SIEMENS

# SICAM AI Unit (20-mA Input Acquisition Device)

## 7XV5674

Device Manual



E50417-G1140-C492-A2

**NOTE**

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



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# Preface

### Purpose of this Manual

This manual describes the application, functions, installation, commissioning and operation of the SICAM AI Unit 7XV5674.

### Target Group

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

### Scope of Validity of this Manual

This manual is valid for the SICAM AI Unit 7XV5674.

### Further support

You find current information (e.g. new features and modifications) about the SICAM AI Unit in the readme file:

https://w3.siemens.com/smartgrid/global/en/products-systems-solutions/Protection/accessories/input-output-devices/Pages/7XV5674.aspx#

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

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

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### Training courses

If you are interested in our current training program, please contact our training center:

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Internet: http://www.siemens.com/poweracademy

**Notes On Safety**

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

These notes are highlighted with a warning triangle and different keywords indicating different degrees of danger.

## DANGER

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

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

## WARNING

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

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

## CAUTION

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

✧ Follow all advice instructions to prevent minor injury.

## NOTICE

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

✧ Follow all advice instructions to prevent damage to property.

**NOTE**

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

**Personnel Qualified in Electrical Engineering**

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

**Use as Prescribed**

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

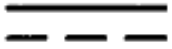
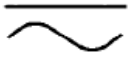
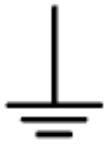
If the device is not used in accordance with the Product Information and this manual, the scheduled protection is impaired.

Correct and safe operation of the product requires adequate transportation, storage, installation, and mounting as well as appropriate use and maintenance.

During the operation of electrical equipment, it is unavoidable that certain parts of this equipment will carry dangerous voltages. Severe injury or damage to property can occur if the appropriate measures are not taken:

- Before making any connections at all, ground the equipment at the PE terminal.
- Hazardous voltages can be present on all switching components connected to the power supply.
- Even after the supply voltage has been disconnected, hazardous voltages can still be present in the equipment (capacitor storage).
- Equipment with current transformer circuits must not be operated while open.
- The limit values indicated in the manual and the Product Information must not be exceeded; this also refers to testing and commissioning.

## Used Symbols

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

**Statement of Conformity**

| | |
|---|---|
| CE | This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Council Directive 2004/108/EC) and concerning electrical equipment for use within specified voltage limits (Low-voltage Directive 2006/95/EC).<br>This conformity has been established by means of tests conducted by Siemens AG according to the Council Directive in agreement with the generic standards EN 61000-6-2 and EN 61000-6-4 for the EMC directives, and with the standard EN 61010-1 for the low-voltage directive.<br>The device has been designed and produced for industrial use.<br>The product conforms to the standard EN 60688. |

**Further Standards**

| This product is UL-certified to Standard UL 61010-1, 3rd edition, based on the specification stated in chapter 13.1 (Technical Data). UL File No.: E228586. | |
|---|---|
| c UL US LISTED | Open-type Measuring Equipment<br>2UD1 |

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

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

# Open Source Software

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

These Open Source Software files are protected by copyright. Your compliance with those license conditions will entitle you to use the Open Source Software as foreseen in the relevant license. In the event of conflicts between Siemens license conditions and the Open Source Software license conditions, the Open Source Software conditions shall prevail with respect to the Open Source Software portions of the software.

The Open Source Software is licensed royalty-free. Insofar as the applicable Open Source Software License Conditions provide for it you can order the source code of the Open Source Software from your Siemens sales contact - against payment of the shipping and handling charges - for a period of at least 3 years since purchase of the Product. We are liable for the Product including the Open Source Software contained in it pursuant to the license conditions applicable to the Product. Any liability for the Open Source Software beyond the program flow intended for the Product is explicitly excluded. Furthermore any liability for defects resulting from modifications to the Open Source Software by you or third parties is excluded. We do not provide any technical support for the Product if it has been modified.

# Contents

# 1 User Information

### Application

The SICAM AI Unit 7XV5674 is used for the acquisition of analog signals from automation processes and transmission of measured values to a connected supervisory system or control center over communication protocol.

The SICAM AI Unit 7XV5674 can support diverse applications. For acquiring DC field signals, SICAM AI Unit 7XV5674 can be applied in the following application fields:

- Protection
- SCADA
- DMS
- EMS systems
- GIS (Gas Insulated Switchgear) - gas pressure monitoring
- Other industrial processes

For example 4-mA to 20-mA signals coming from transducers (for example for monitoring of: power, temperatures, pressure, and position) are delivered over standard protocol for further processing, as visualization or connection to other automation processes.

The DC inputs from SICAM AI Unit 7XV5674 can be parametrized to support the following ranges:

- DC 0 mA to 20 mA
- DC 4 mA to 20 mA

The measuring accuracy amounts to 0.2 % of the rated value (20 mA) under reference condition (see chapter 13.2). The measuring accuracy amounts to 1.0 % of the rated current (20 mA) under environmental impact.

The integrated Web server allows you to configure the parameters via HTML pages using a Web browser.

### Measurands

Only direct currents are measured with SICAM AI Unit. The measurement cycles on the board 1 and board 2 are carried out simultaneously. A complete measurement cycle amounts to 642 ms for 6 channels. The measurement of one channel amounts to 107 ms and is repeated after 642 ms (see chapter 4).

For more detailed information on the measurands and measuring ranges, refer to chapter 4.2.

### Communication

To communicate with the control center and other peripheral devices, the device features an Ethernet interface and optionally a serial interface (RS485 or optical).

Via Ethernet, the following functions are supported:

- Device parameterization
- Transmission of measured data
- Transmission of indications
- Time synchronization via NTP

The communication protocols are HTTP and Modbus TCP or IEC 61850.

The serial interface as RS485 or optical interface supports the following functions:

- Transmission of measured data
- Transmission of indications
- Time synchronization via fieldbus

Depending on the device version, you can use either the Modbus RTU or the SIPROTEC RTU 20 mA communication protocol.

**NOTE**

The communication protocol SIPROTEC RTU 20 mA is only supported by SIPROTEC 4.

With the Ethernet switch that is integrated in the device, further network components can be cascaded via a Y cable, and can therefore also be incorporated in an existing network with IEC 61850 or another Ethernet protocol.

### Time Synchronization

During operation SICAM AI Unit needs the date and time for all time-relevant processes. This ensures that a common time basis exists when communicating with peripheral devices and enables time stamping of the process data. The following types of time synchronization can be executed:

- External time synchronization via Ethernet NTP (preferred)
- External time synchronization via fieldbus using the Modbus RTU communication protocol
- Internal time synchronization via RTC (if external time synchronization is not available)

### Parameterization

No special software is needed for parameterization. You can set the parameters from your computer via HTML pages and a Web browser. Internet Explorer 6 (or higher) is necessary for this purpose.

# 2 Overview

# 2.1 Versions of SICAM AI Unit 7XV5674

**Basic Version (Minimum Equipment)**

The SICAM AI Unit 7XV5674 is used for the acquisition of analog signals from automation processes and for the transmission of measured values to a connected supervisory system or control center over communication protocol. The modules of the device detect, calculate, analyze and transmit measured values. In the basic version, the device is characterized as follows:

Device type:

- DIN rail mounted device
- Plastic case 96 mm x 96 mm x 100 mm (W x H x D)
- Protection class IP20

Input and output circuits:

- Twelve 20-mA inputs for direct-current measurements

Communication:

- Via Ethernet

**Variants**

SICAM AI Unit is available in various variants:

- Serial interface
  - Without serial interface
  - With RS485 interface
  - With optical interface
- Communication if RS485 or optical interface exists
  - With Modbus RTU protocol and SIPROTEC RTU 20 mA protocol
- Communication via Ethernet
  - With integrated Ethernet switch: Modbus TCP protocol
  - With integrated Ethernet switch: Modbus TCP protocol and IEC 61850 protocol

**SICAM AI Unit Variants**


SICAM AI Unit with DC Inputs
and RS485 Interface (D-sub Socket)


SICAM AI Unit with DC Inputs
and Optical Interface (ST connector)


SICAM AI Unit with DC Inputs
without serial Interface

Fig. 2-1 SICAM AI Unit Variants

# 2.2 Ordering Information, Scope of Delivery and Accessories

### Ordering Information

Use the following ordering code to order the SICAM AI Unit 7XV5674:

| Description | Order No. / MLFB | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SICAM AI Unit | | | | | | | | | | | | | | | | |
| | 1 2 3 | 4 | 5 | 6 | 7 | | 8 | 9 | 10 | 11 | 12 | | 13 | 14 | 15 | 16 |
| | 7XV | 5 | 6 | 7 | 4 | - | 0 | K | K | | 0 | - | | A | A | 1 |
| **Device type** | | | | | | | | | | | | | | | | |
| 12 x 20-mA inputs for SIPROTEC devices<br>DIN rail mounting, protection class IP20<br>Case 96 mm x 96 mm x 100 mm<br>Power supply:<br>DC 24 V to 240 V<br>AC 100 V to 230 V<br>Integrated Web server<br>Ethernet port RJ45 and integrated Ethernet switch<br>UL listing | | | | | | | | | | | | | | | | |
| **Serial interface and communication protocol** | | | | | | | | | | | | | | | | |
| Without serial communication | | | | | | | | | | 0 | | | | | | |
| RS485 interface<br>Serial Modbus RTU and SIPROTEC 20 mA protocol<br>point to point connection | | | | | | | | | | 3 | | | | | | |
| FO interface 820 nm, ST connector<br>Serial Modbus RTU and SIPROTEC 20 mA protocol<br>point to point connection | | | | | | | | | | 4 | | | | | | |
| **Ethernet interface and communication protocol** | | | | | | | | | | | | | | | | |
| Ethernet interface with Modbus TCP/UDP | | | | | | | | | | | | | 1 | | | |
| Ethernet interface with Modbus TCP/UDP and IEC 61850 (GOOSE and Server) | | | | | | | | | | | | | 2 | | | |

Fig. 2-2 Ordering Code for SICAM AI Unit 7XV5674

### Scope of Delivery

The delivery comprises the following components depending on the ordering code:

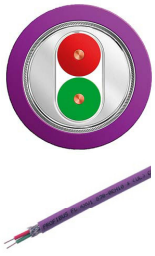
- SICAM AI Unit 7XV5674 according to ordering code (see Figure 2-2)
- Battery (insulated in the battery compartment of the device)
- Product Information E50417-B1050-C541

### Accessories

The following components are optionally available:

- Device Manual E50417-G1140-C492 (download available at www.siprotec.de)
- Y cable, order no. 7KE6000-8GD00-0BA2
- Ethernet patch cables (CAT6)
- RS485 cables for SIPROTEC devices according to Table 2-1:

Table 2-1 Standard RS485 Cables

| Standard RS485 Cable | Cable Length | Order Number |
|---|---|---|
|  | Maximum 1000 m<br>(minimal order quantity 20 m) | 6XV1 830-0EH10 |
| | Length preferred 20 m | 6XV1 830-0EN20 |
| | Length preferred 50 m | 6XV1 830-0EN50 |
| | Length preferred 100 m | 6XV1 830-0ET10 |
| | Length preferred 200 m | 6XV1 830-0ET20 |

- RS485 bus connectors for SIPROTEC devices according to Table 2-2:

Table 2-2 RS485 Bus Connectors

| RS485 Bus Connector | Description | Order Number |
|---|---|---|
|  | SIMATIC DP, bus connector with tilted cable outlet, 15.8 mm x 54 mm x 39.5 mm (WXHXD), terminating resistor with isolating function, without PG socket | 6ES7972-0BA42-0XA0 |
|  | SIMATIC DP, bus connector with tilted cable outlet, 15.8 mm x 54 mm x 39.5 mm (WXHXD), terminating resistor with isolating function, with PG socket | 6ES7972-0BB42-0XA0 |

- Ordering information for ready to use fiber-optic cables (fiber-optic cable) is available on the Internet (SIPROTEC download area) under http://www.siprotec.com under accessories -> 6XV81xx.
- Further notes on device accessories and their environment can be found under http://www.siprotec.com.

# 3 Device Design

# 3.1 Mechanical Design

The electrical modules are installed in a plastic case with the dimensions 96 mm x 96 mm x 100 mm (W x H x D). The case is prepared for mounting on a DIN rail.

The top side of the device accommodates the RJ45 Ethernet connector with 2 LEDs and 4 additional LEDs. At the cover of the battery compartment there is a labeling strip for the configurable LEDs H1/H2/ERROR and a battery symbol that indicates the polarity. The name plate is also located on the top side and provides among other information the most important rated data of the device. A lithium battery is located under the removable cover of the battery compartment.

The terminals for connecting all inputs, for the supply voltage and the protective grounding are located on the terminal side. The number, type and position of the terminals differs according to device version and is described in detail in chapter 5.3. According to the ordering information (see chapter 2.2 ), SICAM AI Unit can also be equipped with a D-sub socket as RS485 interface (see Figure 3-1).

The snap-in unit is mounted in the center of the DIN rail side. The IP Addr. push-button is located in the lower right corner of the DIN rail side. Pressing it (> 3 s) activates the factory-set default IP address. The default IP address and the default subnet mask are imprinted on the side panel.

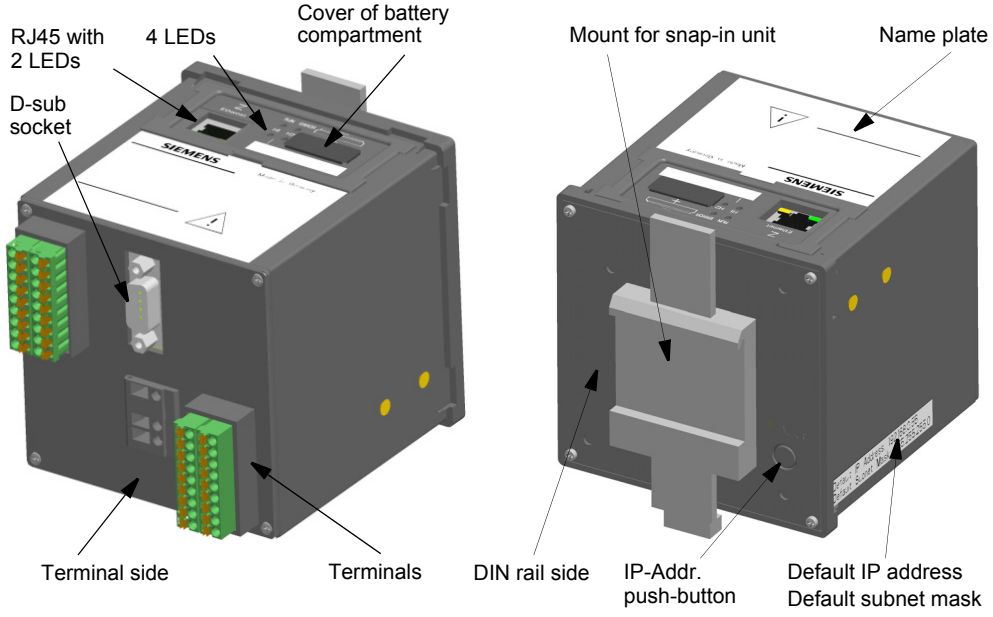



Fig. 3-1 Design of the SICAM AI Unit

# 3.2 Electrical Design

SICAM AI Unit contains the following electrical modules depending on the device version:

- Digital signal processor (DSP)
- Twelve 20-mA inputs for direct-current measurements
- Supply voltage
- Serial interface (RS485 or optical according to order version)
- Ethernet interface with integrated Ethernet switch

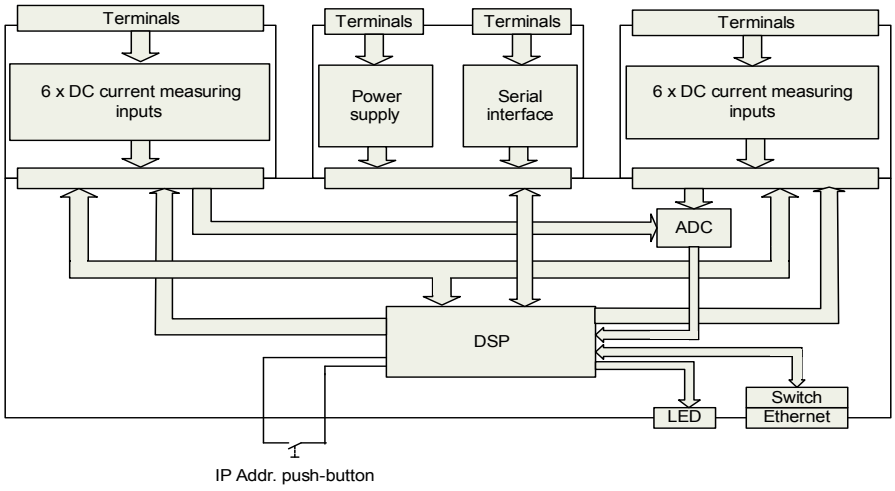



Fig. 3-2 Block Diagram SICAM AI Unit

# 4 Measurands

# 4.1 General

SICAM AI Unit offers twelve 20-mA inputs referring to the standard IEC 60688. The 20-mA inputs are divided in 2 groups, on 2 boards each with 6 channels.

# 4.2 Measurands and Calculated Measurands

| Measurands | Measuring Range | Tolerance Limits [1] |
|---|---|---|
| Channel 1 to 12<br>(current measurement) | 0 mA to 20 mA<br>4 mA to 20 mA | ± 0.2 % |
| Channel 1 to 12<br>(overdriving inputs) | -0.2 mA to 20.2 mA<br>3.8 mA to 20.2 mA | |

1) Tolerance limits referred to the rated current under reference conditions (see Chapter 13.2)
The measuring accuracy amounts to 1.0 % of the rated current (20 mA) over the full range of operating conditions including EMC.

| Calculated Measurands | Measuring Range |
|---|---|
| Channel 1 to 12<br>(10 s mean value) [1] | 0 mA to 20 mA<br>4 mA to 20 mA |
| Channel 1 to 12<br>(1 min mean value) [2] | 0 mA to 20 mA<br>4 mA to 20 mA |
| Channel 1 to 12<br>(1 h mean value) [3] | 0 mA to 20 mA<br>4 mA to 20 mA |
| Channel 1 to 12<br>(24 h mean value) [4] | 0 mA to 20 mA<br>4 mA to 20 mA |

1) The mean-value range begins always to the full 10 s.
2) The mean-value range begins always to the full 1 min.
3) The mean-value range begins always to the full 1 h.
4) The mean-value range begins always at 0 o'clock device time.

# 4.3 Measuring Times

The measurement cycles on the board 1 and board 2 are carried out simultaneously. A complete measurement cycle amounts to 642 ms for 6 channels. The measurement of one channel amounts to 107 ms and is repeated after 642 ms.

# 5 Getting Started

# 5.1 Unpacking, Inspecting the Delivery and Installing the Battery

### Unpacking

The 7XV5674 has been safely packed for transport in the factory. Unpack the device with care and do not use force. Use an appropriate tool if necessary. After unpacking, inspect the device visually for any mechanical defects.

**NOTE**

If the device has been damaged during transport, do not connect and operate it.

Observe any additional notes enclosed with the packaging.

Keep the transport packaging for future transport.

### Inspecting the Delivery

After unpacking, first compare the packing list against your original purchase order to check that the delivered device has the desired rated data and functions and that all necessary and ordered accessories are enclosed.

### Installing the Battery

If you want to operate the device immediately after the delivery, first insert the battery before beginning the installation. Upon delivery the battery is insulated in the battery compartment of the device.

If you want to operate the device later, insert the battery only just before you intend to use the device.

**NOTE**

The battery powers the battery-buffered memory (SRAM) and the real-time clock (RTC). But the device can still be operated when no battery is inserted or when the battery is discharged. If, however, the supply voltage is lost, all metered energy values and error reports are deleted and the real-time clock is reset (2000-01-01 00:00).

Customer-specific parameters are permanently stored in the Flash-EPROM even without a battery.

To insert the battery, observe the notes in the supplied Product Information E50417-B1050-C541 and proceed as follows:

✧ Lever the cover of the battery compartment out of the socket with a suitable tool (e.g. precision engineer screwdriver 2.0 mm).

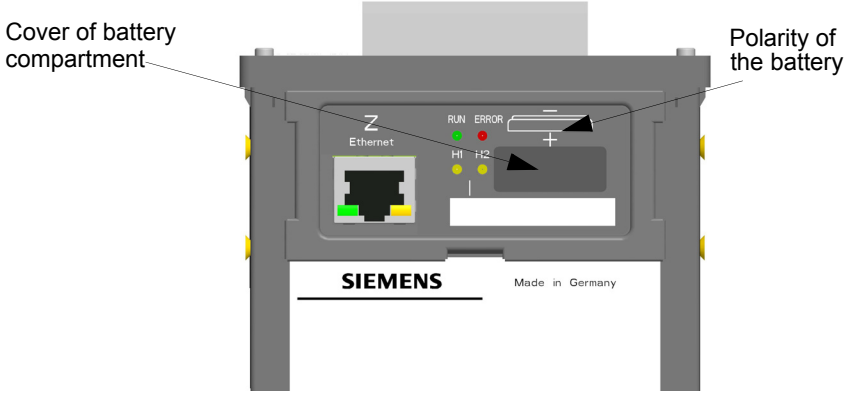



Fig. 5-1 Top Side of the SICAM AI Unit

- ✧ Take the wrapped battery out of the battery compartment.
- ✧ Remove the plastic foil from the battery.
- ✧ Insert the battery into the battery compartment with the polarity imprinted on the top side of the device (see Figure 5-1).
- ✧ Close the cover of the battery compartment.

**NOTE**

For additional information on replacing used battery, refer to the product information (component of the device delivery).

Information on battery life can be found in 13.1.5.

**WARNING**

Warning of incorrect treatment of the lithium battery (type PANASONIC CR2032 or VARTA 6032 101 501) or the use of an incorrect battery type. In the case of incorrect treatment or the wrong battery type, the battery may burn, explode or trigger a chemical reaction.

See product information for type of battery to be used.

