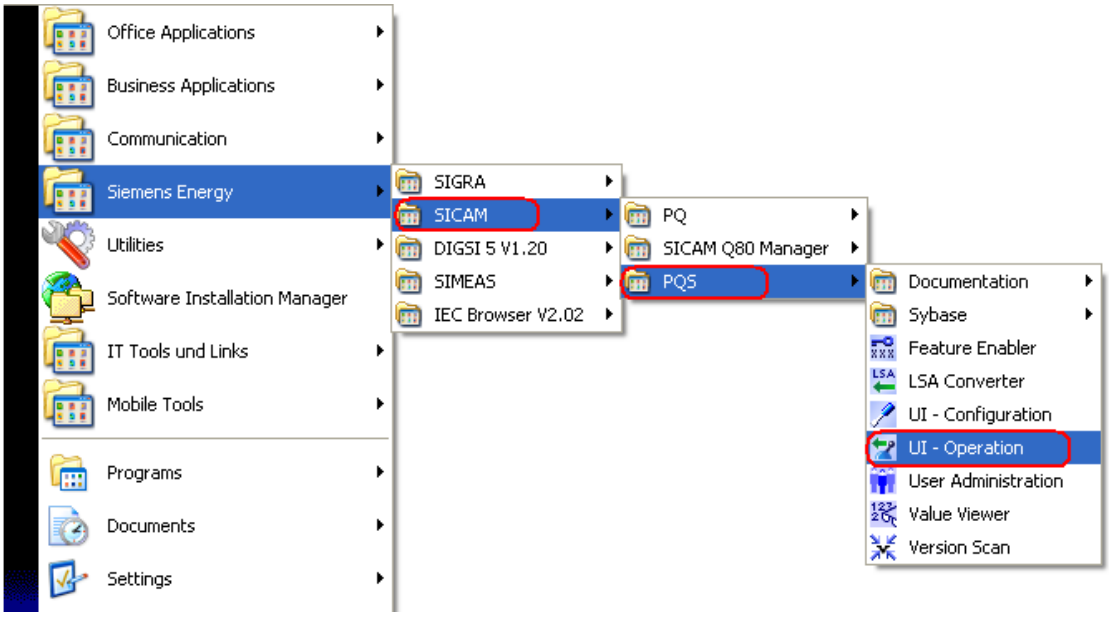
Figure 3-16 Entries

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

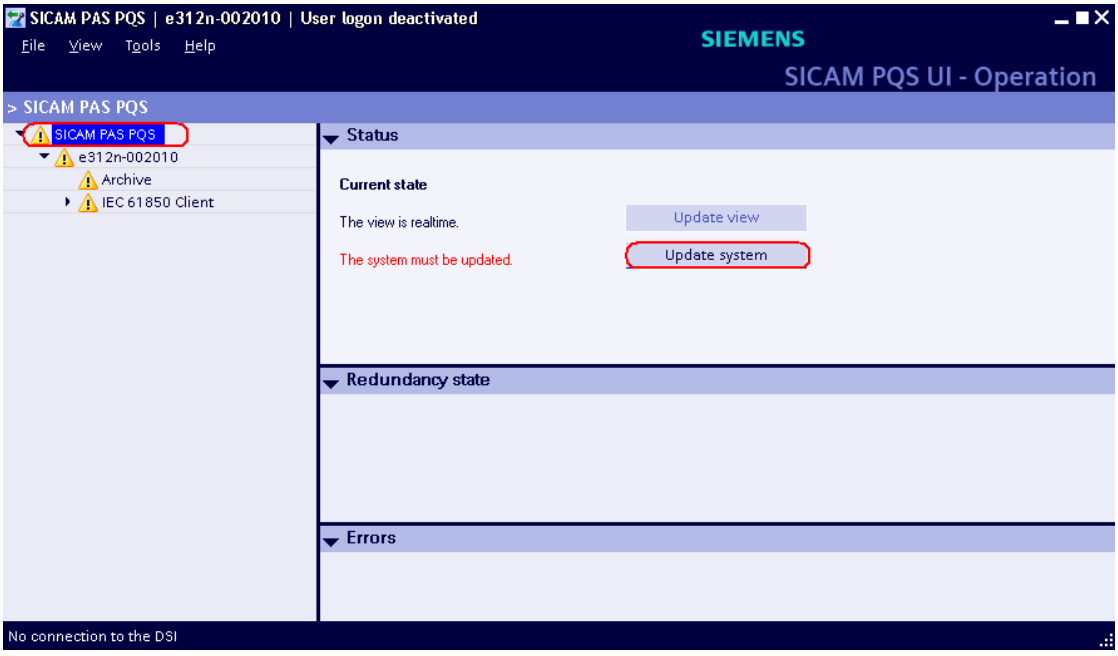
- Start the UI - Operation updating interface in SICAM PQS.