**Non-observance may lead to death or serious injury.**

- Installing the battery or replacing it may only be carried out by trained personnel (see preface) who are familiar with and observe the safety requirements and precautions.
- Do not reverse the polarity of the battery.
- Do not attempt to open the battery.
- Do not attempt to recharge the battery.
- Servicing of the circuitry involving the batteries and replacement of the lithium batteries shall be done by a trained technician.
- Replace battery with VARTA 6032 101 501 or PANASONIC CR2032 only. Use of another battery may present a risk of fire or explosion. See manual for safety instructions.
- Caution: The battery used in this device may present a fire or chemical burn hazard if mistreated. Do not recharge, disassemble, heat above 100 °C (212 °F) or incinerate.
- Dispose of used battery promptly. Keep away from children.

# 5.2 Assembly

## 5.2.1 General Assembly Notes

SICAM AI Unit is intended to be installed on a DIN rail, e.g. in a control cabinet.

**WARNING**

Warning: do not touch any voltage-carrying parts

**Non-observance may lead to death or serious injury.**

✧ After installation of the device and wiring, close the control cabinet.

**NOTE**

For operating heights > 2000 m, a reduction of the test voltages according to IEC 60255-5 / 60870-2-1 is necessary.

- The installation site must be vibration-proof. The permitted ambient temperature must be observed (see the technical data in  13).
- Operating the device outside the permitted operating temperature range can lead to measuring errors and device failure.
- The terminal of the supply voltage is designed for conductor cross-sections of 1.5 mm² (AWG 16) to 2.5 mm² (AWG 14) max.
- The terminal of the 20-mA inputs (T) and (Q) are designed for conductor cross-sections of 0.2 mm² (AWG 24) to 1.5 mm² (AWG 16) max (see also Terminals).
- The device must not be exposed to condensation during operation.
- The device must be installed in a location where it is not exposed to direct sunlight and strong temperature variations.

## 5.2.2 Assembly

Mount the SICAM AI Unit to a DIN rail according to EN 60750 in the following way:

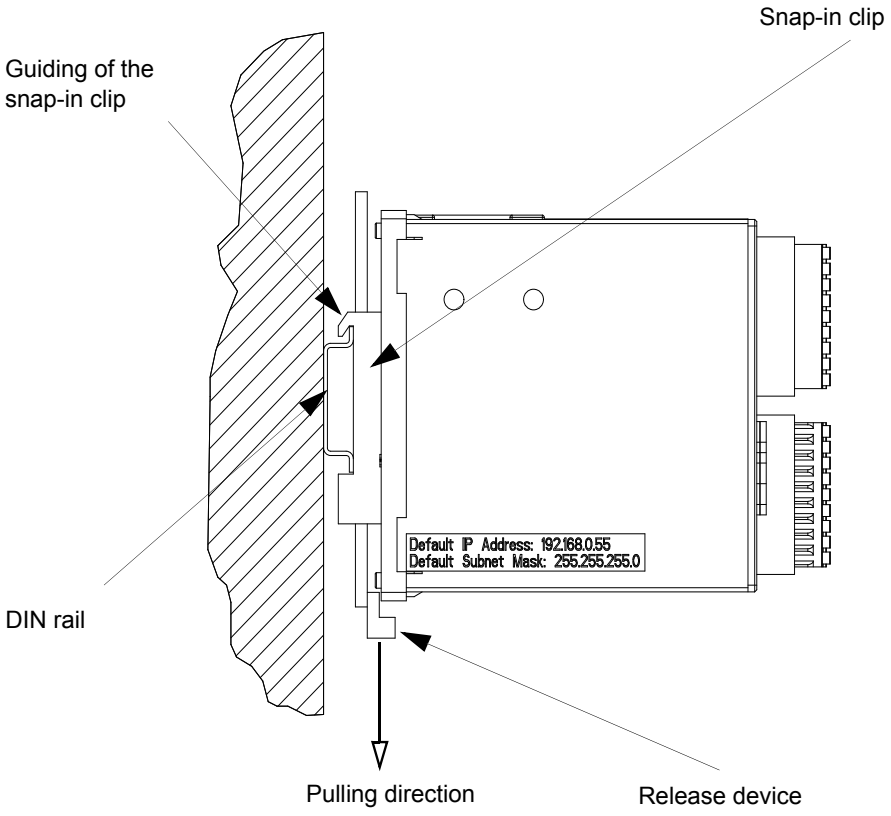



Fig. 5-2 Mounting on a DIN Rail

- ✧ Pull down the release device at the snap-in clip and hold it in this position.
- ✧ Slide the device with the guiding of the snap-in clip onto one side of the DIN rail.
- ✧ Move the device into the desired position on the DIN rail.
- ✧ Release the release device. The device is now firmly mounted on the DIN rail.

**NOTE**

The snap-in clip is adjusted to a certain height setting by the manufacturer. You can change this setting if necessary. To do so, lever the release device out of its guiding (no special tool required) and move the release device into the desired position. Subsequently, press the release device back into its guiding.

**UL-certification Conditions**

Field Wires of Control Circuits shall be separated from other circuits with respect to the end use requirements!

# 5.3 Electrical Connection

## 5.3.1 Safety Notes

**DANGER**

Hazard due to high voltage

**Non-observance will lead to death or serious injury.**

- Work may only be carried out by trained personnel (see Preface) who are familiar with and observe the safety requirements and precautions.
- Work may never be carried out if there is any dangerous voltage present.
- Deenergize the device.
- **Circuit breaker:** A suitable isolating device shall be connected upstream in order to permit disconnection of the device from the power supply. The circuit breaker must be mounted close to the device, be easily accessible to the user and marked as a circuit breaker for the device.
- Secure the supply voltage with an approved (UL/IEC) fuse: 1.6 A, type C.
- If a melting fuse is used, a suitable approved (UL/IEC) fuse holder has to be used.

**NOTE**

For electrical installations you have to observe and comply with the national and international provisions concerning the installation of electrical power installation and the low voltage directive 2006/95/EG.

- Before commissioning the device, you have to check that all connections are made properly.
- Connect the protective grounding terminal H ⏚ to the protective ground of the switch panel or of the control cabinet.
- Check the polarity of the current measuring inputs.
- Siemens recommends leaving the device for a minimum of 2 hours in the operating room, before using it to allow temperature equalization and to avoid dampness and condensation.

**NOTE**

Before you switch on the supply voltage, verify that the operational data match the rated data on the name plate and the technical data according to 13. This applies in particular to the supply voltage $V_H$.

## 5.3.2 Electrical Connection of SICAM AI Unit

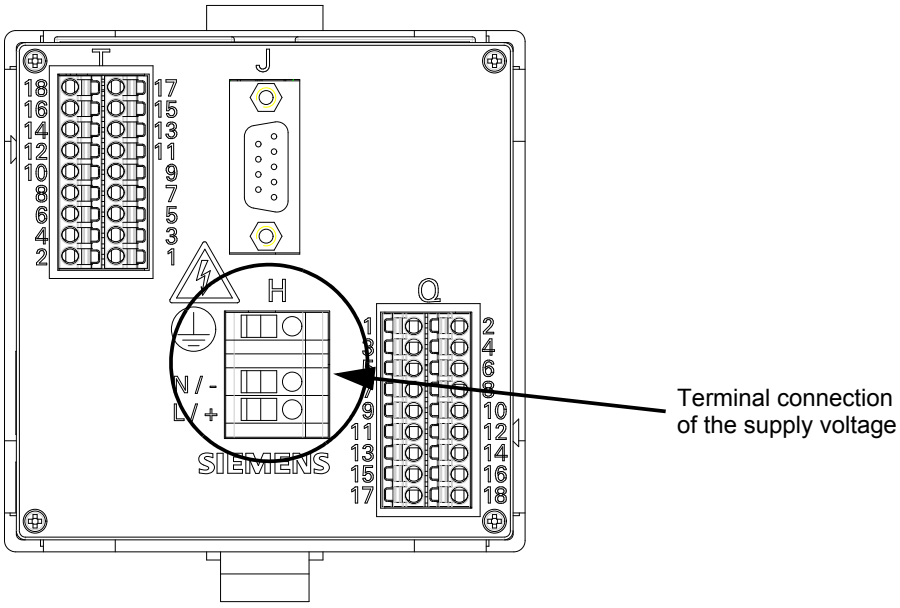



Fig. 5-3 Terminal Connection of the Supply Voltage at the SICAM AI Unit

Connect the cables of the supply voltage on the terminal side of the device at **terminal block H** as follows:

**Supply from the AC Voltage System**

| | |
|---|---|
| Terminal N/-: | Neutral conductor of the supply voltage |
| Terminal L/+: | Phase of the supply voltage |
| Terminal ⏚ : | Protective grounding terminal |

**Supply from a Direct Voltage Source**

| | |
|---|---|
| Terminal N/-: | Negative supply voltage |
| Terminal L/+: | Positive supply voltage |
| Terminal ⏚ : | Protective grounding terminal |

**NOTE**

The grounding on the SICAM AI Unit always has to be connected to the terminal for protective conductor ⏚ (terminal block H).

If several SICAM AI Units are cascaded via the internal Ethernet switch or via the RS485 interface (also in connection with SICAM I/O Units), you must create **a current-carrying grounding capacity of all devices on the communication bus (also, for example, RTU and protection device) on the same grounding potential**.

**NOTE**

The device is provided with Phoenix FMC 1.5/ 9-ST-3.81 plug connector for the (T) and (Q) connections.

**Terminals**

The conductor cross-section for the supply voltage terminal (H) amounts to:

- 1.5 mm² (AWG 16) to 2.5 mm² (AWG 14) without bootlace ferrule
- 1.5 mm² (AWG 16) with bootlace ferrule

| | |
|---|---|
| Tightening torque | 0.4 Nm to 0.5 Nm (3.5 in-lb to 4.5 in-lb) |

The conductor cross-section for the 20-mA input terminals (T) and (Q) amounts to:

- 0.2 mm² (AWG 24) to 1.5 mm² (AWG 16), direct connection of stranded wires without bootlace ferrule is not recommended.

| | |
|---|---|
| Wire stripping length | 10 mm (0.39 in) |
| Material | Cu / E-Cu |

**Communication Interfaces**

| | |
|---|---|
| RS485 interface (J) on the terminal side (if installed in the device model): | RS485 cable with plug connector |
| 820-nm fiber-optic interface (J) on the terminal side (if installed in the device model): | Fiber-optic cable with prepared ST connector, for example 6XV8100 |

**DANGER**

Danger due to Laser radiation class 1

**Non-observance will lead to death or serious injury.**

✧ Do not look into the fiber-optic elements!

| | |
|---|---|
| Ethernet interface (Z) on the top side: | Ethernet patch cable, crossover cable, or a Y cable, when using the internal Ethernet switches |

## 5.4 System Requirements

To operate SICAM AI Unit with a PC or notebook, the following system requirements must be met:

- PC or notebook with Intel Pentium processor (or compatible type); clock frequency min. 800 MHz
- Operating system: Microsoft Windows XP Professional with Internet Explorer 6.0 (or higher)
- Minimum 1 GB RAM primary storage
- VGA display 1024 x 768 with truecolor
- Mouse and keyboard

# 5.5 Access Rights

### Access Rights for Configuration and Maintenance

To determine access rights, you have to set up passwords when configuring the device. You have to specify an activation password and a maintenance password.  7.3.4.4 describes how to set up passwords.

The **activation password** is necessary to enable parameter changes in the device. The **maintenance password** is necessary to make changes in the device using the Maintenance tab.

**NOTE**

If you do not specify new passwords, the factory-set default passwords (see  7.3.4.4) are used.

### Access Rights for Communication

The access rights for the communication via **Ethernet** with **Modbus TCP** protocol are made for port 502 and for the user port. You can assign either full access rights or read-only authorization.  7.3.4.2 describes the settings.

You can also determine the access rights for **serial communication** using the **Modbus RTU** protocol. You can assign either full access rights or read-only authorization.  7.3.4.3 describes the settings.

No access rights are required when **serial communicating** via the **IEC 60870-5-103** protocol.

Communication via **Ethernet** with **IEC 61850** protocol and **serial communication** with **SIPROTEC RTU 20 mA** protocol do not require any access rights.

# 5.6 Description of the LEDs

7XV5674 automatically monitors the functions of its hardware and software components. The LEDs on the top side of the housing indicate the current device status.

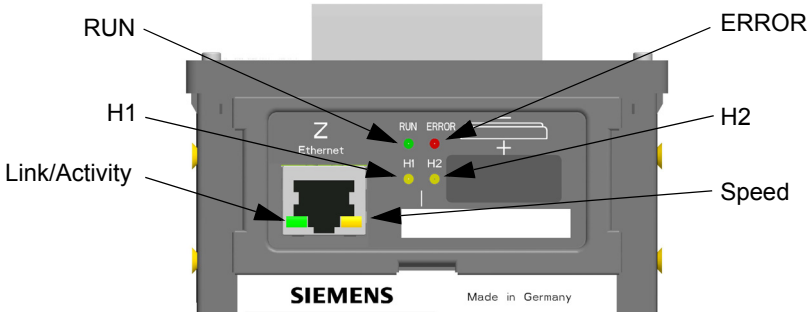



Fig. 5-4 Designation of the LEDs

Depending on the status, the LEDs can be permanently on, flash or off. The states are described in 12.3. The meaning of the LEDs during normal operation is explained in the following table:

Table 5-1 Meaning of the LEDs

| LED | Meaning |
|---|---|
| RUN | Device active |
| ERROR | Indicates an error and indicates according to parameterization |
| H1 | According to parameterization |
| H2 | According to parameterization |
| Ethernet switch turned off:<br>Link/Activity (green) | LED on: Ethernet link is up<br>LED flashing: Ethernet link is up and data are transferred<br>LED off: no Ethernet partners connected |
| Ethernet switch turned off:<br>Speed (yellow) | LED on: 100 Mbit/s<br>LED off: 10 Mbit/s |
| Ethernet switch turned on:<br>Link/Activity channel 2 (green) | LED on: Ethernet link is up<br>LED flashing: Ethernet link is up and data are transferred<br>LED off: no Ethernet partners connected |
| Ethernet switch turned on:<br>Link/Activity channel 1 (yellow) | LED on: Ethernet link is up<br>LED flashing: Ethernet link is up and data are transferred<br>LED off: no Ethernet partners connected |

# 5.7 Commissioning

## 5.7.1 Initial Commissioning

**DANGER**

Hazard due to high voltage

**Non-observance will lead to death or serious injury.**

- Work may only be carried out by trained personnel (see Preface) who are familiar with and observe the safety requirements and precautions.
- Work may never be carried out if there is any dangerous voltage present.
- Deenergize the device.
- **Circuit breaker:** A suitable isolating device shall be connected upstream in order to permit disconnection of the device from the power supply. The circuit breaker must be mounted close to the device, be easily accessible to the user and marked as a circuit breaker for the device.
- Secure the supply voltage with an approved (UL/IEC) fuse: 1.6 A, type C.
- If a melting fuse is used, a suitable approved (UL/IEC) fuse holder has to be used.

After you have inserted the battery, assembled the device and connected the supply voltage lines, you can start the device for the first time. Proceed as follows:

✧ Check that the operational data match the rated data on the name plate and the technical data of the device (see chapter 13). This applies in particular to the supply voltage and to the maximum values of AC current and AC voltage.

**NOTE**

You only have to wire the terminals needed for your purposes.

✧ On the terminal side of the device, connect the measuring lines linked with the measurement objects at the terminal blocks T and Q. Chapter 6 describes interfaces, connection principles, and examples of connection possibilities.

✧ Connect a cable to the systems control on the terminal side of the device at terminal block J (RS485 or optical interface, if installed).

✧ On the top side of the device, connect the network cable to the PC at the RJ45 socket Z (Ethernet).

✧ Switch on the supply voltage of the device

✧ Close the door of the control cabinet to prevent touching live parts accidentally.

✧ Switch on the connected peripheral devices (PC, measuring device or modules) for measurand analysis.

**NOTE**

The device does not have a power on/off switch. The supply voltage must be switched on or off directly at the respective supply cable.

After an operating time of approximately 15 minutes, the device will stay within the tolerances specified in the technical data.

✧ Switch the direct currents to be measured at the measurement object on the measuring lines.

✧ Carry out the measurements as described in 7.

**NOTE**

For the operation of the device through the browser, JavaScript must be enabled. If JavaScript is not yet enabled, activate it as described in 7.2.2.

## 5.7.2 Changes During Operation

The device is designed for permanent operation.

If you want to change the measurement setup, e.g. by connecting terminals so far unused, proceed analogously to the Initial Commissioning.

**NOTE**

If you change the measurement setup, you must de-energize the supply voltage lines and all measuring lines before opening the control cabinet. Please note the warnings in 5.7.1.

## 5.7.3 Starting the Device with the Default IP Address

SICAM AI Unit has the following internal default IP address: **192.168.0.55**.

If you have entered a custom IP address during device configuration, you can temporarily activate the internal default IP address of the device if necessary. For this purpose, press the IP-Addr. push-button on the DIN rail side for at least 3 s.

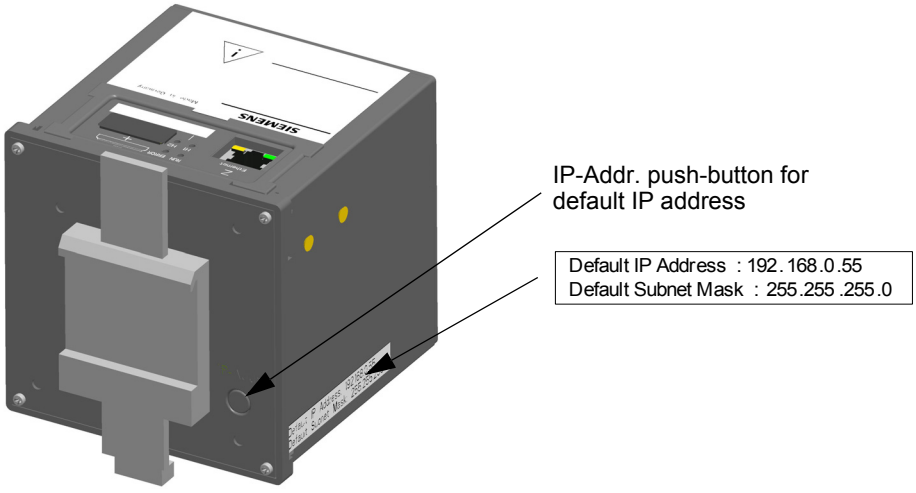



Fig. 5-5 Location of the Push-button for Activating the Default IP Address

When you press the IP-Addr. push-button, SICAM AI Unit will reset and use the default IP address until you have set a new IP address or switched the device off and on again.

**NOTE**

Resetting the IP address will lead to a device reset, and the LEDs on the top side of the device indicate that the device was started with the default IP address (see 12.3).

In this case, the parameterized IP address and the default IP address are displayed on the **Information** tab, **Device information** item (see 7.2.5).

When the device has restarted with the default IP address, the factory-set default passwords are also active (see 7.3.4.4).

# 6 Connection Principle

# 6.1 Terminals

The terminals on the terminal side of the device are designed as terminal blocks:

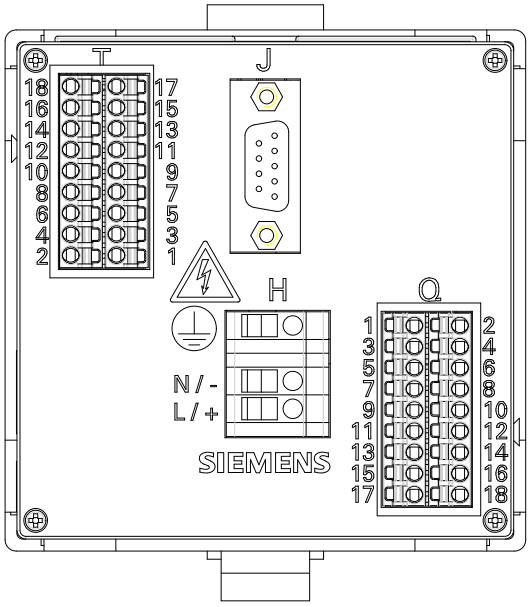



Fig. 6-1 Terminal Blocks on the Terminal Side of the SICAM AI Unit

Table 6-1 Terminal Blocks at SICAM AI Unit

| Terminal Block | Description |
|---|---|
| H | Supply voltage |
| Q | Six 20-mA inputs for direct-current measurement |
| T | Six 20-mA inputs for direct-current measurement |

**NOTE**

SICAM AI Unit 7XV5674-0KK00-xAA1 has a covered cut-out at position **J** on the terminal side.

SICAM AI Unit 7XV5674-0KK30-xAA1 has the RS485 interface and SICAM AI Unit 7XV5674-0KK40-xAA1 has the optical interface in this position, see chapter 6.2.2.

**Functions of the Terminals at SICAM AI Unit**

Table 6-2 Functions of the Terminals

| Terminal | Assigned Function, Measured Value or Indication | Description |
|---|---|---|
| **H:** ⏚ | Protective conductor | - |
| **H: N / -** | N/- | Neutral of the mains voltage/ negative supply voltage |
| **H: L / +** | ph/+ | Phase of the mains voltage/<br>Positive supply voltage |
| **J** [1)] | RS485 | Serial interface |
| | Optical (FO) | Serial interface |
| **Q: $I_{Channel\ 1}$** | $I_1$ | Channel 1 current measurement,<br>Positive terminal → pin number 2<br>Negative terminal → pin number 1 |
| **Q: $I_{Channel\ 2}$** | $I_2$ | Channel 2 current measurement,<br>Positive terminal → pin number 6<br>Negative terminal → pin number 4 |
| **Q: $I_{Channel\ 3}$** | $I_3$ | Channel 3 current measurement,<br>Positive terminal → pin number 3<br>Negative terminal → pin number 5 |
| **Q: $I_{Channel\ 4}$** | $I_4$ | Channel 4 current measurement,<br>Positive terminal → pin number 7<br>Negative terminal → pin number 9 |
| **Q: $I_{Channel\ 5}$** | $I_5$ | Channel 5 current measurement,<br>Positive terminal → pin number 11<br>Negative terminal → pin number 13 |
| **Q: $I_{Channel\ 6}$** | $I_6$ | Channel 6 current measurement,<br>Positive terminal → pin number 15<br>Negative terminal → pin number 17 |
| **T: $I_{Channel\ 1}$** | $I_1$ | Channel 1 current measurement,<br>Positive terminal → pin number 2<br>Negative terminal → pin number 1 |
| **T: $I_{Channel\ 2}$** | $I_2$ | Channel 2 current measurement,<br>Positive terminal → pin number 6<br>Negative terminal → pin number 4 |

| Terminal | Assigned Function, Measured Value or Indication | Description |
|---|---|---|
| **T: $I_{Channel\ 3}$** | $I_3$ | Channel 3 current measurement,<br>Positive terminal → pin number 3<br>Negative terminal → pin number 5 |
| **T: $I_{Channel\ 4}$** | $I_4$ | Channel 4 current measurement,<br>Positive terminal → pin number 7<br>Negative terminal → pin number 9 |
| **T: $I_{Channel\ 5}$** | $I_5$ | Channel 5 current measurement,<br>Positive terminal → pin number 11<br>Negative terminal → pin number 13 |
| **T: $I_{Channel\ 6}$** | $I_6$ | Channel 6 current measurement,<br>Positive terminal → pin number 15<br>Negative terminal → pin number 17 |
| **Z** | Ethernet interface | Ethernet connection; on the top side of the housing |

1) Only for device variants with an RS485 or optical interface

# 6.2 Communication Interfaces

## 6.2.1 Ethernet Interface

The Ethernet interface **Z** is located on the top side of the SICAM AI Unit. Data are exchanged via the RJ45 Ethernet socket, see also chapter 9.1.1.