[sc_SICAM_PQS_UI-Operation, 1, en_US]

Figure 3-17 Start UI - Operation

- Click **Update system**.



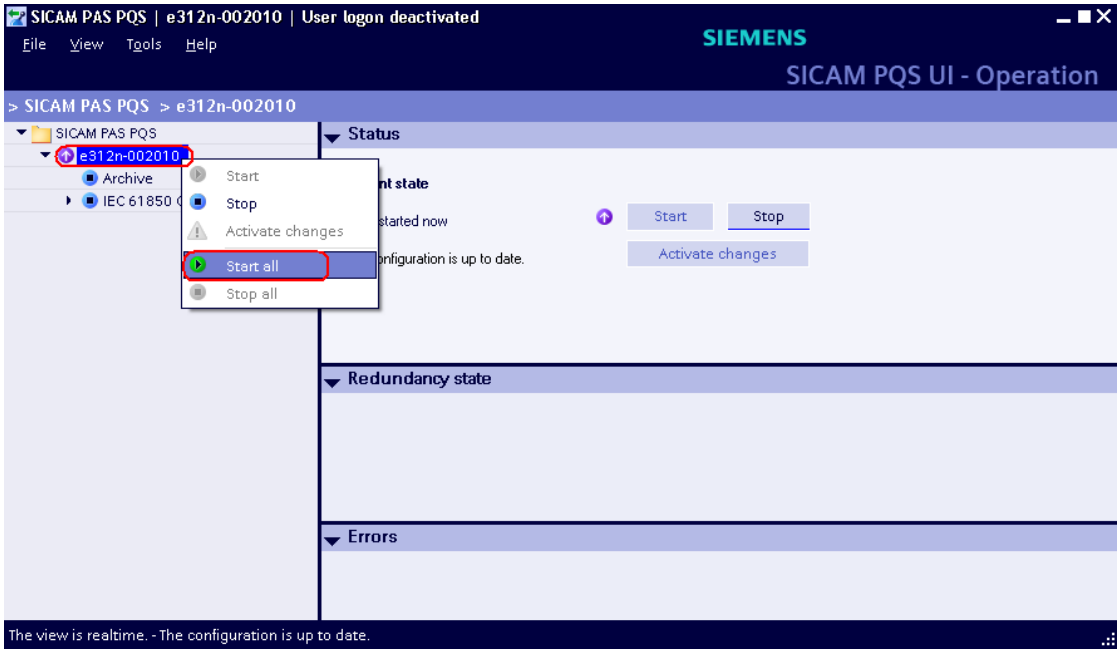
[sc_11_System_update, 1, en_US]

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.

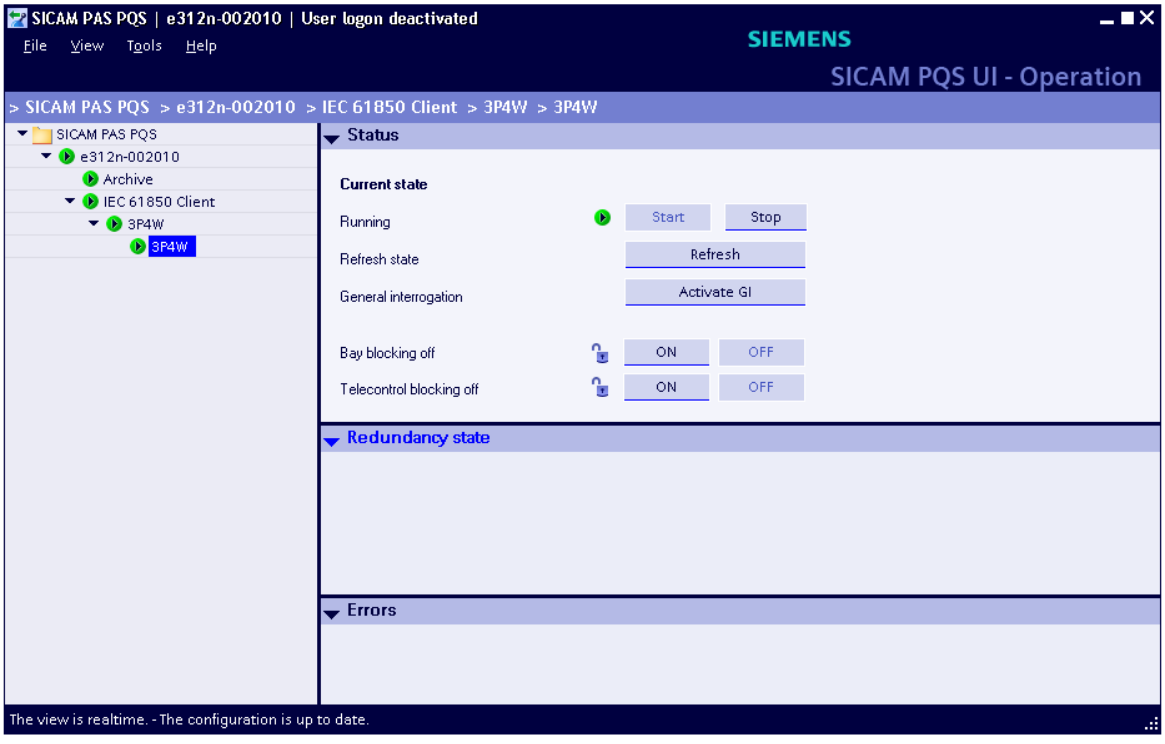
- In the navigation window right-click your **Computer name** and subsequently **Start all**.



[sc_12_Start, 1, en_US]

Figure 3-19 Starting the System

The current system status is displayed in the following window.

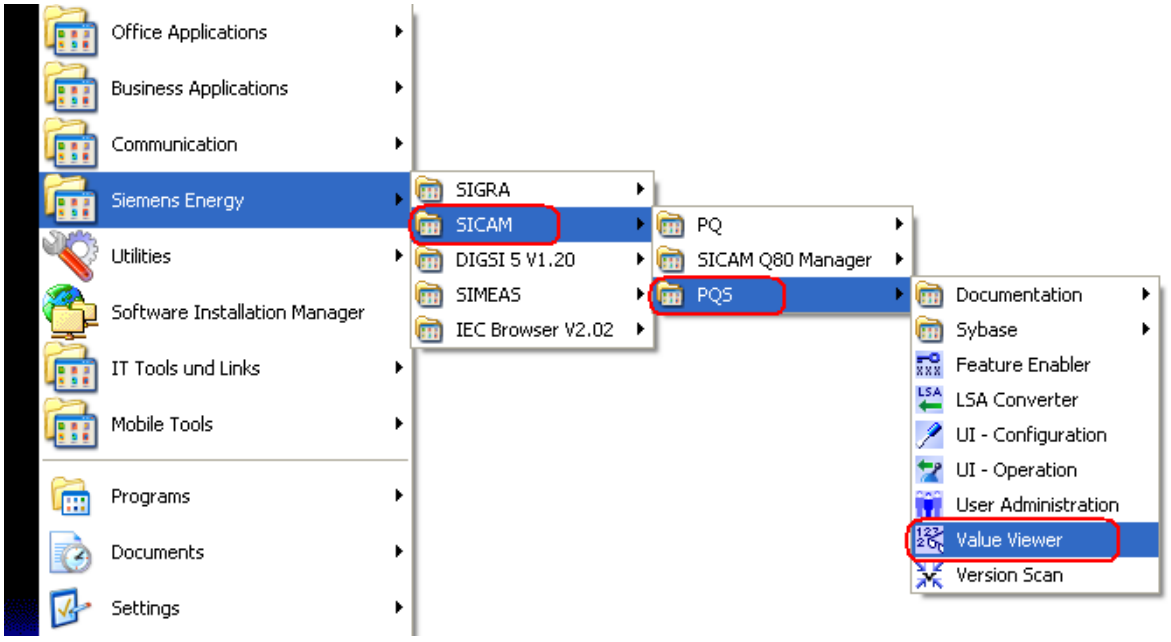


[sc_13_current_status, 1, en_US]