.

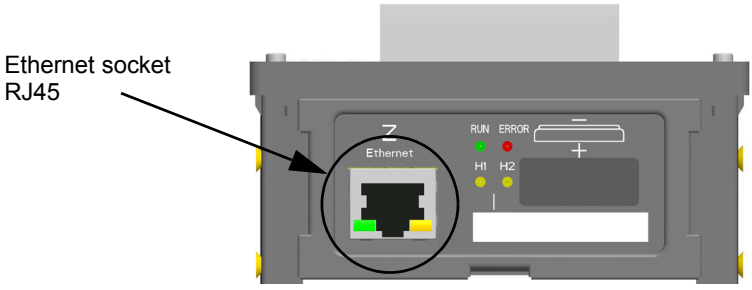



Fig. 6-2 Ethernet Interface Z (detail of the top side)

**NOTE**

If you do not connect a cable to the RJ45 socket, Siemens recommends covering the socket with a cap or dummy plug (not included in the delivery) to prevent the contacts from becoming dirty.

## 6.2.2 Serial Interface

As per device model, the RS485 interface (7XV5674-0KK30-xAA1) or the optical interface (7XV5674-0KK40-xAA1) at position **J** is located on the terminal side of the SICAM AI Unit, see also chapter 9.1.2.

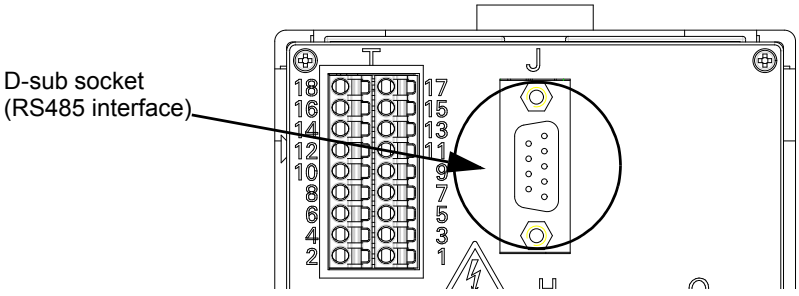



Fig. 6-3 RS485 Interface J (detail of the terminal side)

**NOTE**

If you do not connect a cable to the RS485 or optical interface, Siemens recommends covering it with a cap (not included in the delivery) to prevent the contacts from becoming dirty.

# 6.3 Connection Type

For the input wiring, observe the following operating conditions:

- ✧ Each channel obtains its own current source.
- ✧ Check the polarity of the current measuring inputs (see Table 6-2).

**DANGER**

Hazard due to high voltages in the event of a breakdown of the winding insulation

**Non-observance will lead to death or serious injury.**

- Ground the secondary windings of the current transformers on one side. They are installed in a high-voltage power system.

The connection example for the terminal block **T** is shown in the following figure. This connection example also applies to the terminal block **Q**. For the input wiring and polarity of the current measuring inputs, see Table 6-2.

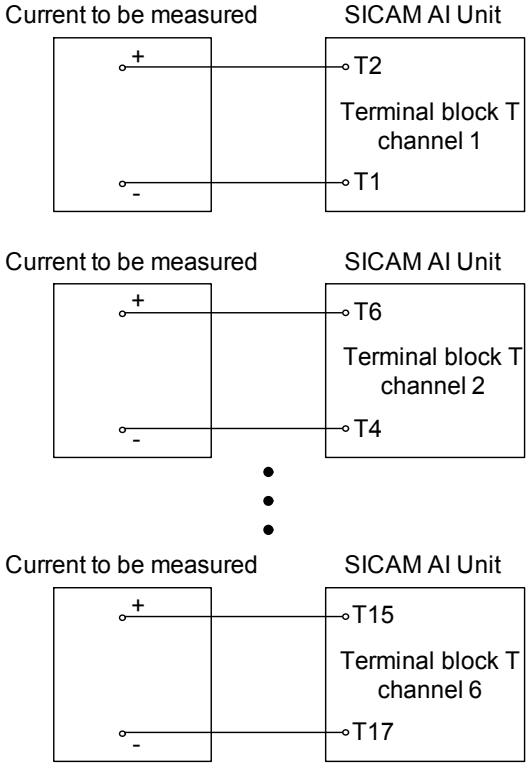



Fig. 6-4 Connection Example

# 7 Operation

# 7.1 General Usage Notes

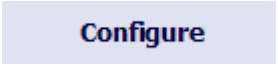
The device is operated from a connected PC or notebook only. The graphical user interface is stored in the device. To display the user interface, start Microsoft Internet Explorer 6.0 (or higher) and enter the IP address of the device.

You can navigate through Microsoft Internet Explorer using the icons on the toolbar, for example back, forward, print etc. The user interface itself does not contain any navigation icons.

Operating actions are performed with the mouse. Parameters and text are entered using the keyboard.

The following table lists the control elements.

Table 7-1 Control Functions

| Control Element | Control Function |
|---|---|
|  | Option button: selects one option |
|  | List box: selects an item from a list |
|  | Button: Executing an action by clicking the button, i.e. the current settings on the user interface are transmitted to the device. |
|  | Active tab (light blue) |
|  | Inactive tab (dark blue) |
|  | Selects and opens the item to be activated, for example a tab |

**HINWEIS**

Measured values are entered or displayed with a decimal point separating the integral and the fractional parts, for example 19.8 mA.

# 7.2 Start and Design of the User Interface

## 7.2.1 Initial Start of the User Interface

**Requirements**

Before starting the user interface, the following preconditions must be satisfied:

- ✧ Assemble the SICAM AI Unit as described in chapter 5.2.
- ✧ Connect the lines for measurement, communication and supply voltage as described in chapter 5.3 and observe the safety provisions.
- ✧ Switch on the devices needed for the measurement.
- ✧ Switch on the supply voltage of the SICAM AI Unit.
- ✧ Check whether the LEDs at the SICAM AI Unit indicate that the device is ready (see chapter 12.3).
- ✧ Match the IP address and the subnet mask of the network interface card of your computer to the device settings.
- ✧ Check on the computer screen whether the LAN connection is up. Activate the LAN connection if it is down (see the Windows manual or the Windows online help for information).
- ✧ For checking purposes, carry out the ping test as follows (example for Windows XP):
  - – Click **Start** on the Windows interface.
  - – Select **Execute...**.
  - – Enter **cmd** in the dialog and click **OK**.
  - – Enter: **ping 192.168.0.55**.
  - – Press the **Enter** button.
  - – Check the following output in the window.

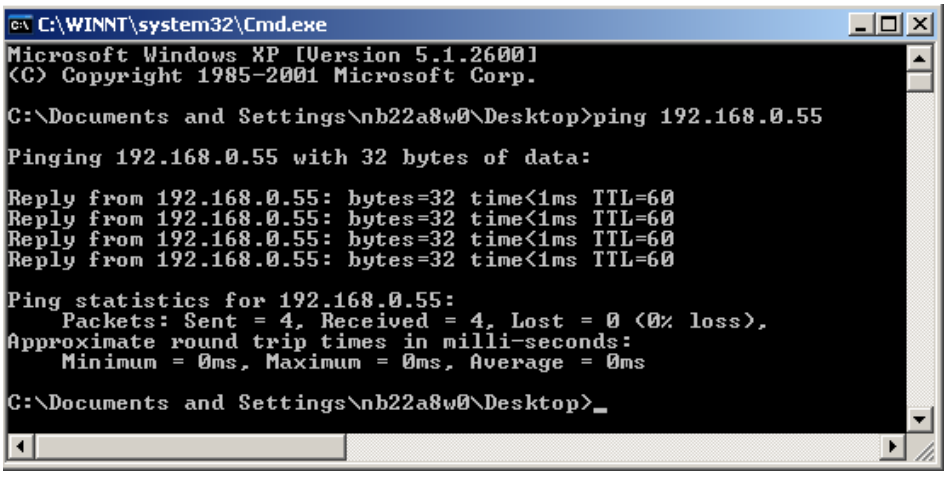



Fig. 7-1 Ping Test

- ✧ Start Microsoft Internet Explorer.
- ✧ Enter the IP address in Microsoft Internet Explorer (e.g. default IP address: http://192.168.0.55) of SICAM AI Unit and press ENTER.

  The user interface opens with the **Information** tab → **Show device information** (see figure 7-4).

**NOTE**

When starting the device for the first time, a set of parameters with factory settings is loaded. You can modify these settings during the parameterization (see chapter 7.3).

To set a different user language for the user interface, open the **Administrative** menu on the **Configure** tab, select the **Device and language** menu item and change the user language as described in chapter 7.3.4.4.

**NOTE**

If user interface does not open or the displayed user interface does not show the view depicted in figure 7-3, JavaScript may be the cause. The operation of user interface requires JavaScript. You may have to activate JavaScript as described in chapter 7.2.2.

## 7.2.2 Enabling JavaScript

The operation of the user interface requires JavaScript.

Enable JavaScript as follows:

- ✧ Start Microsoft Internet Explorer.
- ✧ Click the **Tools** menu on the menu bar of Microsoft Internet Explorer.
- ✧ Select **Internet options...** from the **Tools** menu.
- ✧ In the **Internet options** dialog open the **Security** tab.

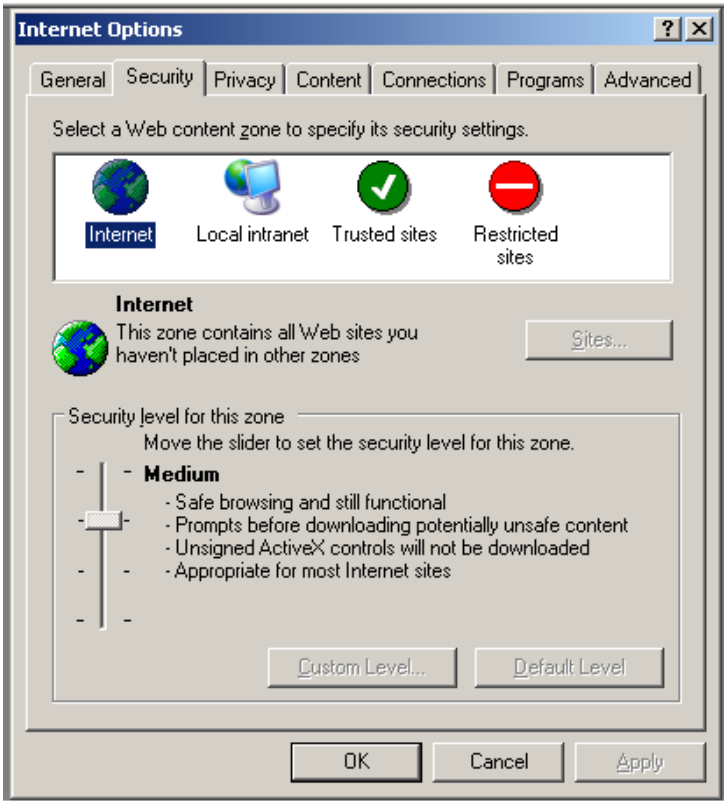



Fig. 7-2 Enabling JavaScript

- ✧ In the window of the **Security** tab select the **Internet** icon.
- ✧ On the **Security** tab scroll to **Medium** by moving the scroll bar with your mouse. Alternatively, if there is no scroll bar, click the **Default Level** button and set the scroll bar that appears to **Medium**.
- ✧ Click the **Apply** button.
- ✧ Click the **OK** button.

### 7.2.3 Number of Connections via HTML

Three connections maximum are possible via HTML.

## 7.2.4 Layout of the User Interface

The user interface has the following layout:

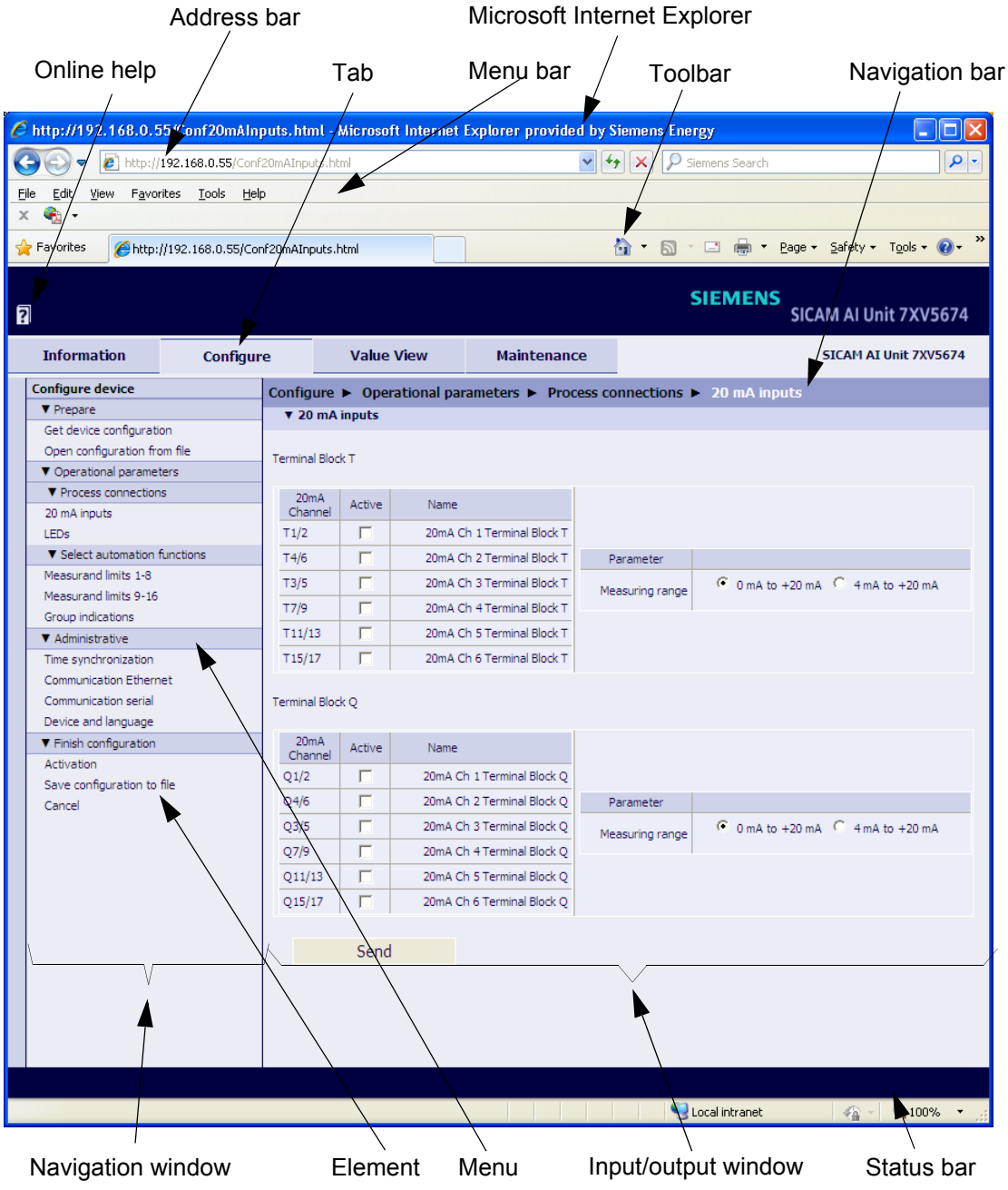



Fig. 7-3 Designations in the User Interface

## 7.2.5 Starting the User Interface during Operation

### Starting the User Interface

To start the user interface, proceed as follows:

- ✧ Start Microsoft Internet Explorer.
- ✧ Enter the IP address in Microsoft Internet Explorer (for example the default IP address: 192.168.0.55) of SICAM AI Unit and press ENTER.

  The user interface opens with the **Information** tab → **Show device information** item (see figure 7-4).

### Information Tab

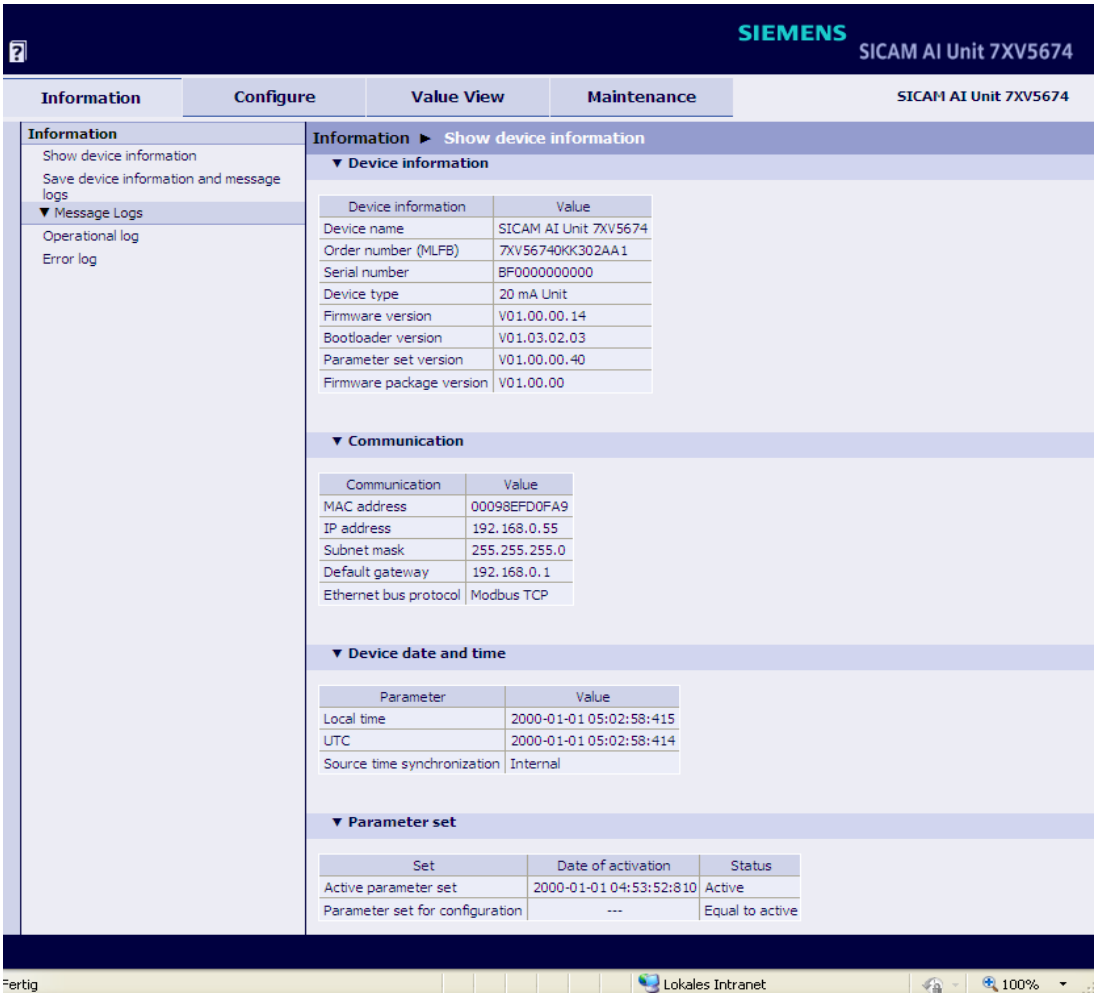



Fig. 7-4 Information Tab, Show Device Information Input/Output Window

### Navigation Window of the Information Tab

The navigation window of the **Information** tab contains the elements **Show Device Information**, **Save device information and message logs** and the **Message Logs** menu with the elements **Operational log** and **Error log**.

### 7.2.5.1 Show Device Information

✧ Click the **Show device information** item in the navigation window.

The **Show device information** input/output window shows the following information (see figure 7-4):

– **Device information**: Information about the device and the installed software
– **Communication**: Information about the data transfer between device and periphery
– **Device date and time**: Information about the time settings of the device
– **Parameter set**: Information about the active and passive set of parameters

### 7.2.5.2 Save Device Information and Message Logs

✧ Click the **Save device information and message logs** item in the navigation window.

The **Save .TXT** and **Save .CSV** buttons in the **Save device information** input/output window are displayed.