Figure 3-20 Current System Status

3.5 Viewing Measured Values in Value Viewer

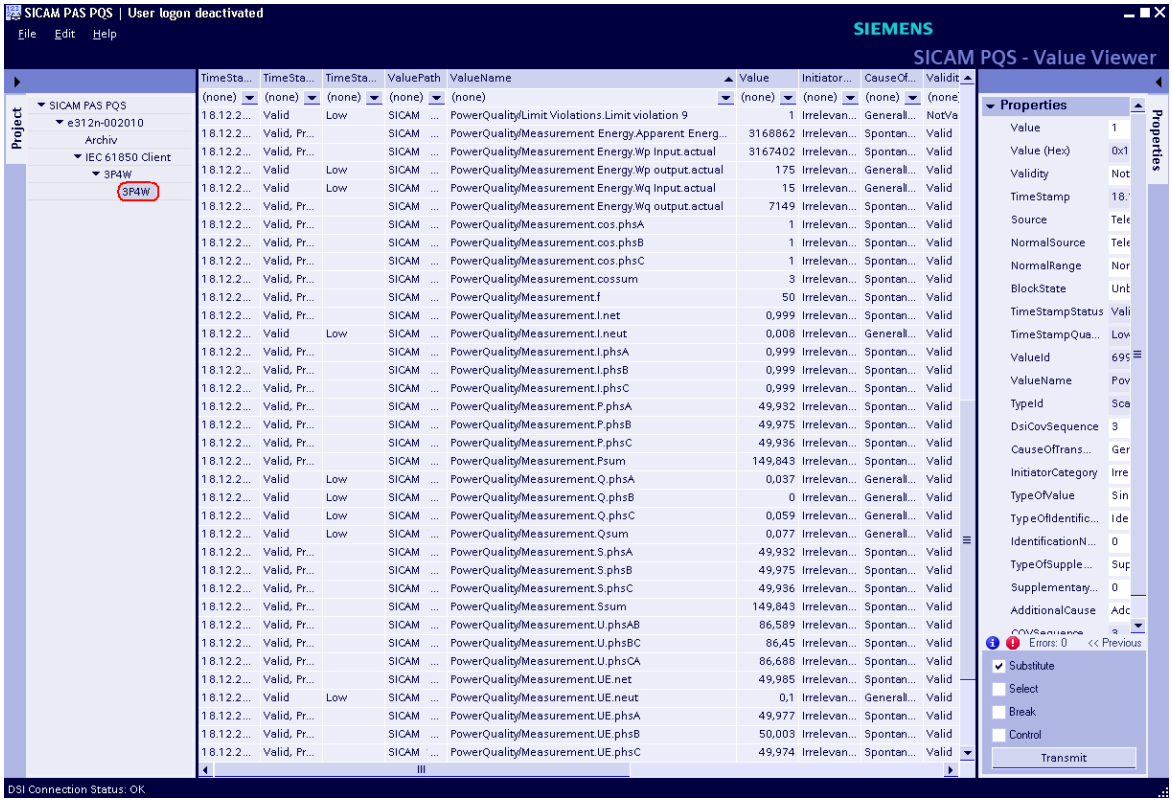
- Start the **Value Viewer** in **SICAM PQS**.



[sc_14_Start_Value_Viewer, 1, en_US]

Figure 3-21 Selecting Value Viewer

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



[sc_15_View_in_Value_Viewer, 1, en_US]

Figure 3-22 Measured Values Display in Value Viewer

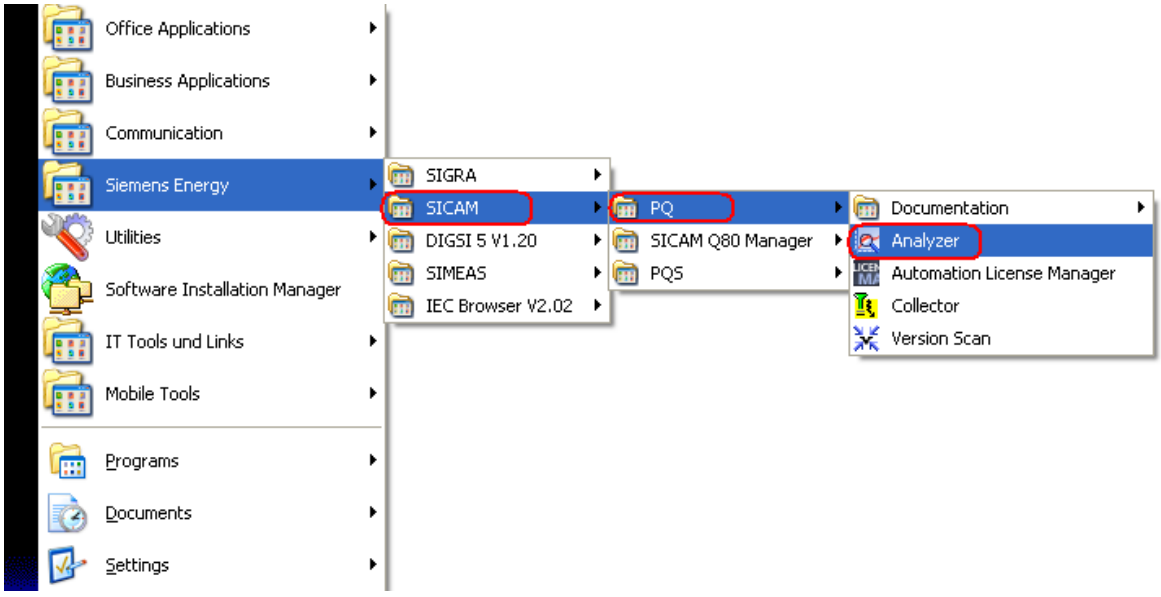
3.6 Graphic Display in PQ Analyzer

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:



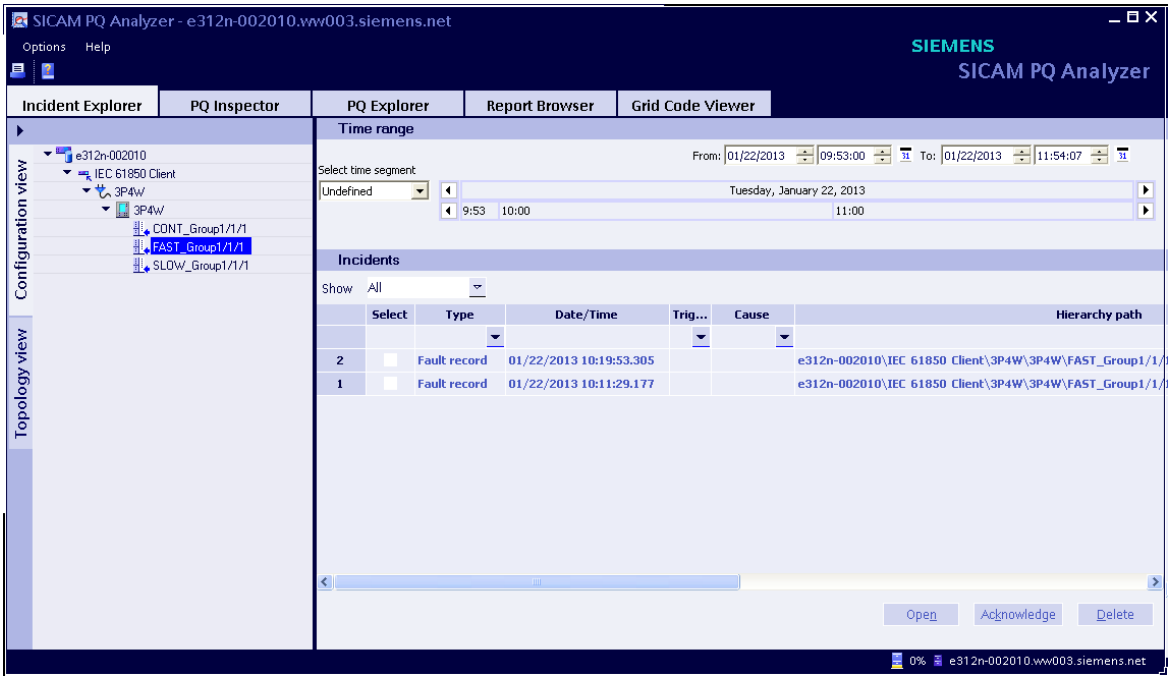
[sc_16_PQ-Analyzer_opend, 1, en_US]