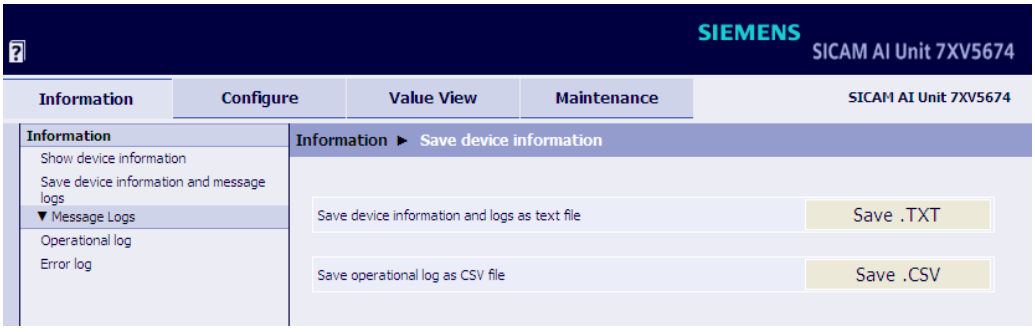
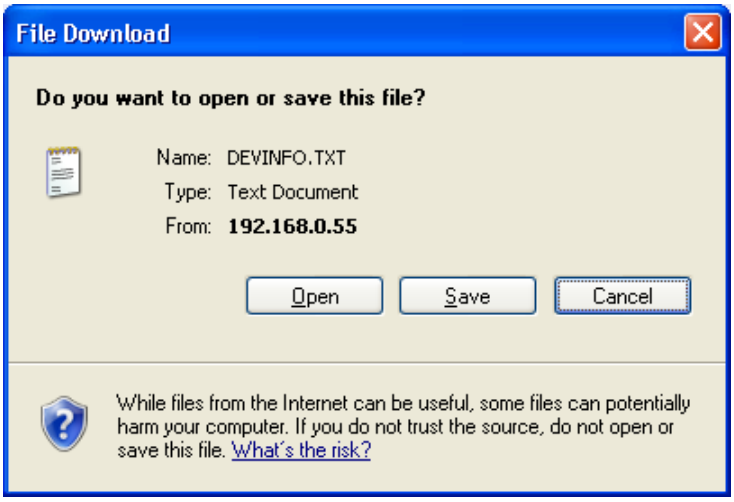



Fig. 7-5 Information Tab, Save Device Information Input/Output Window

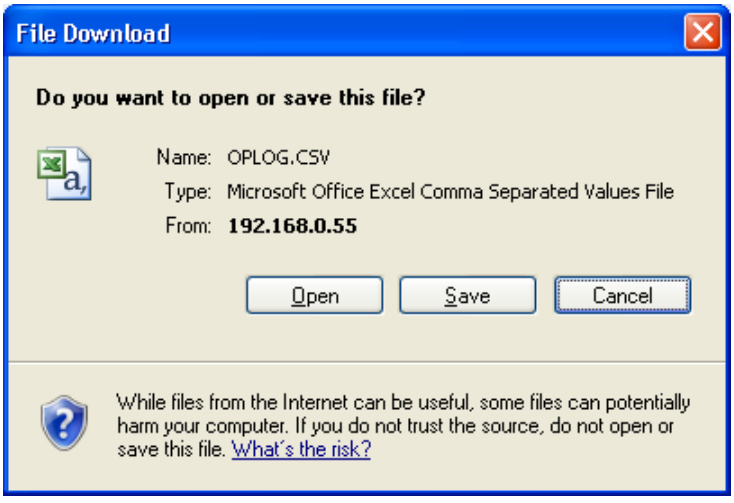
✧ In order to save the device information and logs as text file, click the **Save .TXT** button.

✧ In order to save the operational log as CSV file, click the **Save .CSV** button.

The **File Download** dialog opens.




File Download Dialog (**DEVINFO.TXT**)



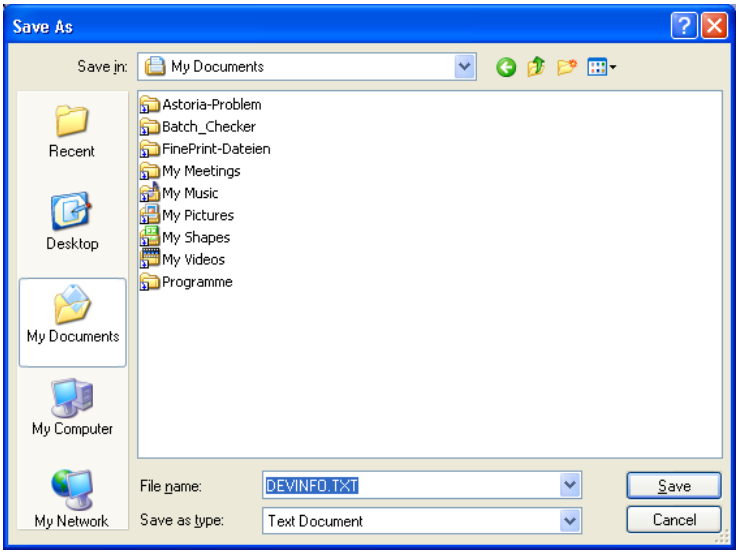

File Download Dialog (**OPLOG.CSV**)

Fig. 7-6 File Download Dialog (**DEVINFO.TXT**) or (**OPLOG.CSV**)

**File Download → Save**

✧ Click the **Save** button.

The **Save As** dialog opens.



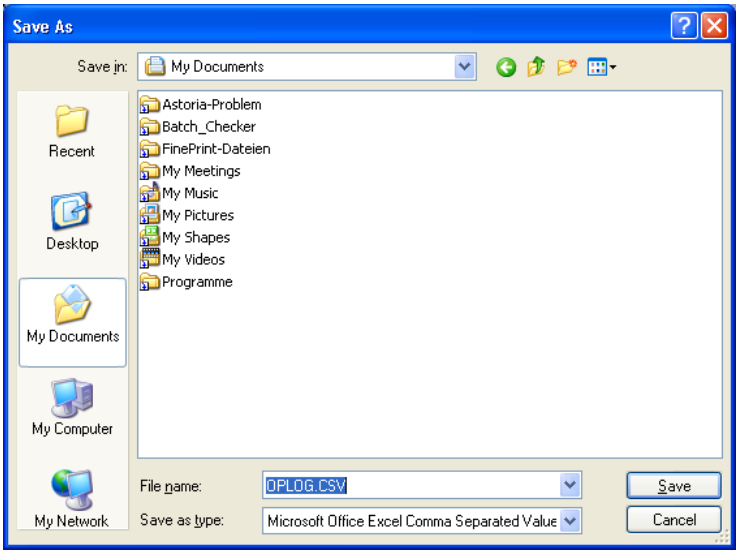




Fig. 7-7 Save As Dialog with File Name (**DEVINFO.TXT**) or (**OPLOG.CSV**)

✧ Select the file path in the **Save in:** list box.

✧ Use the file name suggested in the **File name:** list box or enter a new file name with the file extension .TXT or .CSV.

✧ Click the **Save** button.

The **Download complete** dialog opens.

✧ In the **Download complete** dialog, click the **Close** button.

**File Download → Open**

Alternatively, you can view the device information and message logs on the screen and print them if needed. Proceed as follows:

- ✧ In the **File download** dialog (see figure 7-6), click the **Open** button.

  A Text Editor or a CSV file opens. The Text Editor contains the following information:

  – DEVICE INFORMATION
  – OPERATIONAL LOG
  – ERROR LOG

  The CSV file contains the OPERATIONAL LOG as a list.

- ✧ On the menu bar of the Text Editor, click **File** → **Print...**, select the desired printer in the following **Print** dialog and click the **Print** button.

  The list is printed on the connected printer.

- ✧ On the menu bar of the CSV file, click **File** → **Print...**, select the desired printer in the following **Print** dialog and click the **Print** button.

  The list is printed on the connected printer.

- ✧ Close the Text Editor.

- ✧ Close the CSV file.

- ✧ Click an element on the navigation window or a tab, or alternatively, click the **Back** icon on the toolbar of Microsoft Internet Explorer twice.

### 7.2.5.3 Message Logs Menu

The **Message Logs** menu contains operational indications and error messages registered and saved by the device during operation. The device can save up to 128 operational indications and up to 128 error messages. When the storage capacity is exceeded, the oldest indications will be overwritten successively.

#### Operational Log

To show the operational indications, proceed as follows:

✧ In the navigation window, click the **Message Logs** menu and then the **Operational log** menu item.

The operational indications are listed in the input/output window as follows:

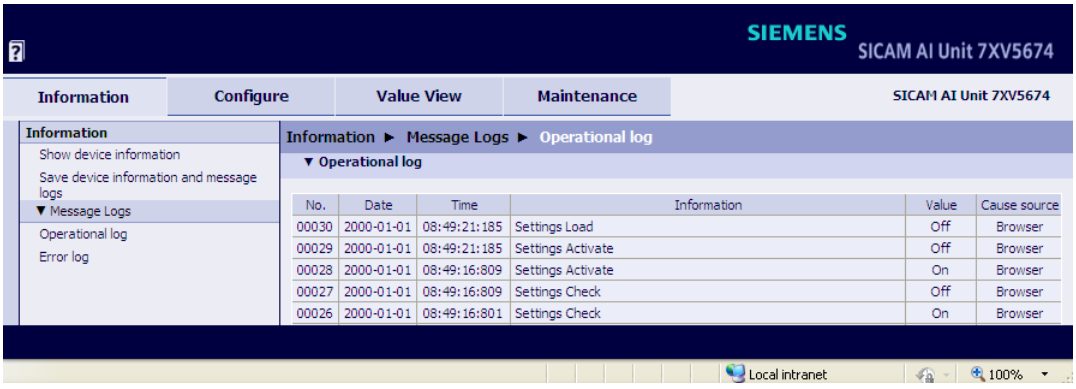



Fig. 7-8 Information Tab, Operational Log

- Serial **No**.
- **Date** of registration
- **Time** of registration
- **Information** on the indication
- **Value** of the indication (On, Off or invalid)
- **Cause source** of the indication (e.g. Intern, Browser)

**NOTE**

The operational indications can be printed as described in chapter 7.2.5.2, section **File Download** → **Open**.

The chapter 7.5.6.1 explains how to delete the operational indications manually.

### Error Log

**NOTE**

The information about error messages described below is intended for service purposes. Inform the customer service about this information when there are problems with your device.

To display the error messages, proceed as follows:

✧ In the navigation window, click the **Message Logs** menu and then **Error log**.
The error messages are listed in the input/output window as follows:

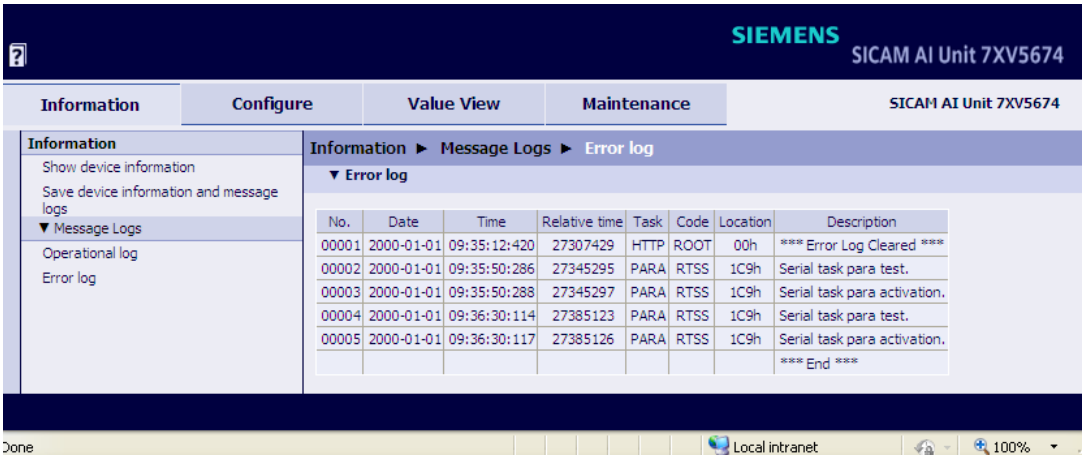



Fig. 7-9 Information Tab, Error Log

- Serial **No.**
- **Date** of registration
- **Time** of registration
- **Relative time** (referring to the start of operation, output in milliseconds)
- **Task**, **Code** and **Location** are service information for the manufacturer.
- **Description** of the error

**NOTE**

The error messages can be printed as described in chapter 7.2.5.2, section **File Download** → **Open**.

The chapter 7.5.6.2 explains how to delete the error messages manually.

# 7.3 Configuration of the Device

**NOTE**

The device contains two set of parameters. The set of parameters currently used for device operations is the **active set of parameters**. The inactive set of parameters is called the **passive set of parameters**.

The following sections describe how to change and enable the passive set of parameters.

## 7.3.1 Device Configuration Procedure

If you have not changed the set of parameters since the first start of the device (see chapter 7.2.1), use the factory settings (see chapter 7.3.3 and chapter 7.3.4). To change the settings of the set of parameters, proceed as follows:

✧ Click the **Configure** tab on the user interface.

The **Configure** tab opens.

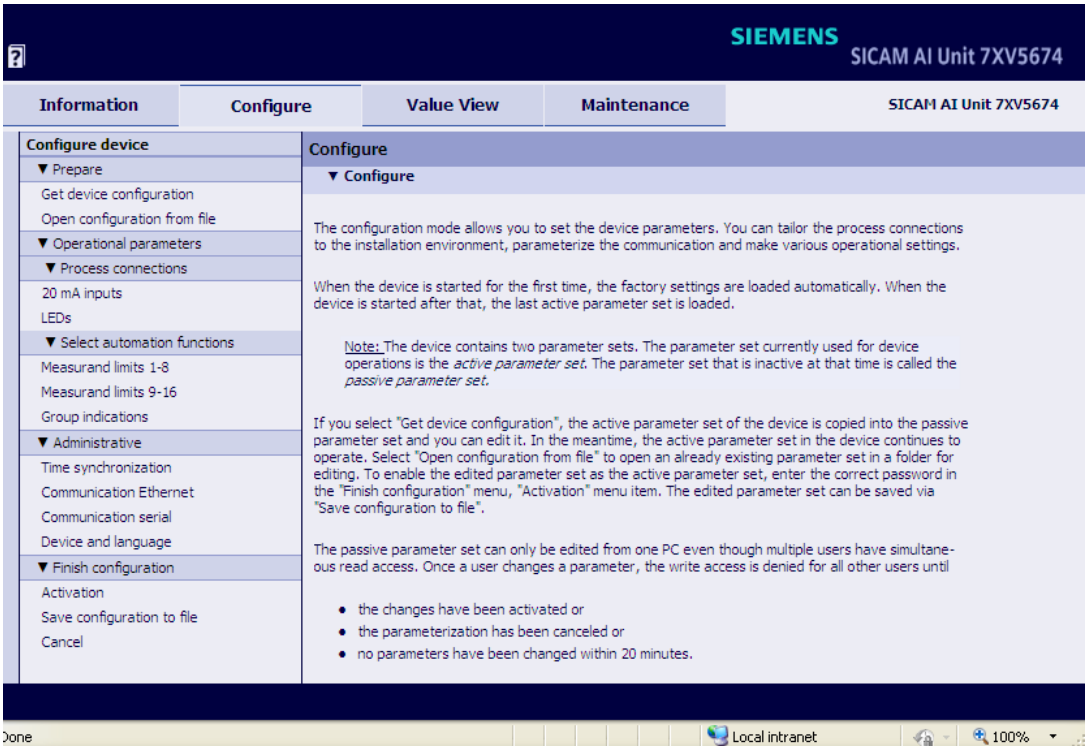



Fig. 7-10 Configure Tab

**NOTE**

The items in the **Process connections** menu show the current hardware and software configuration of the device.

✧ Select the **Prepare** menu in the navigation window and then either **Get device configuration** or **Open configuration from file**.

**NOTE**

If you have selected **Get device configuration**, an editable copy of the active set of parameters of the device is displayed on the screen. In the meantime, the active set of parameters in the device continues to operate. If you have selected **Open configuration from file**, you can open and enable or edit the copy of a set of parameters that was already created and saved to a folder.

### 7.3.1.1 Get Device Configuration

If you have selected **Get device configuration** in the **Configure** tab, you can open and edit either the **Get active configuration** or the **Get default configuration** in the input/output window. Proceed as follows:

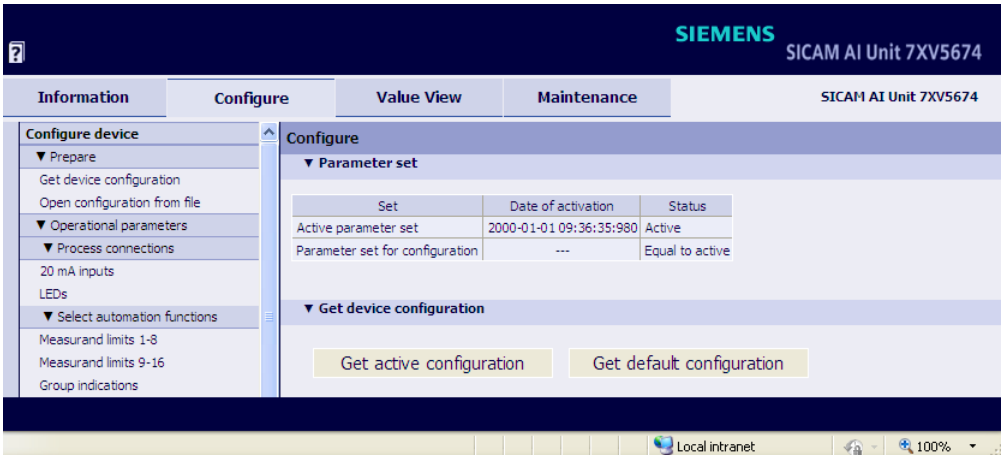



Fig. 7-11 Configure Tab, Get Device Configuration

#### Get Active Configuration and Editing

✧ Click the **Get active configuration** button.

A copy of the active set of parameters (= passive set of parameters) of the device is opened for editing.

✧ Check and, if necessary, change the set parameters by opening the desired **Operational** menu described in chapter 7.3.4 and the **Administrative** menu according to chapter 7.3.3.

✧ Activate the modified configuration as described in chapter 7.3.1.3.

#### Get Default Configuration and Editing

✧ Click the **Get default configuration** button.

A copy of the factory settings (= passive set of parameters) of the device is opened for editing.

**NOTE**

You can edit the displayed factory settings, activate and use them as active set of parameters. The original factory settings are not overwritten and can be used at anytime.

✧ Activate the modified configuration as described in chapter 7.3.1.3.

### 7.3.1.2 Open Configuration from File

If you have selected **Open configuration from file** in the **Configure** tab, you can open an already existing file in a folder. Proceed as follows:

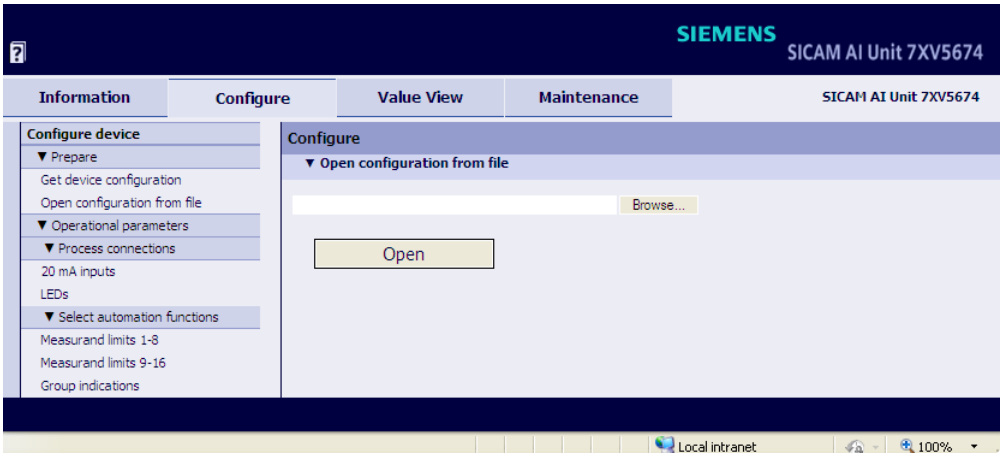



Fig. 7-12 Configure Tab, Open Configuration from File

✧ Click the **Browse...** button.

The **Choose File to Upload** dialog opens.

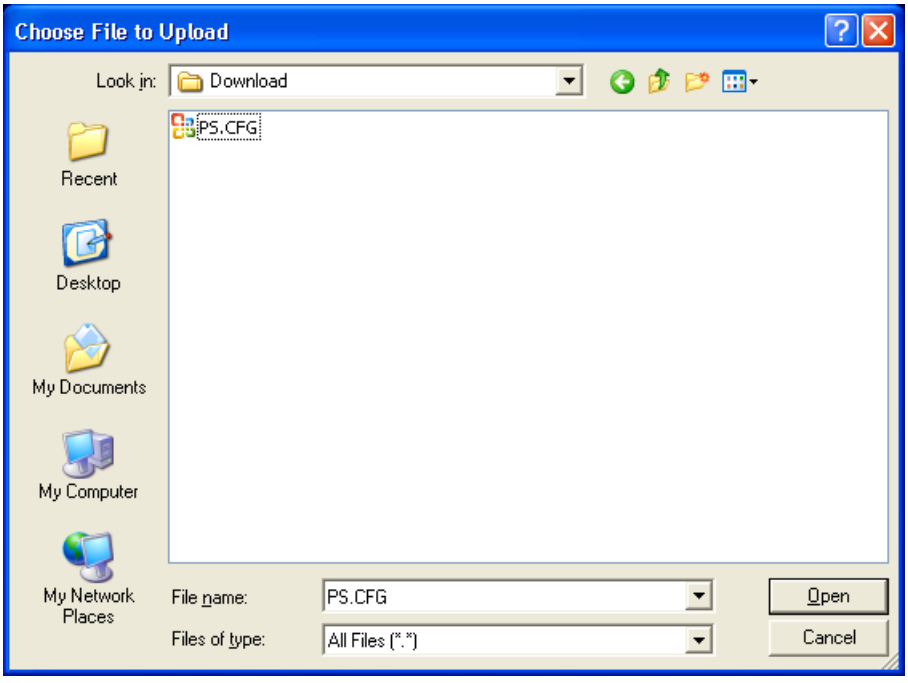



Fig. 7-13 Choose File

✧ Select the desired file (extension .cfg) in the directory.

**NOTE**

You can open only files with the following properties of the file name:

- Maximum 8 characters and extension (.cfg)
- Only containing:
  - Letters: a to z, A to Z
  - Numbers: 0 to 9
  - Hyphen (-) and underline (_)

✧ Click the **Open** button.
The selected path is inserted into the **Browse** field in the input/output window, figure 7-12.

✧ Click the **Open** button.
The device configuration from the CFG file is loaded.

### 7.3.1.3 Finish Configuration

When you have changed the configuration, you must either enable it as the active set of parameters or save it.

#### Activating the Set of Parameters

To **activate** the set of parameters, proceed as follows:

✧ In the navigation window, click the **Finish configuration** menu and then the **Activation** menu item.
The **Activation** input/output window opens.

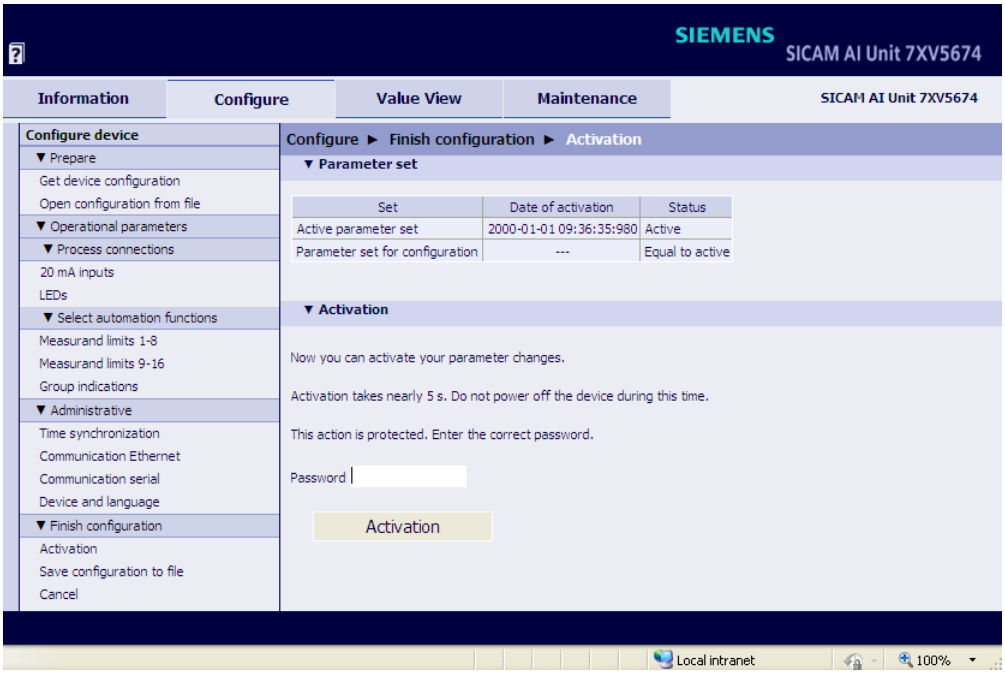



Fig. 7-14 Configure Tab, Activation Input/Output Window

- ✧ In the **Activation** input/output window, enter the valid activation password into the **password** field. chapter 7.3.4.4 explains how to set the password.
- ✧ Click the **Activation** button.

  At first the message **Parameter activation is still in progress** will be shown and then the message **Parameter activation is complete** in the input/output window.

  The modified set of parameters is loaded as the active set of parameters into the device and the new parameters take effect immediately.

  If the password is wrong, this message appears: **The password is wrong. Please enter the correct password.**

**NOTE**

The active and passive set of parameters are listed in the **Activation** input/output window in the **Set** column for your information.

### Save Configuration to File

You can save both the active and the passive configuration to a file. Proceed as follows:

- ✧ In the navigation window, click the **Finish configuration** menu and then **Save Configuration to File**.

  The **Save Configuration to File** input/output window opens.

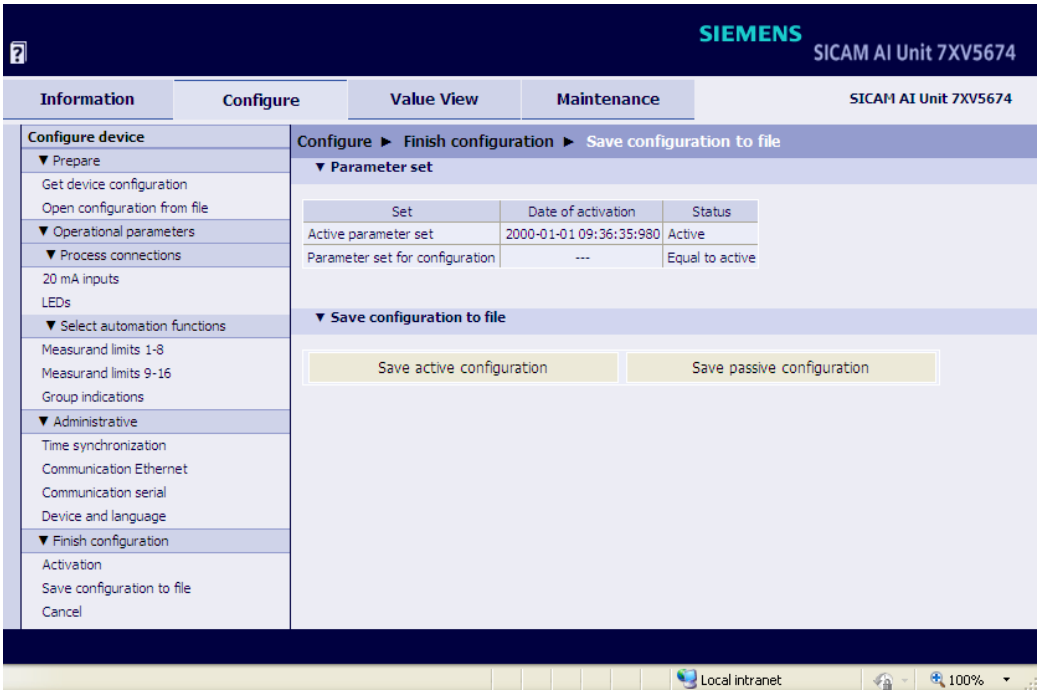



Fig. 7-15 Configure Tab, Save Configuration to File Input/Output Window

- ✧ Click either of the buttons **Save active configuration** or **Save passive configuration**.

The **File Download** dialog opens.

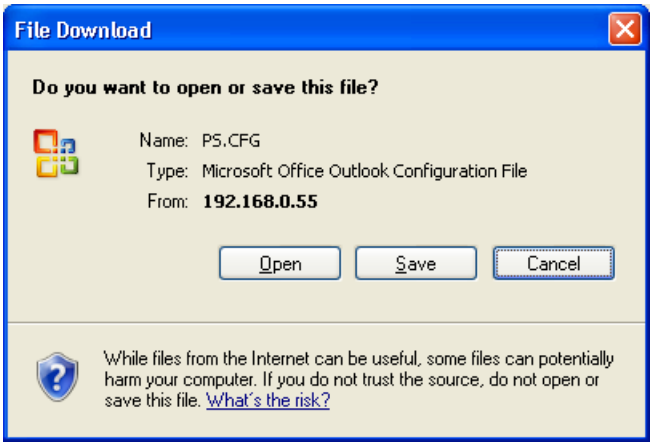



Fig. 7-16 File Download Dialog

**File Download → Save**

✧ Click the **Save** button.
The **Save As** dialog opens.

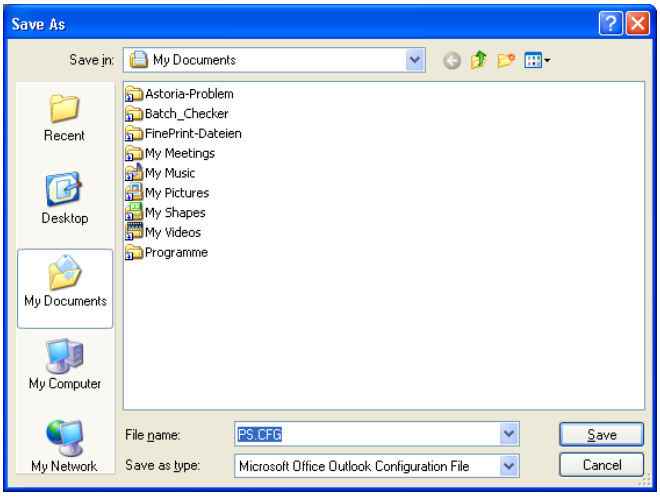



Fig. 7-17 Save As Dialog

✧ Select the file path in the **Save in:** list box.

✧ Use the file name suggested in the **File name:** list box or enter a new file name with the file extension .CFG.

**NOTE**

File names mustn't be longer than 8 signs. You use only characters according to NOTE in chapter 7.3.1.2.

✧ Click the **Save** button.
The **Download complete** dialog opens.

✧ In the **Download complete** dialog, click the **Close** button.

### Cancel

To cancel the configuration, proceed as follows:

✧ In the navigation window, click the **Finish configuration** menu and then **Cancel**.

The **Cancel** input/output window opens.

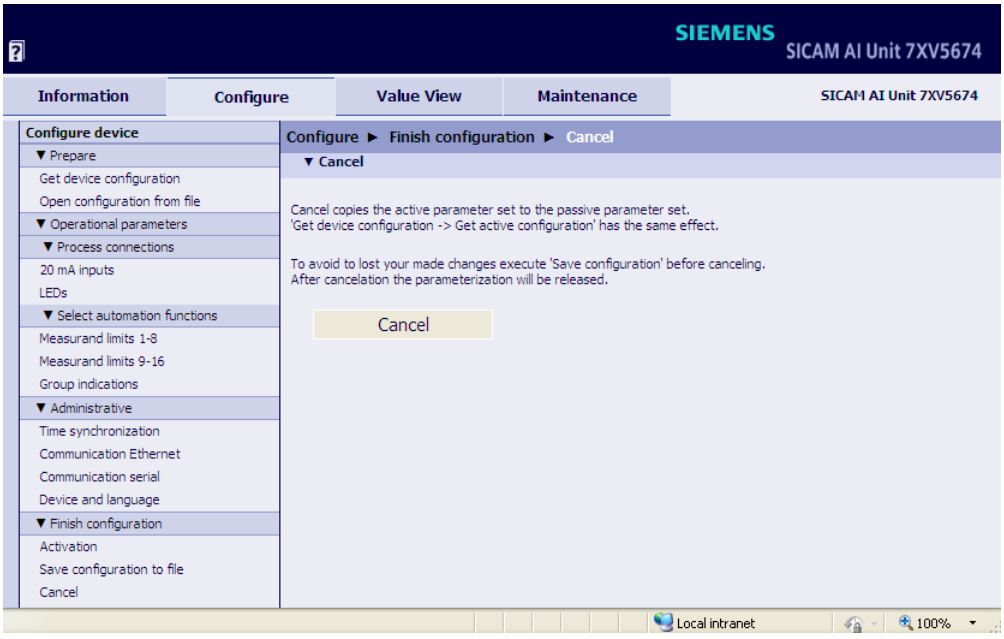



Fig. 7-18 Configure Tab, Cancel Input/Output Window

✧ Click the **Cancel** button in the input/output window.

**NOTE**

After clicking the **Cancel** button, the active set of parameters is copied into the passive set of parameters. This action is the same as **Get device configuration** → **Get active configuration** described in chapter 7.3.1.1.

When you have clicked the **Cancel** button, the parameterization is released and can be run from a different computer if necessary.

## 7.3.2 Access to the Passive Set of Parameters by Multiple Users

### Reading the Passive Set of Parameters

The user interface allows the simultaneous read access of up to 3 web servers to the passive set of parameters.

### Editing the Passive Set of Parameters

The passive set of parameters can only be edited from one PC or notebook even though multiple users have simultaneous read access.

Once a user changes a parameter on the user interface, the write access is denied for all other users.

If the write access is blocked, **modified** in brackets will be displayed in the upper right corner of the user interface. The user making the changes will see **modified** without brackets.

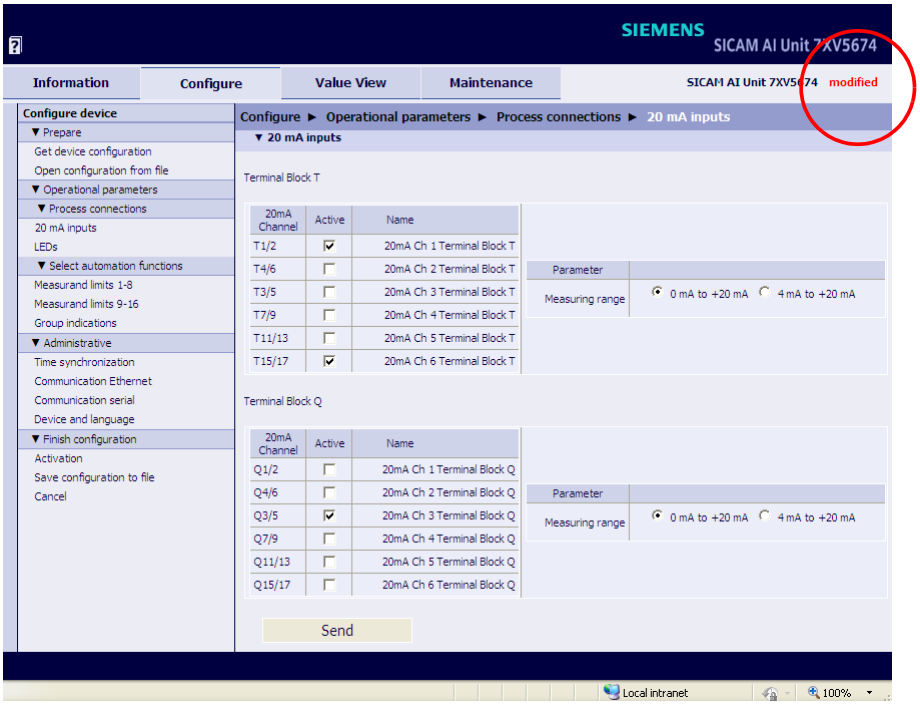



Fig. 7-19 Access Blocked

If a user makes a change, the server starts a 20-minute timer. If no further changes to the set of parameters are entered by the time the timer has counted down, write access is released again for all users. In this case, the modified data are discarded and the passive set of parameters is overwritten with the content of the active set of parameters.

If new changes to the passive set of parameters are made during the 20-minute countdown, the timer is restarted by each action.

If the user has completed his changes to the passive set of parameters or finished the parameterization by clicking the **Cancel** button, write access for all users is also released.

### 7.3.3 Setting the Operational Parameters

In the **Configure** tab you can view and edit the set operational parameters. You can select the parameters in the **Operational** menu in the navigation window. The submenus **Process connections**, **Select automation function** and **Administrative** are available for making the settings. The submenus contain the following elements:

- Process connections
  - 20-mA inputs
  - LEDs
- Select automation functions
  - Measurand limits 1-8
  - Measurand limits 9-16
  - Group indications
- Administrative
  - Time synchronization
  - Communication Ethernet
  - Communication serial
  - Device and language

**NOTE**

Observe the procedure for the device configuration described in chapter 7.3.1 when you set the operational parameters.

## 7.3.3.1 Process Connections

### 7.3.3.1.1 20-mA Inputs

**Default Settings and Setting Ranges of Measured-value Acquisition checkmark set**

Table 7-2 Settings for 20-mA Inputs

| Parameter | Default Setting | Setting Range |
|---|---|---|
| T1/2<br>(20-mA Channel 1 terminal block T) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| T4/6<br>(20-mA Channel 2 terminal block T) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| T3/5<br>(20-mA Channel 3 terminal block T) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| T7/9<br>(20-mA Channel 4 terminal block T) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| T11/13<br>(20-mA Channel 5 terminal block T) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| T15/17<br>(20-mA Channel 6 terminal block T) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| Q1/2<br>(20-mA Channel 1 terminal block Q) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| Q4/6<br>(20-mA Channel 2 terminal block Q) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| Q3/5<br>(20-mA Channel 3 terminal block Q) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |

Table 7-2 Settings for 20-mA Inputs (cont.)

| Parameter | Default Setting | Setting Range |
|---|---|---|
| Q7/9<br>(20-mA Channel 4 terminal block Q) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| Q11/13<br>(20-mA Channel 5 terminal block Q) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| Q15/17<br>(20-mA Channel 6 terminal block Q) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| Measuring range | 0 mA to +20 mA | 0 mA to +20 mA<br>4 mA to +20 mA |

To change the parameters of the 20-mA inputs, proceed as follows:

✧ In the navigation window, select the **Operational** menu, then the **Process connections** submenu and click the **20-mA inputs** menu item.

The **20-mA inputs** input/output window opens.

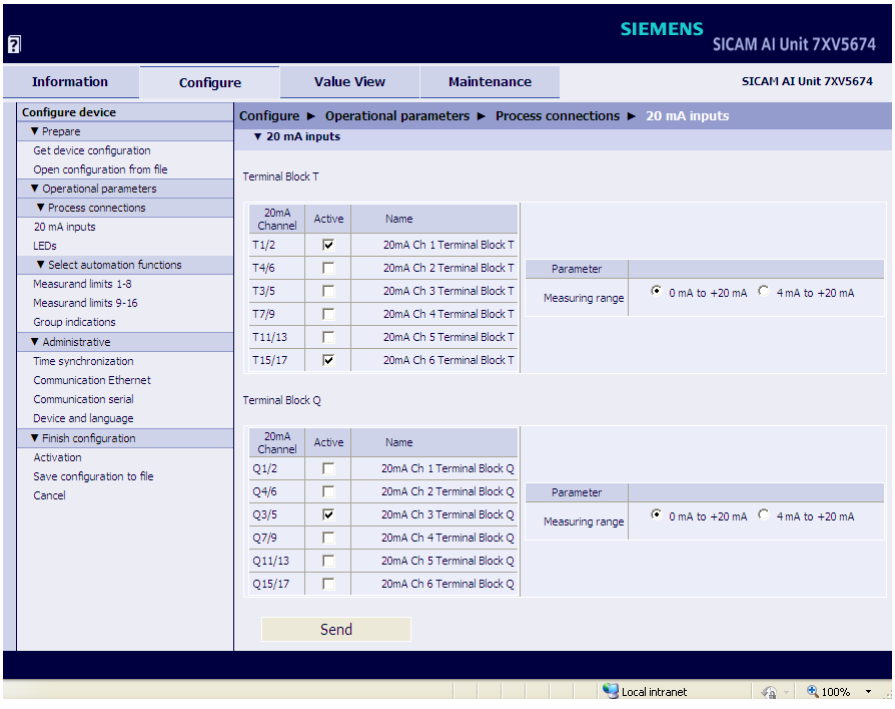



Fig. 7-20 Configure Tab, 20-mA Inputs Input/Output Window

✧ For the direct-current measurement, select the measuring channels of the terminal block **T** with the option button **Active**. For this purpose, set the checkmark (Yes = checkmark set).

- ✧ Select the desired input measuring range with the option buttons of the **Measuring range**. You can set the parameters of the following input measuring ranges:
  - – 0 mA to +20 mA
  - – 4 mA to +20 mA
- ✧ For the direct-current measurement, select the measuring channels of the terminal block **Q** with the option button **Active**. For this purpose, set the checkmark (Yes = checkmark set).
- ✧ Select the desired input measuring range with the option buttons of the **Measuring range**. You can set the parameters of the following input measuring ranges:
  - – 0 mA to +20 mA
  - – 4 mA to +20 mA
- ✧ Click the **Send** button.

  The parameters are transmitted to the device but not enabled yet (passive set of parameters).
- ✧ If you do not want to make any additional settings, continue with the **activation** of the device configuration according to **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in **Activating the Set of Parameters**.

#### 7.3.3.1.2 LEDs

**Default Settings of the LEDs**

Table 7-3 LED Settings

| LED | Default Setting | Setting Range |
|---|---|---|
| RUN | Device ready | Not settable |
| ERROR | -none- | Indicates an error and indicates according to parameterization<br>Acc. to list box<br>(see chapter 15) |
| H1 | -none- | Acc. to list box<br>(see chapter 15) |
| H2 | -none- | Acc. to list box<br>(see chapter 15) |
| Indication inverted | no | no<br>yes |

To change the outputs of the LEDs H1, H2, ERROR, proceed as follows:

✧ In the navigation window, select the **Operational** menu, then the **Process connections** submenu and click **LEDs**.

The **LEDs** input/output window opens.

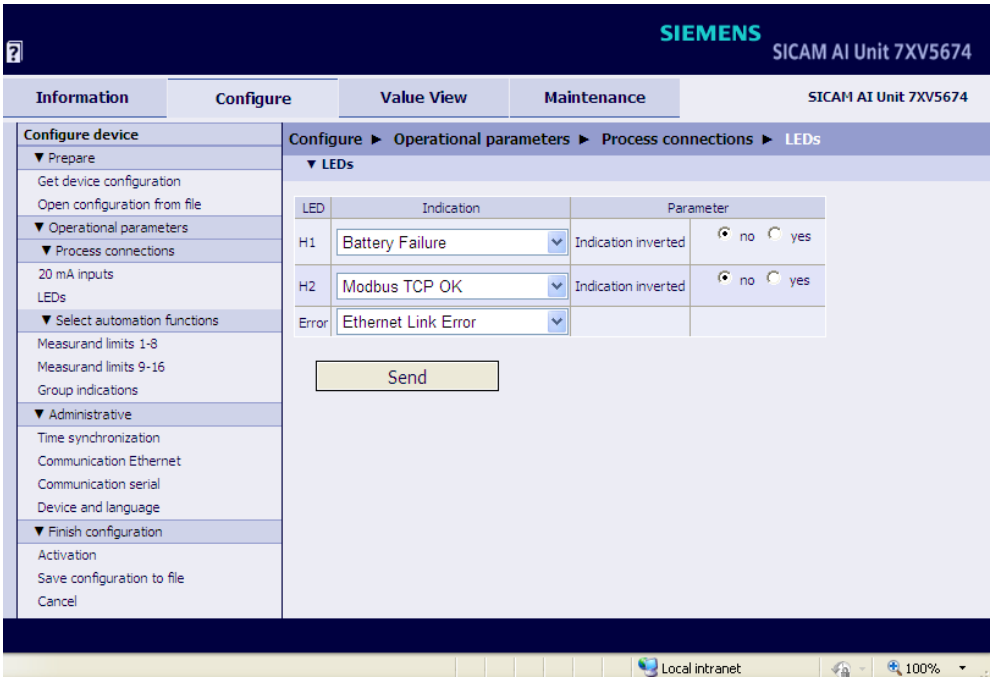



Fig. 7-21 Configure Tab, LEDs Input/Output Window

✧ Select the indication to be assigned to the corresponding LED from the **H1** or **H2** list box. You can select from the following indications:

- Ready and status indications, for example Device OK, Modbus TCP OK, Input not active T1/2
- Indications about present device activities, for example Settings load
- Group indication, example Group Indication 2
- Error indications, for example Battery Failure, Ethernet Link Error
- Administrative indications, for example Daylight Saving Time
- Limit violation indications, for example Limit Violation 1 (see chapter 7.3.3.2)
- Measuring range exceedance, for example Out of range Q4/6
- Measuring range lower deviation, for example Wire broken Q3/5

✧ Select the indication, which will be assigned to the red Error LED from the **Error** list box. You can only select the Error indications.