Figure 3-23 Starting PQ Analyzer

Example of Displaying Fault Records

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

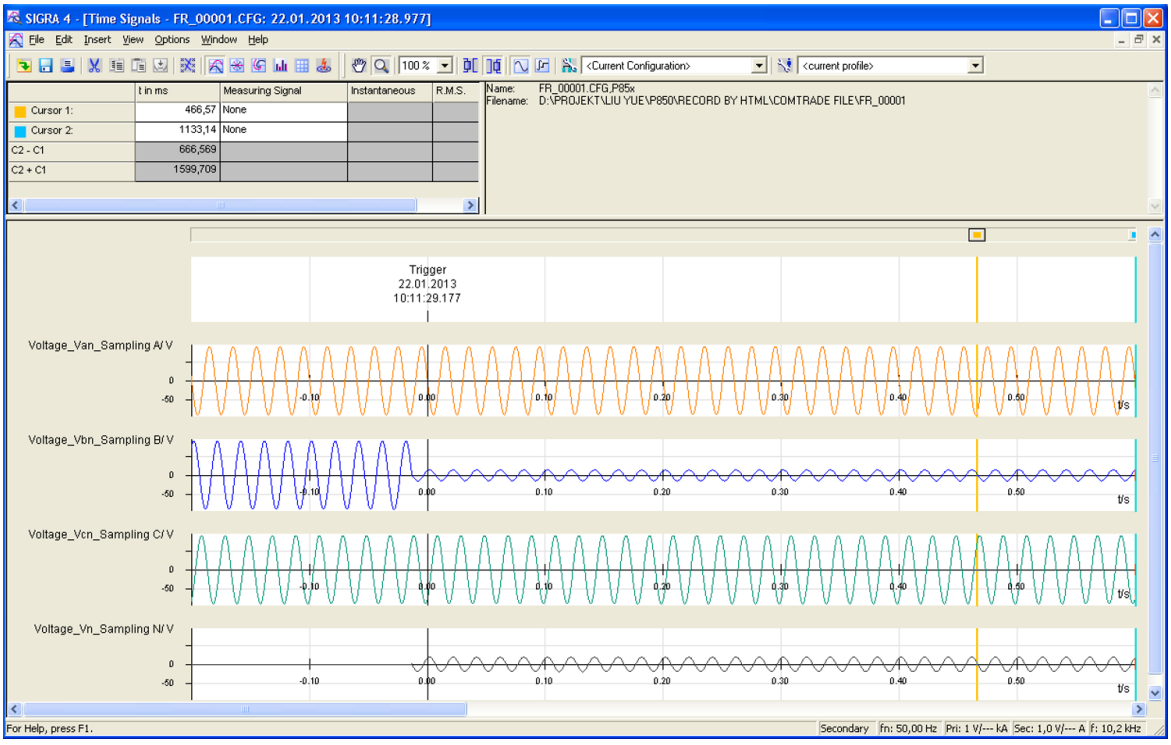
- Select the fault record you want to display graphically and click **Open**.



[sc_17_GUI_COMTRADE-Data, 1, en_US]

Figure 3-24 Window of the PQ Analyzer

The selected fault record is displayed.



[sc_graphic_display, 1, en_US]

Figure 3-25 Display of a Fault Record

Glossary

AC

Alternating **C**urrent

ARP

Address **R**esolution **P**rotocol: Network protocol

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

COMTRADE

COMmon format for **TRA**nsient **D**ata **E**xchange

DHCP

Dynamic **H**ost **C**onfiguration **P**rotocol enables the network configuration to be assigned to the devices by a DHCP server

Ethernet

Cable-based data network technology for local data networks

Holding register

Area for representing data in Modbus communication

IP

Internet **P**rotocol

IP address

Addresses in computer networks based on the Internet protocol

Limit violation

A value exceeding or falling under a parameterized limiting value

MBAP

Mod**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.

NaN

Not **a** **N**umber means **invalid**: Result of an invalid computing operation

NTP

Network **T**ime **P**rotocol: Standard for synchronizing clocks in computer systems using packet-based communication networks

RJ45

Connector type

RS485

Interface standard for digital, wire-based, differential, serial data transmission

STP

Shielded **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.

TCP/IP

Transmission **C**ontrol **P**rotocol/**I**nternet **P**rotocol: Family of network protocols

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