Select **-none-** to disable the corresponding LED.

✧ In the **Indication inverted** section, select whether you want to invert the indication for the output (**yes**) or not (**no**).

**NOTE**

The output of the **Error** LED cannot be inverted.

✧ Click the **Send** button.

The parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **activation** of the device configuration according to **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in **Activating the Set of Parameters**.

**Behavior of the LEDs**

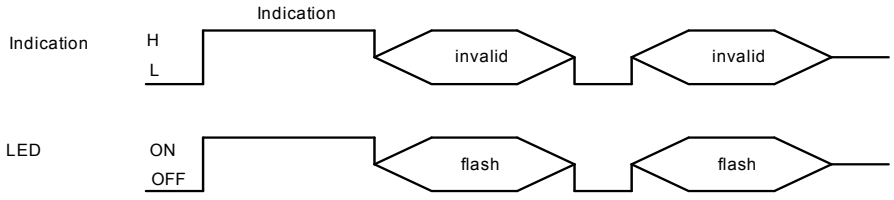



Fig. 7-22 Behavior of the LEDs

## 7.3.3.2 Automation Functions

### 7.3.3.2.1 Limit Settings

In the **Select automation functions** menu you can set upper or lower limits for up to 16 measured values. Limit violations of the upper or lower value range can be output as indications. Up to 4 limit value violations can be signaled at the device via the LEDs H1 and H2. Furthermore, all 16 limit violations can be sent to peripheral devices via Ethernet.

The programmable limits are divided into two groups **Measurand limits 1-8** and **Measurand limits 9-16**. The parameterization is identical for all limits.

**Default Settings and Setting Ranges of the Limits**

Table 7-4 Limit Settings

| Parameter | Default Setting | Setting Range |
|---|---|---|
| Measurand | -none- | Acc. to list box<br>(see chapter 15) |
| Limit | 0.00 | 0.00 mA to 20.00 mA |
| Limit type | Lower | Lower<br>Upper |
| Hysteresis (%) | 1.00 | 0.00 to 20.00 |
| Violation indication | Limit Violation x<br>(x = 1 to 16) | The name of the limit violation indication is customizable. |

### Parameterizing a Limit

To change for example limit 1, proceed as follows:

✧ In the navigation window, select the **Operational** menu, then the **Select automation functions** submenu and click **Measurand limits 1-8**.

The **Measurand limits** input/output window opens.

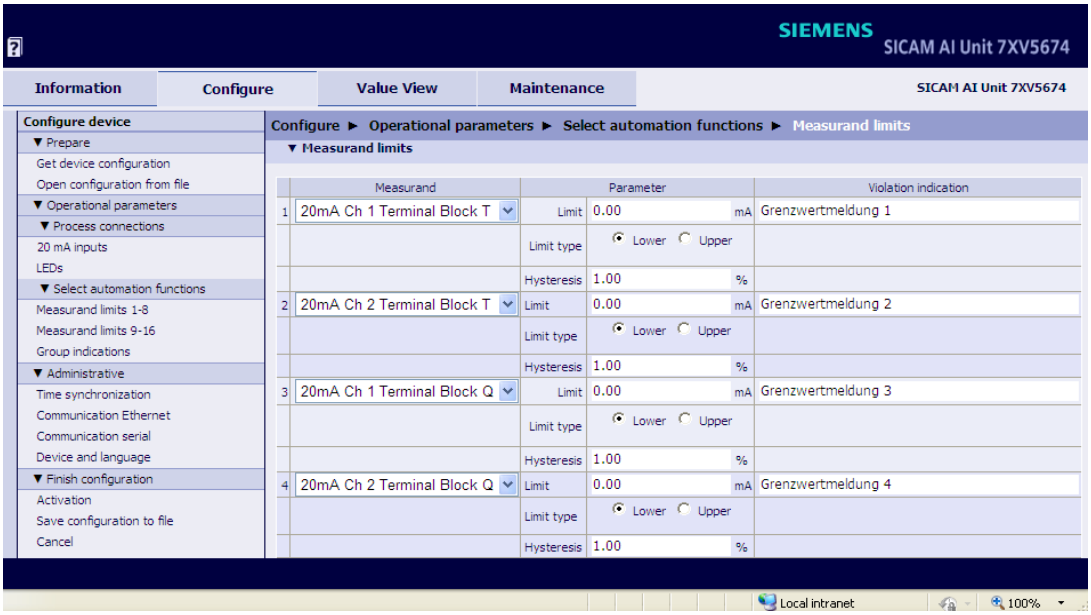



Fig. 7-23 Configure Tab, Measurand Limits 1-8 Input/Output Window (Detail)

✧ Select the measured value for which you want to parameterize the limit value indication from the **Measurand** list box. You can parameterize a limit value indication for the following measured values:

– 20-mA Channel x terminal block **T** (x = 1 to 6)

– 20-mA Channel x terminal block **Q** (x = 1 to 6)

Select **-none-** to disable the limit value indication.

✧ Enter a limit value into the **Parameter** column in the **Limit type** option field that lies below the permitted value range (**Lower** limit value) or above the permitted value range (**Upper** limit value).

✧ Enter the limit value into the **Limit** field.

✧ In the **Hysteresis** field enter a value for the hysteresis of the limit value violation.

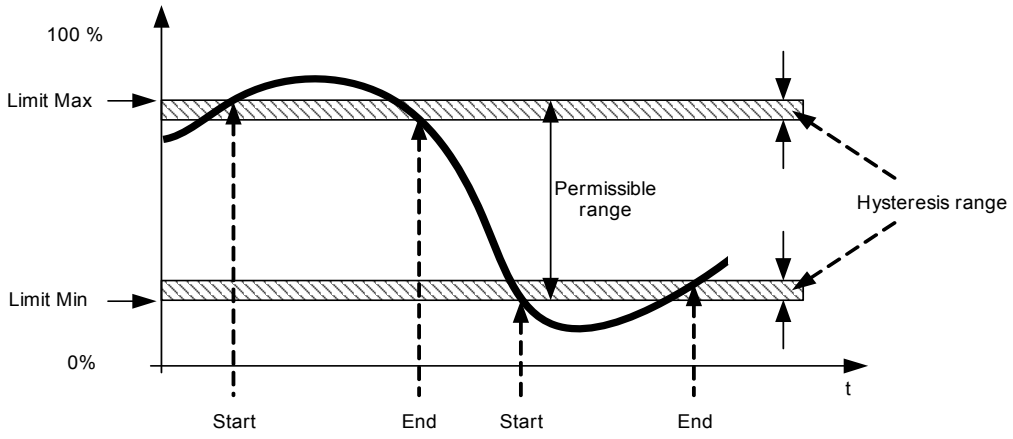



Fig. 7-24 Hysteresis (General Representation)

✧ Enter a name for the limit violation indication in the **Violation indication** field. By doing so, the original entry is overwritten.

✧ Click the **Send** button.

After clicking the **Send** button, the parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **activation** of the device configuration according to **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in **Activating the Set of Parameters**.

### 7.3.3.2.2 Group Indications

In the **Select automation functions** menu, up to 4 **Group indications** can be parameterized and each of them can be assigned up to 16 logically linked single-point indications. For this purpose, set the checkmark.

Table 7-5 Group Indications

| Parameter | Default Setting | Setting Range |
|---|---|---|
| Indication<br><br>According to the available indications (see chapter 15) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |

### Parameterizing a Group Indication

To change for example group indication 1, proceed as follows:

✧ In the navigation window, select the **Operational parameters** menu, then the **Select automation functions** submenu and click **Group indications**.

The **Group indications** input/output window opens.

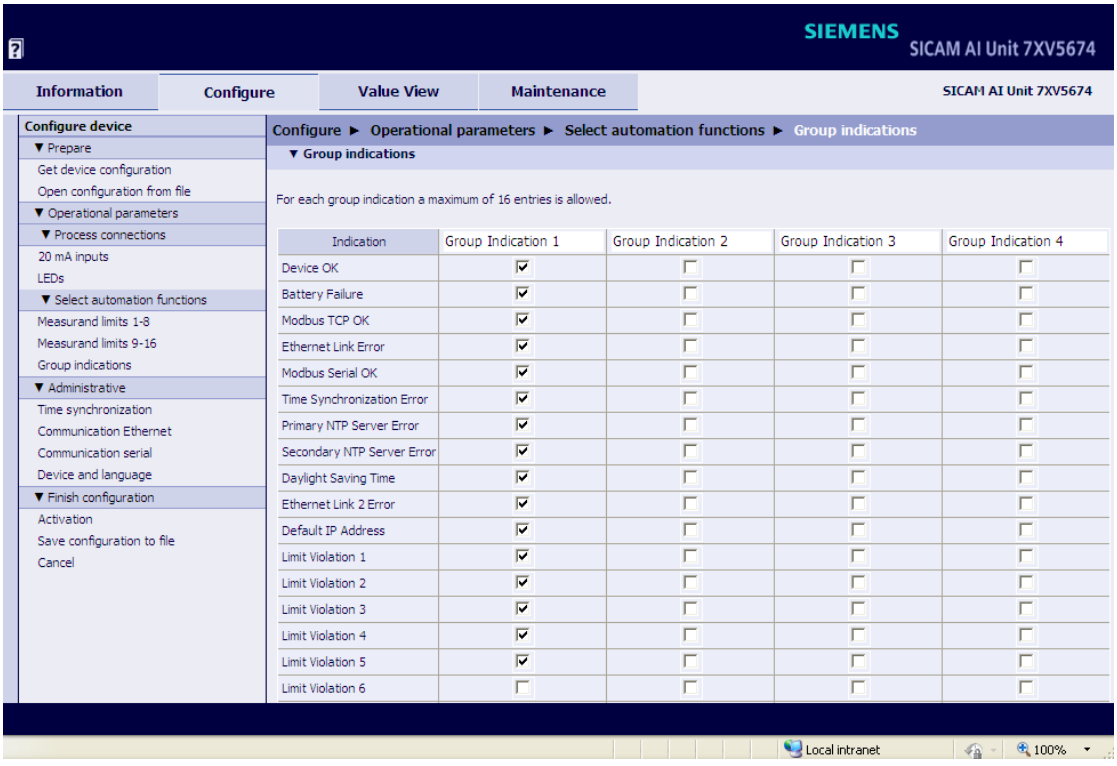



Fig. 7-25 Configure Tab, Group Indications Input/Output Window (Detail)

✧ For the **Group Indication 1**, select up to 16 indications you want to assign to **Group Indication 1**. For this purpose, set the checkmark. You can assign the following indications to a group indication:

- Ready and status indications, for example Device OK, Modbus TCP OK, Input not active T1/2
- Error indications, for example Battery Failure, Ethernet Link Error
- Administrative indications, for example Daylight Saving Time
- Limit violation indications, for example Limit Violation 1 (see chapter 7.3.3.2)
- Measuring range exceedance, for example Out of range Q4/6
- Measuring range lower deviation, for example Wire broken Q3/5

If you do not set any checkmark for all indications of a group indication, the respective group indication is inactive.

✧ Click the **Send** button.

After clicking the **Send** button, the parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **activation** of the device configuration according to **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in **Activating the Set of Parameters**.

## 7.3.4 Setting Administrative Parameters

In the **Configure** tab you can view and if necessary edit the administrative settings. You can select the parameters in the **Administrative** menu in the navigation window. These parameters can be changed in the input/output windows **Time synchronization**, **Communication** (consisting of **Communication Ethernet** and **Communication serial**) and **Device and language**.

**NOTE**

Observe the procedure for the device configuration described in chapter 7.3.1 when setting the administrative parameters.

### 7.3.4.1 Time Synchronization

**Default Settings and Setting Ranges of the Time Synchronization**

Table 7-6 Time Synchronization Settings

| Parameter | Default Setting | Setting Range |
|---|---|---|
| Source time synchronization | Internal | Acc. to list box<br>(see chapter 15) |
| Time zone offset to UTC | +00:00 | -12 to +13 (hours)<br>(in increments of 0.5 h) |
| Daylight Saving Time switchover | yes | no<br>yes |
| DST offset to UTC | +01:00 | 0 to + 2 (hours)<br>(in increments of 0.5 h) |
| Start of DST | March<br>Last week<br>Sunday<br>02:00 AM | Acc. to list boxes<br>(see chapter 15) |
| End of DST | October<br>Last week<br>Sunday<br>03:00 AM | Acc. to list boxes<br>(see chapter 15) |
| **Additional Parameters if the Source is Ethernet NTP (Modbus TCP and IEC 61850)** | | |
| Primary NTP server IP address | 192.168.0.254 | Any |
| Secondary NTP server IP address | 192.168.0.253 | Any<br>No polling of the NTP server if 0.0.0.0 was entered |
| Error indication after | 10 min | 2 min to 120 min |
| **Additional Parameter if the Source is Fieldbus (Modbus RTU)** | | |
| Error indication after | 10 min | 2 min to 120 min |

To change the time synchronization, proceed as follows:

✧ In the navigation window, click the **Administrative** menu and then **Time synchronization**.

The **Time synchronization** input/output window opens.


Fig. 7-26 Configure Tab, Time Synchronization Input/Output Window, Ethernet NTP Selected

✧ Select one of the three following sources from the **Source time synchronization** list box:
  – Internal (no time synchronization)
  – Ethernet NTP
  – Fieldbus

✧ Parameterize the time synchronization according to the selected source.

### Internal Time Synchronization

✧ Select **Internal** as the source from the **Source time synchronization** list box:

✧ In the **Time zone offset to UTC** list box select the time difference to UTC (Universal Time Coordinated).

✧ The option buttons at **Daylight Saving Time switchover** allow you to enable (**yes**) or disable (**no**) the automatic Daylight Saving Time adjustment.

If you have selected the **no** option button, the time synchronization is complete. Click the **Send** button in this case. If you have selected the **yes** option button, continue the parameterization as follows:

✧ Select the time difference to UTC in the **DST offset to UTC** list box.

✧ In the list boxes under **Start of DST** specify the month, week, day and time for starting Daylight Saving Time.

✧ In the list boxes under **End of DST** specify the month, week, day and time for switching back to standard time.

- ✧ Click the **Send** button.

  After clicking the **Send** button, the parameters are transmitted to the device but not enabled yet (passive set of parameters).

- ✧ If you do not want to make any additional settings, continue with the **activation** of the device configuration according to **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in **Activating the Set of Parameters**.

**Time Synchronization via Ethernet NTP**

- ✧ Select **Ethernet NTP** as the source from the **Source time synchronization** list box:
- ✧ Enter the IP address in the **Primary NTP server IP address** field.
- ✧ Enter the IP address of the redundant NTP server in the **Secondary NTP server IP address** field.
- ✧ In the **Error indication after** field enter the time in **min** after which the operational indication "Clock error" is output.
- ✧ Select the time difference to UTC in the **Time zone offset to UTC** list box.
- ✧ The option buttons at **Daylight Saving Time switchover** allow you to enable (**yes**) or disable (**no**) the automatic Daylight Saving Time adjustment.

  If you have selected the **no** option button, the time synchronization is complete. Click the **Send** button in this case. If you have selected the yes option button, continue the parameterization as follows:

- ✧ Select the time difference to UTC in the **DST offset to UTC** list box.
- ✧ In the list boxes under **Start of DST** specify the month, week, day and time for starting Daylight Saving Time.
- ✧ In the list boxes under **End of DST** specify the month, week, day and time for switching back to standard time.
- ✧ Click the **Send** button.

  After clicking the **Send** button, the parameters are transmitted to the device but not enabled yet (passive set of parameters).

- ✧ If you do not want to make any additional settings, continue with the **activation** of the device configuration according to **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in **Activating the Set of Parameters**.

**Time Synchronization via Fieldbus**

- ✧ Select **Fieldbus** as the source from the **Source time synchronization** list box:
- ✧ In the **Error indication after** field enter the time in **min** after which the operational indication "Clock error" is output.
- ✧ Select the time difference to UTC in the **Time zone offset to UTC** list box.
- ✧ The option buttons at **Daylight Saving Time switchover** allow you to enable (**yes**) or disable (**no**) the automatic Daylight Saving Time adjustment.

  If you have selected the **no** option button, the time synchronization is complete. Click the **Send** button in this case. If you have selected the **yes** option button, continue the parameterization as follows:

- ✧ Select the time difference to UTC in the **DST offset to UTC** list box.
- ✧ In the list boxes under **Start of DST** specify the month, week, day and time for starting Daylight Saving Time.
- ✧ In the list boxes under **End of DST** specify the month, week, day and time for switching back to standard time.

- ✧ Click the **Send** button.

  After clicking the **Send** button, the parameters are transmitted to the device but not enabled yet (passive set of parameters).

- ✧ If you do not want to make any additional settings, continue with the **activation** of the device configuration according to“**Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in **Activating the Set of Parameters**.

### 7.3.4.2 Ethernet Communication

**General Settings**

Table 7-7 Ethernet Communication Settings - General Settings

| Parameter | Default Setting | Setting Range |
|---|---|---|
| IP address [1)] | 192.168.0.55 | Any<br>0.0.0.0 = DHCP |
| Subnet mask [1)] | 255.255.255.0 | Any |
| Default gateway [1)] | 192.168.0.1 | Any |
| Ethernet switch on | no | no<br>yes |
| Bus protocol | Modbus TCP | -none-<br>Modbus TCP<br>IEC 61850<br>Modbus UDP |

1) After the parameter changes have been enabled, the device will reset.

**Bus Protocols Modbus TCP and Modbus UDP**

Table 7-8 Ethernet Communication Settings - Modbus TCP/UDP

| Parameter | Default Setting | Setting Range |
|---|---|---|
| **Bus Protocol Modbus TCP** | | |
| Use a user-port number [1)] | no | no<br>yes |
| User-port number [1)]<br>(can only be set when *Use a user-port number* is parameterized with *yes*) | 10000 | 10000 to 65535 |
| Access rights for user port<br>(can only be set when *Use a user-port number* is parameterized with *yes*) | Full | Full<br>Read only |
| Access rights for port 502 | Full | Full<br>Read only |
| Keep Alive time | 10 s | 0 s = switch off<br>1 s to 65 535 s |
| Communication supervision time | 50 [* 100 ms] | 0 s = none<br>100 ms to 6 553 400 ms |
| **Bus Protocol Modbus UDP** | | |
| Port number | 51000 | 10000 to 65535 |
| Access rights | Full | Full,<br>Read only |
| Communication supervision time | 20 [* 10 ms] | 0 ms = invalid<br>10 ms to 60 000 ms |

1) After enabling the parameter changes, any currently active Modbus TCP connections will be closed. The Modbus TCP client must later reopen these connections.

**Bus Protocol IEC 61850**

Table 7-9 Ethernet Communication Settings - IEC 61850

| Parameter | Default Setting | Setting Range |
|---|---|---|
| **Bus Protocol IEC 61850 [1)]** | | |
| **General** | | |
| IEC 61850 Edition | Edition 1 | Edition 1<br>Edition 2 |
| IED name number | 1 | 0 to 65 534 |
| Deadband percentage | 2.0 | 0.0 % to 10.0 % |
| **GOOSE Publisher parameters** | | |
| GOOSE Control Block name | Goose_20mA_Values | |
| Multicast MAC address | 01-0C-CD-01-00-01 | [xx-xx-xx-xx-xx-xx] hexadecimal |
| App ID | 3001 | [xxxx] hexadecimal |
| VLAN ID | 000 | [xxx] hexadecimal |
| VLAN priority | 4 | 0 to 7 |
| Retransmit MIN | 10 | 1 ms to 500 ms |
| Retransmit MAX | 2000 | 500 ms to 65 534 ms |

1) After having selected IEC 61850 or having changed the IEC 61850 settings with the following activation, the device is automatically restarted.

To change the Ethernet communication settings, proceed as follows:

✧ In the navigation window, click the **Administrative** menu and then **Communication Ethernet**.
The **Communication Ethernet** input/output window with **Protocol Modbus TCP** opens.

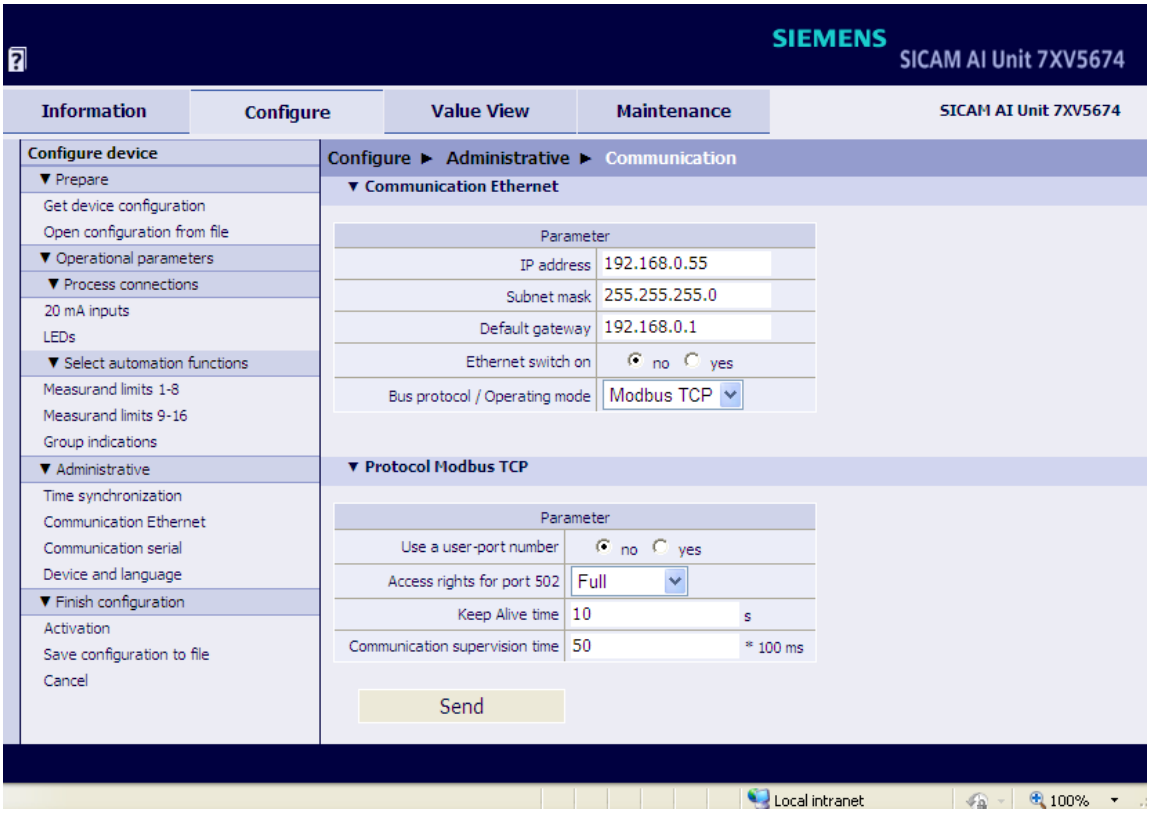



Fig. 7-27 Configure Tab, Communication Ethernet via Modbus TCP Input/Output Window

✧ Enter the IP address into the **IP address** field.

✧ Enter the subnet mask into the **Subnet mask** field.

✧ Enter the gateway into the **Default gateway** field.

✧ In the **Ethernet switch on** option field, select whether Ethernet switch is to be enabled (**yes**) or not (**no**).

**NOTE**

The Ethernet switch is switched off at delivery. In order to cascade further network components and therefore also incorporate them in an existing network with IEC 61850, the release of the Ethernet switch (option **yes**) is required. For this purpose, connect a Y cable to the Ethernet connector.

**Ethernet Communication with Bus Protocol Modbus TCP (see figure 7-27)**

- ✧ In the **Bus protocol** list box select the entry **Modbus TCP**.
- ✧ Under **Use a user-port number** select the option **yes** to enter your own port number.

**NOTE**

If you have selected **no** under **Use a user-port number**, you can adjust only the **Access rights for user port 502**, the **Keep Alive time** and the **Communication supervision time** parameters.

- ✧ Enter the user port number (≥ 10000) into the **User port number** field.
- ✧ Under **Access rights for user port,** you can select either the **Full** access rights or **Read only** authorization.
- ✧ Under **Access rights for user port 502** you can select either the **Full** access rights or **Read only** authorization.
- ✧ Enter the time in **s** in the **Keep Alive time** field.
- ✧ Enter the time in x *** 100 ms** into the **Communication supervision time** field.
- ✧ Click the **Send** button.

  After clicking the **Send** button, the parameters are transmitted to the device but not enabled yet (passive set of parameters).
- ✧ If you do not want to change any other settings, continue with the **Activation** of the device configuration according to chapter 7.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

**NOTE**

After changing the network settings and subsequent parameter activation the device will reset.

### Ethernet Communication with Bus Protocol Modbus UDP

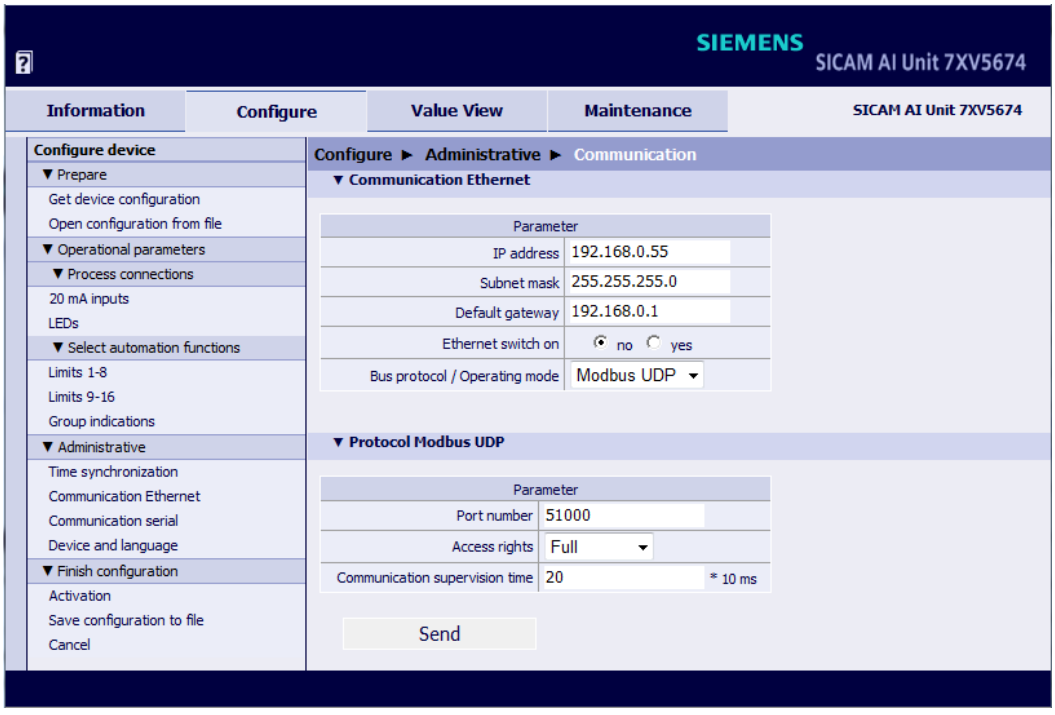



Figure 7-28 Configure Tab, Communication Ethernet via Modbus UDP Input/Output Window

- ✧ Enter the port number (≥ 10000) into the **Port number** field.
- ✧ Under **Access rights** you can select either the **Full** access rights or **Read only** authorization.
- ✧ Enter the time in x *** 10 ms** into the **Communication supervision time** field..
- ✧ Click the **Send** button.

  After clicking the **Send** button, the parameters are transmitted to the device but not enabled yet (passive parameter set).
- ✧ If you do not want to change any other settings, continue with the **Activation** of the device configuration according to chapter 7.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

### Ethernet Communication with Bus Protocol IEC 61850

✧ In the **Bus protocol** list box select the entry **IEC 61850**.

The **Communication Ethernet** input/output window with **Protocol IEC 61850** opens.


Fig. 7-29 Configure Tab, Communication Ethernet via IEC 61850 Input/Output Window

✧ Select **Edition 1** or **Edition 2** from the **IEC 61850 Edition** list box.

**NOTE**

The device behaves as defined in the respective edition.

When you click the **Download ICD file** button, the ICD file that corresponds to the selected edition is downloaded.

**NOTE**

Clicking the **Download IID file** button the instantiated IED description file will be downloaded. It contains the information from the ICD file with information of the following current configured parameters:

- IP address
- Subnet mask
- Default gateway
- IED name
- Multicast MAC addresses
- App IDs
- VLAN IDs
- VLAN priorities
- Retransmit MINs
- Retransmit MAXs

✧ If several SICAM AI Unit devices are used in the substation, change the **IED Name** of the SICAM AI Unit by setting the **IED name number** (factory setting 1).

The number must comply with the number parameterized for this SICAM AI Unit in the configurator of the substation.

The originating IED name is **S_AI_XXXXX**, for example:

**IED name number** = 72 → results in → IED-Name = **S_AI_00072**

**NOTE**

By stating the **IED name number**, the SICAM AI Unit is clearly identified in the network.

✧ Enter a percentage between 0 % and 10 % in the **Deadband percentage** field.

### Integrating Deadband Process

The SICAM AI Unit uses an integrating deadband process.

Differences between current and previous measurements of the respective direct current input will be added up until their sum reaches or exceeds the parameterized percentage of the rated current (20 mA). Only in this case the new value will be transmitted to IEC 61850 server and GOOSE. The sum will be resetted to 0 after a new value is transmitted.

If 0 % is parameterized for deadband percentage, every change in measurements will be transmitted to IEC 61850 server and GOOSE. This can cause huge traffic in communication.

**Example for the Integrating Deadband Process**

Adjusted deadband percentage: 5 % (5 % of 20 mA = 1 mA)

Table 7-10 Example for the Integrating Deadband Process

| Number of the measuring | Measurement | Difference to previous value | Summed differences | Transmission ? |
|---|---|---|---|---|
| 1 | 4.0 mA | 4.0 mA | 4.0 mA | yes |
| 2 | 4.4 mA | 0.4 mA | 0.4 mA | no |
| 3 | 4.9 mA | 0.5 mA | 0.9 mA | no |
| 4 | 5.1 mA | 0,2 mA | 1.1 mA | yes |
| 5 | 5.4 mA | 0.3 mA | 0.3 mA | no |
| 6 | 6.4 mA | 1.0 mA | 1.3 mA | yes |

The following parameters describe the configuration of the GOOSE publisher (20-mA values):

- ✧ Enter the hexadecimal multicast address [xx-xx-xx-xx-xx-xx] in the **Multicast MAC address** field. The **Multicast MAC Address must** be clear.
- ✧ Enter the hexadecimal App ID [xxxx] in the **App ID** field. The **App ID should** be clear (only a warning appears in the System configurator).
- ✧ Enter the hexadecimal VLAN ID [xxx] in the **VLAN ID** field. If no VLAN is available, then is **VLAN ID = 000**.
- ✧ Enter the VLAN priority (0 to 7) in the **VLAN Priority** field.
- ✧ Enter the time (1 ms to 500 ms) in the **Retransmit MIN** field.
- ✧ Enter the time (500 ms to 65 534 ms) in the **Retransmit MAX** field.

**HINWEIS**

The GOOSE Publisher can be activated/deactivated under the tab **Maintenance**, see chapter 7.5.4. The GOOSE Publisher is disabled by default.

- ✧ Click the **Send** button.

  After clicking the **Send** button, the parameters are transmitted to the device but not enabled yet (passive set of parameters).
- ✧ If you do not want to change any other settings, continue with the **Activation** of the device configuration according to chapter 7.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

**NOTE**

Changing any of the parameters shown under Bus protocol IEC 61850 (see figure 7-29) leads to an automatic restart of the device. Devices that are cascaded via the internal Ethernet switch will be disconnected during the restart of the device.

**Download ICD File**

✧ Click the **Download ICD file** button.

The ICD file of the SICAM AI Unit corresponding to the currently selected edition is downloaded.

**Download IID File**

✧ Click the Download IID file button.

The IID file of the SICAM AI Unit corresponding to the currently activated edition and configured parameters is downloaded.

The IID file for example can be used for setting up reporting when imported to a RTU (e.g. SICAM PQS). Also it can be loaded into a system configuration tool (e.g. System configurator, DIGSI) for setting up GOOSE communication between several devices.

**No Ethernet Communication**

✧ In the **Bus protocol** list box select the entry **-none-**.

If you select **-none-**, no protocol will be available. Click the **Send** button in this case.

After clicking the **Send** button, the parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to change any other settings, continue with the **Activation** of the device configuration according to chapter 7.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

### 7.3.4.3 Serial Communication for Devices with RS485 or Optical Interface

**Default Settings and Setting Ranges of the Serial Communication**

Table 7-11 Serial Communication Settings

| Parameter | Default Setting | Setting Range |
|---|---|---|
| Bus protocol | Modbus RTU | -none-<br>Modbus RTU<br>SIPROTEC RTU 20 mA |
| **Bus Protocol Modbus RTU** | | |
| Device address | 1 | 1 to 247 |
| Baud rate | 19 200 bit/s | Acc. to list box<br>(see chapter 15) |
| Parity | Even | Acc. to list box<br>(see chapter 15) |
| Access rights | Full | Full<br>Read only |
| Communication supervision time | 600 * 100 ms | 0 s = none<br>100 ms to 6 553 400 ms |
| Response delay | 0 [ms] | 0 ms to 1000 ms |
| If there is an optical interface:<br>Fiber-optic idle state | Light OFF | Light OFF<br>Light ON |
| **Bus Protocol SIPROTEC RTU 20 mA** | | |
| MBS mode | 8 MBS, simplex | Acc. to list box<br>(see chapter 15) |
| Repeat time [1)] | 600 ms | 0 ms to 65 534 ms |
| Device address [2)] | 1 | 1 or 2 |
| Baud rate | 9600 Bit/s | Acc. to list box<br>(see chapter 15) |

Table 7-11 Serial Communication Settings (cont.)

| Parameter | Default Setting | Setting Range |
|---|---|---|
| Parity | Even | Acc. to list box<br>(see chapter 15) |
| Communication supervision time | 600 * 100 ms | 0 s = none<br>100 ms to 6 553 400 ms |
| If there is an optical interface:<br>Fiber-optic idle state | Light OFF | Light OFF<br>Light ON |

1) Only visible, if **8 MBS, simplex** is selected as **MBS mode**.

2) Only visible, if **8 MBS, half duplex** is selected as **MBS mode**.

To change the serial communication settings, proceed as follows:

- In the navigation window, click the **Administratives** menu and then the **Communication serial** menu item.

  The **Communication serial** input/output window opens.

- In the **Bus protocol** list box select one of the entries **Modbus RTU**, **SIPROTEC RTU 20 mA** or **none**.

  If you select **-none-**, no protocol will be available. Click the **Send** button in this case.

  If you select **Modbus RTU** or **SIPROTEC RTU 20 mA** (available depending on the device variant), set the parameters for the corresponding protocol as follows:

### Serial Communication via the Modbus RTU Protocol

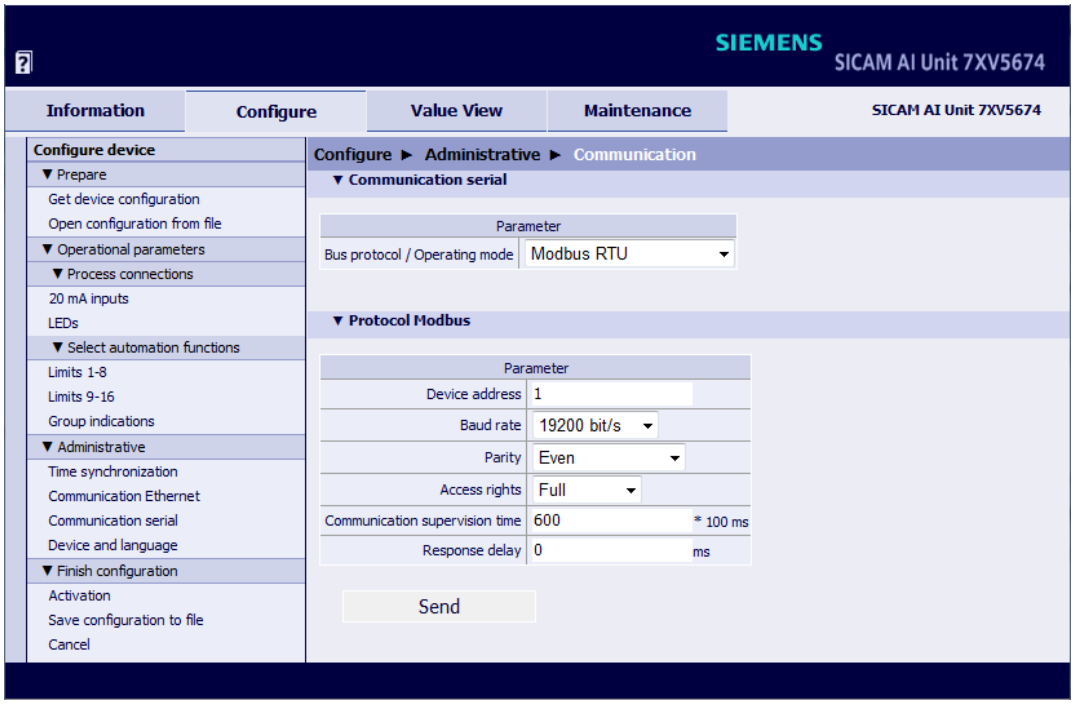



Fig. 7-30 Configure Tab, Communication Serial via Modbus RTU Input/Output Window

- ✧ Select the entry **Modbus RTU** in the **Bus protocol** list box.
- ✧ Enter the slave address into the **Device address** field.
- ✧ Select the baud rate in the **Baud rate** list box.
- ✧ Select the parity in the **Parity** list box.
- ✧ Under **Access rights** you can select either the **Full** access rights or **Read only** authorization.
- ✧ Enter the time in x *** 100 ms** into the **Communication supervision time** field.
- ✧ Enter the time in x **ms** into the **Response delay** field.
- ✧ Click the **Send** button.

  After clicking the **Send** button, the parameters are transmitted to the device but not enabled yet (passive set of parameters).
- ✧ If you do not want to make any additional settings, continue with the **activation** of the device configuration according to **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in **Activating the Set of Parameters**.

### Serial Communication via the SIPROTEC RTU 20 mA Protocol

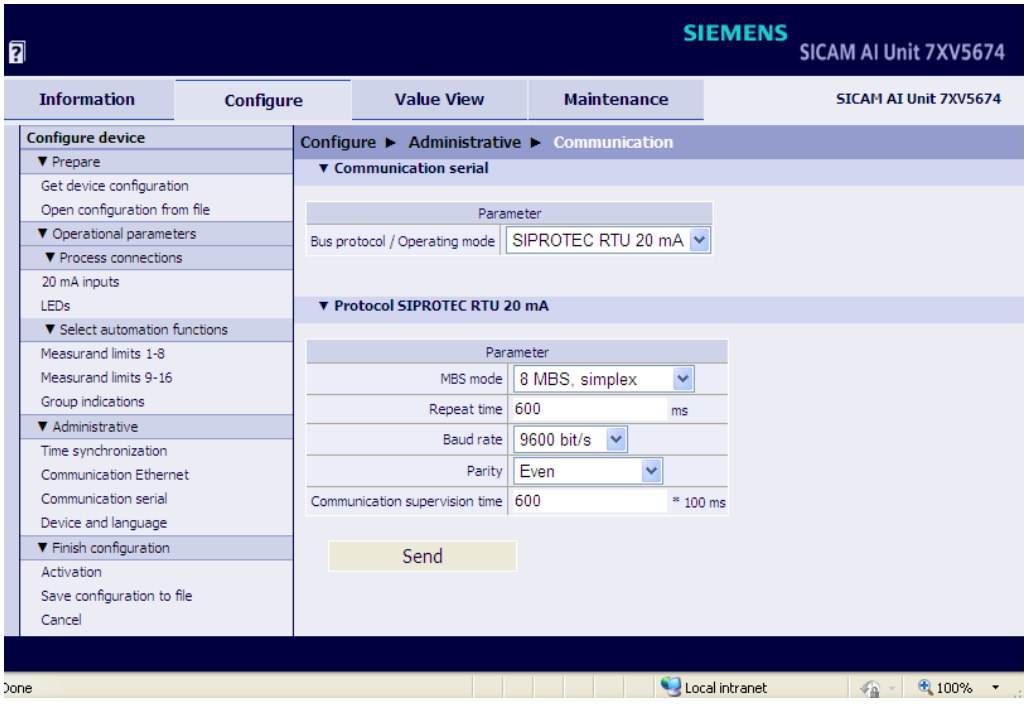



Fig. 7-31 Configure Tab, Input/Output Window Communication Serial via SIPROTEC RTU 20 mA

- ✧ Select the entry **SIPROTEC RTU 20 mA** in the **Bus protocol** list box.
- ✧ Select the MBS mode in the **MBS mode** list box.
- ✧ Enter the repeat time into the **Repeat time** field.

**NOTE**

The **Repeat time** field is visible only if **8 MBS, simplex** has been selected as **MBS mode**.

- ✧ Enter the slave address into the **Device address** field.

**NOTE**

The **Repeat time** field is visible only if **8 MBS, half duplex** has been selected as **MBS mode**.

- ✧ Select the baud rate in the **Baud rate** list box.
- ✧ Select the parity in the **Parity** list box.
- ✧ Enter the time in x * 100 ms into the **Communication supervision time** field.
- ✧ Click the **Send** button.

  After clicking the **Send** button, the parameters are transmitted to the device but not enabled yet (passive set of parameters).
- ✧ If you do not want to make any additional settings, continue with the **activation** of the device configuration according to **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in **Activating the Set of Parameters**.

### 7.3.4.4 Device and Language

**Default Settings and Setting Ranges for Device and Language**

Table 7-12 Device and Language Settings

| Parameter | Default Setting | Setting Range |
|---|---|---|
| Device name | [DEVICE] | Max. 32 characters |
| Language | ENGLISH (US) | ENGLISH (US)<br>DEUTSCH (DE) |
| Date/time format | YYYY-MM-DD,<br>Time with 24 hours | Acc. to list box<br><br>(see chapter 15) |
| Activation password | 000000 | Any 6 to 14 characters |
| Maintenance password | 311299 | Any 6 to 14 characters |

To change the settings of device and language, proceed as follows:

✧ In the navigation window, click the **Administrative** menu and then **Device and language**.

The **Device and language** input/output window opens.

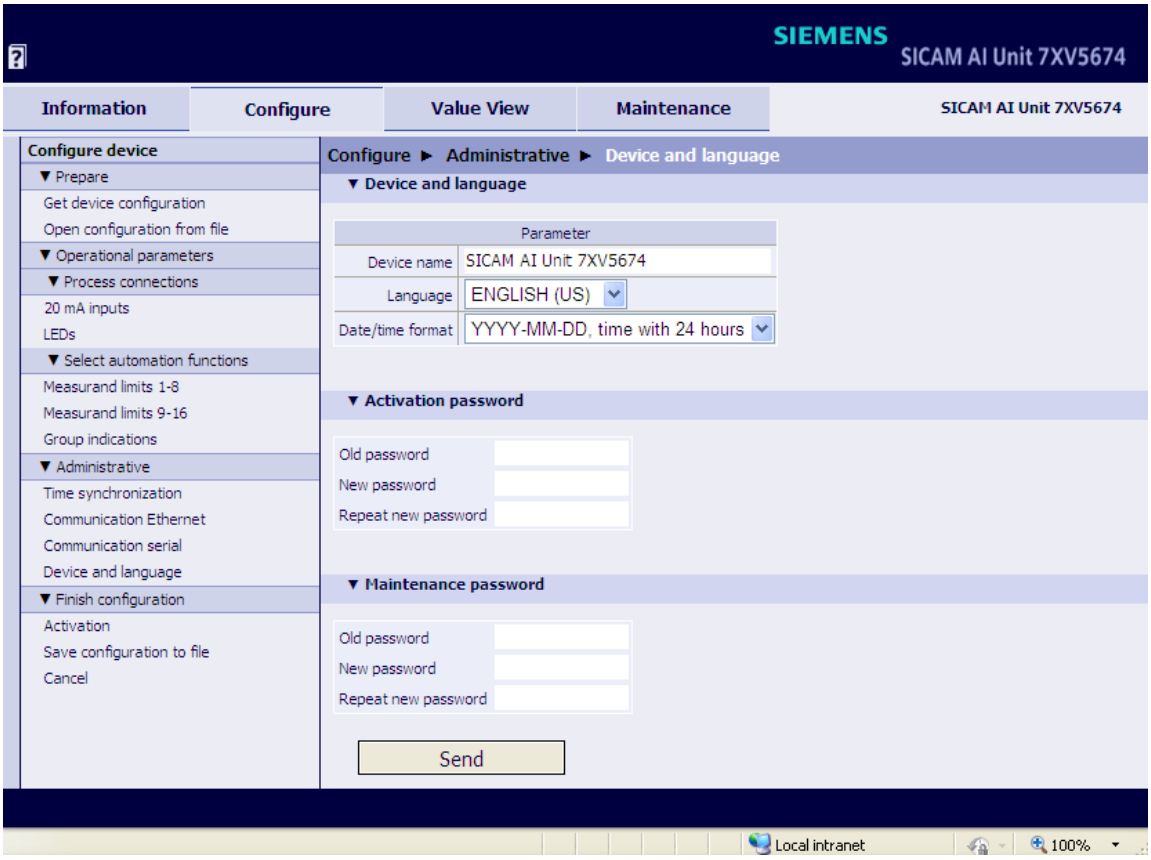



Fig. 7-32 Configure Tab, Device and Language Input/Output Window

### 7.3.4.4.1 Changing the Parameters

#### Changing the Device Name

- ✧ Enter the name of the device into **Device name** field.

#### Changing the Language

- ✧ Select the user interface language of user interface in the **Language** list box.

#### Changing the Time Format

- ✧ Select the date and time format in the **Date/time format** list box.

### 7.3.4.4.2 Changing the Passwords

#### Changing the Activation Password

- ✧ Enter the old activation password in the **Old password** field.
- ✧ Enter the new activation password (any 6 to 14 characters of the keyboard) into the **New Password** field.
- ✧ Repeat the new activation password in the **Repeat new Password** field.

**Changing the Maintenance Password**

- ✧ Enter the old maintenance password in the **Old password** field.
- ✧ Enter the new maintenance password (any 6 to 14 characters of the keyboard) into the **New password** field.
- ✧ Repeat the new maintenance password in the **Repeat new Password** field.
- ✧ Click the **Send** button.
  After clicking the **Send** button, the parameters are transmitted to the device and take effect.

### 7.3.4.4.3 Finish Configuration

The items in the **Finish configuration** menu in the navigation window are described in chapter 7.3.1, Device Configuration Procedure, in these subsections:

**Activation**: see **Activating the Set of Parameters**

**Save configuration to file**: see **Save Configuration to File**

**Cancel**: see “Cancel”

# 7.4 Value View

The measured values are displayed in the **Value view** tab. To display the measured values on the screen, proceed as follows:

✧ Click the **Value view** tab on the user interface.

The **Value view** tab opens.


Fig. 7-33 Value View Tab

✧ In the navigation window open the **Operational** menu, then the **Process connections** or **Automation functions** submenu and click one of the following items:

– 20- mA inputs
– Measurand limits
– Group indications

Depending on which operational parameters are selected, the input/output window displays the measured values of the measurands with the corresponding unit or indications in a tabular list that is updated every 5 s.

**NOTE**

If ***** is displayed instead of a measured value, this measured value is invalid or out of measuring range.

The current measuring inputs must be applied with min. 4 mA, so that respective channels are identified as intact. All values below 3.8 mA (measuring tolerance) are displayed as 0 mA and indicate a wire break.

✧ To print out the measured values, click the (**Print**) icon on the toolbar of Microsoft Internet Explorer.

# 7.5 Maintenance

In the **Maintenance** tab you can:

- Update the firmware
- Perform the calibration
- Perform the simulation
- Make various presettings
- View and delete message logs
- Analyze protocol-specific communication data of Modbus

If you want to edit this tab, you need the Maintenance password.

To open the **Maintenance** tab, proceed as follows:

✧ Click the **Maintenance** tab on the user interface.
The **Maintenance** tab opens.

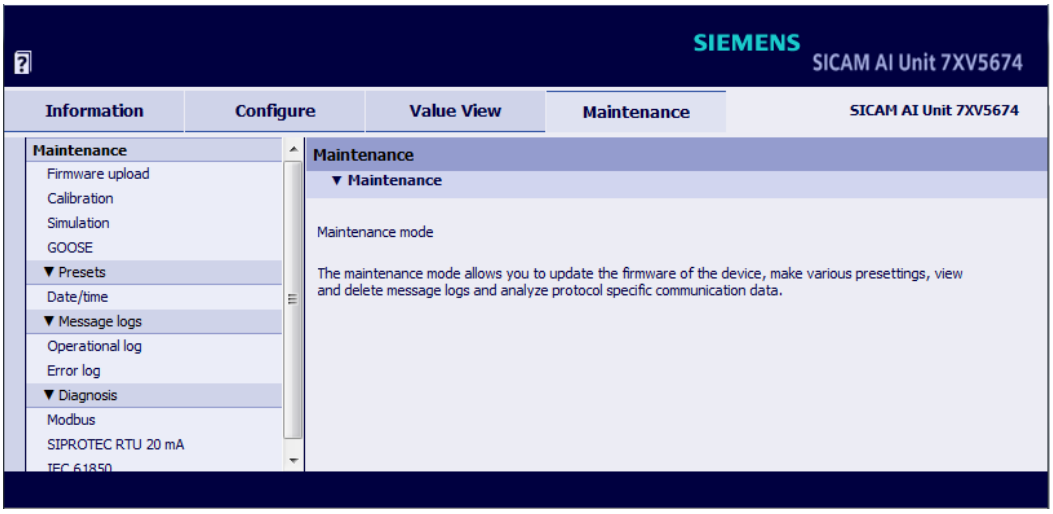



Fig. 7-34 Maintenance Tab

## 7.5.1 Firmware Upload

During a firmware update, the device firmware, the default set of parameters, text libraries, HTML files or parts thereof are updated.

**NOTE**

Before updating the firmware, Siemens recommends saving the current parameters set as described in **Save Configuration to File**.

**NOTE**

If you activated the Web Browser option that the local folder name is transferred in addition to the file name when uploading a file, the total number of characters in the folder name and file names must not exceed 126. Otherwise, the firmware in your device will not be updated.

To update the firmware proceed as follows:

✧ Click the **Firmware upload** element in the navigation window.

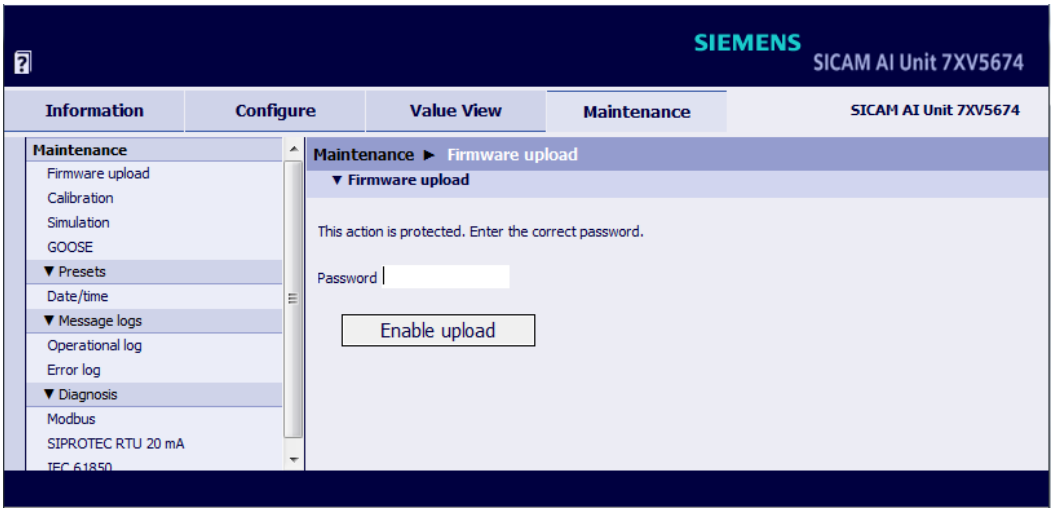



Fig. 7-35 Maintenance Tab, Firmware Upload - Enable Upload Input/Output Window

✧ Enter the maintenance password

✧ Click the **Enable upload** button.

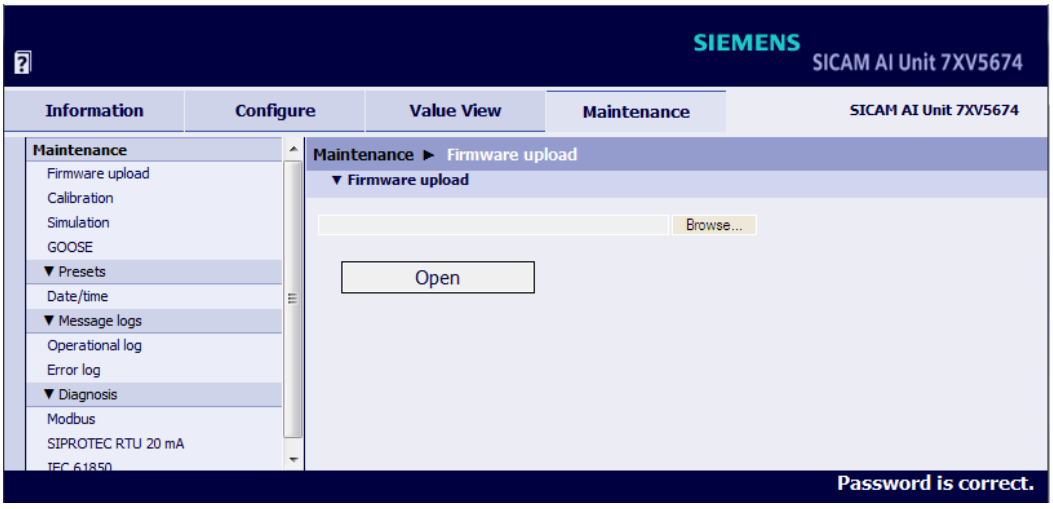



Fig. 7-36 Maintenance Tab, Firmware Upload - Open Input/Output Window

✧ Click the **Browse...** button.

The **Choose File to Upload** dialog opens.

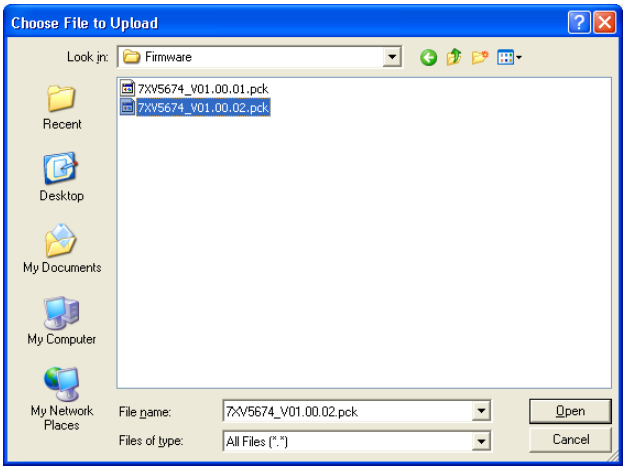



Fig. 7-37 Choose File Dialog

✧ Select the desired update (extension .pck) in the directory.

✧ Click the **Open** button.

The selected path is inserted in the input/output window, figure 7-36, into the **Browse...** field.

✧ Click the **Open** button.

✧ After approx. 2 s, the message **Action was successful!** is displayed in the input/output window.

Device firmware, default set of parameters, text libraries, HTML files or parts thereof are uploaded within one minute.

The device then restarts automatically.

**NOTE**

Do not switch off the supply voltage during the upload process as this can lead to data loss.

## 7.5.2 Calibration

Chapter 10 gives a detailed description of the measuring-range calibration of direct current.

It contains:

- Measurement setup
- Calibration procedure

## 7.5.3 Simulation

In the simulation mode, the measured-value acquisition of the 20-mA inputs is switched off and the values are simulated.

Depending on the configuration of the device, the simulated measured values are transmitted to further devices or to the control center.

**NOTE**

If the simulation is not active, the message **Simulation mode is not active** appears in the **Simulation** input/output window.

Simulation of the 20-mA inputs and entering the simulated currents in **Simulated current** field are active only when the inputs to be simulated are active in the **Operational parameters** menu → **Process connections** submenu → **20-mA inputs** element (20-mA Channel: T1/2 to T15/17 or Q1/2 to Q15/17).

If the simulation is active, the message **Simulation mode is active** appears in red text in the **Simulation** input/output window.

To simulate the 20-mA inputs, proceed as follows:

✧ Click the **Simulation** element in the navigation window.

The **Simulation** input/output window opens.


Fig. 7-38 Maintenance Tab, Simulation Input/Output Window

- ✧ Enter a random value between 0 mA and 20 mA which you want to simulate for the respective channel into the **Simulated current** field.
- ✧ Select the appropriate quality bits (**Failure**, **Invalid**, and **Overload**) which are to be transmitted. For this purpose, set the checkmark (Yes = checkmark set). If no quality bit is checked, the quality is valid.

**NOTE**

The quality bits describe the properties of the simulated measured values, that for example are transmitted to further devices or to the systems control.

- ✧ In the **Set data attribute „test bit“** option field, select whether the data attribute **test bit** is to be transmitted (**yes**) or not (**no**).

**NOTE**

The protocol IEC 61850 is the only protocol in which the data attribute **test bit** is transmitted.

If you set the data attribute **test bit**, the systems control recognizes the simulated process.

If you do not set the data attribute **test bit**, the systems control does not recognize the simulated process.

✧ Enter the maintenance password into the **Password** field.

✧ Click the **Start simulation** button.
The message **Simulation mode is active** appears in red text in the **Simulation** input/output window and the message **Action was successful** appears in the status bar.

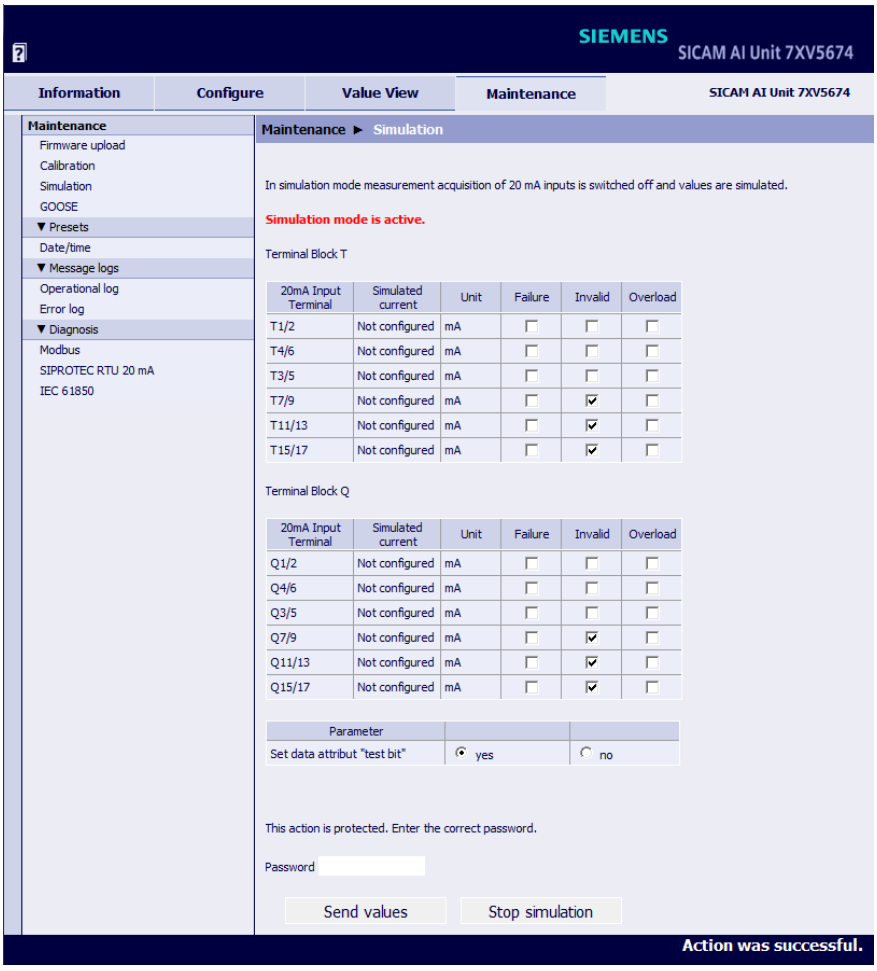



Fig. 7-39 Maintenance Tab, Simulation Mode is Active Input/Output Window

If you want to send the values to the control center, proceed as follows:

✧ Enter the maintenance password.

✧ Click the **Send values** button (see figure 7-39).
The message **Action was successful!** is displayed in the input/output window.

If you want to interrupt the simulation, proceed as follows:

✧ Click the **Stop simulation** button (see figure 7-39).

or:

✧ Click on a differernt element in the navigation window or a tab.

**NOTE**

If you want to exit the input/output window by clicking another element or another tab during the simulation, answer the appearing retrieval to leave the simulation mode with **yes**.

After 20 minutes without clicking the **Start simulation** button, the simulation mode is exited and the device measures the present currents again.

## 7.5.4 GOOSE

GOOSE Publisher of the device can be activated and deactivated here.

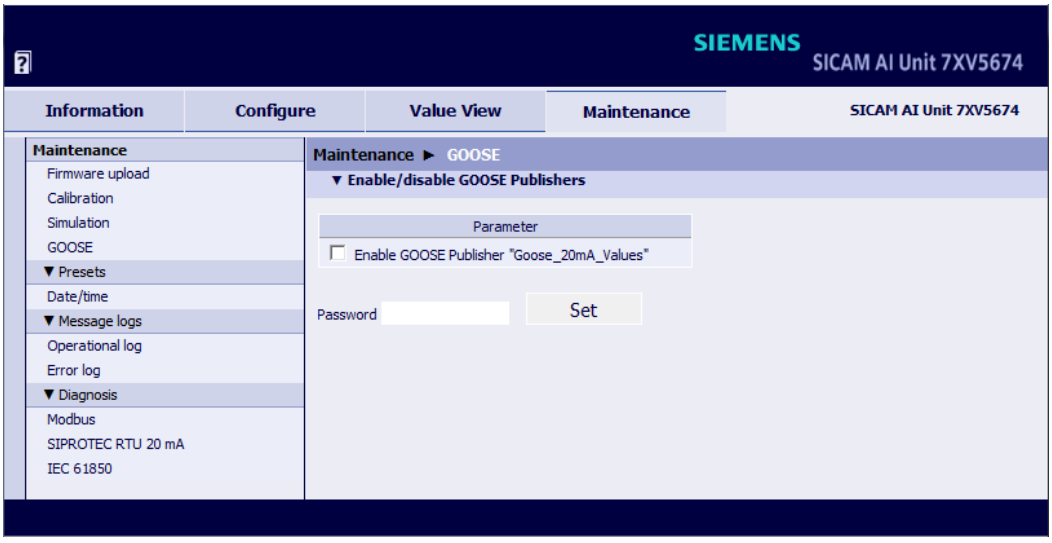



Fig. 7-40 GOOSE Publisher

To enable GOOSE Publishers proceed as follows:

- ✧ Select **GOOSE** Publishers you want to activate or deactivate.
- ✧ Enter the **maintenance password**
- ✧ Click the **Set** button.

Enabling/disabling GOOSE Pulishers is equal to writing the GoEna attribute of the corresponding GOOSE control block with an IEC 61850 client. The current state is shown on **Maintenance** → **IEC 61850** HTML page.

The state of enabled and disabled GOOSE Publishers is not stored in device configuration that can be downloaded on tab **Configure** → **Get device configuration**.

## 7.5.5 Presettings

### 7.5.5.1 Date/Time

To set the date and time, proceed as follows:

✧ In the navigation window, click the **Presets** menu and then **Date/time**.
The **Date/time** input/output window opens.

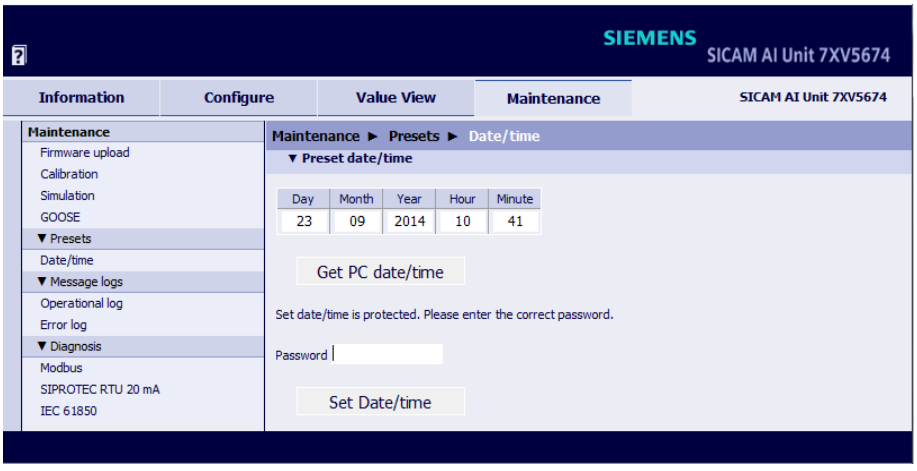



Fig. 7-41 Maintenance Tab, Preset Date/time

You can either get the date and time from the connected PC or adjust it manually.

**Get PC Date and Time**

✧ In the input/output window, click the **Get PC date/time** button.
The PC time is displayed in the fields of the input/output window and applied in the device.

**Setting the Date and Time Manually** (24-hour format)

✧ In the input/output window enter the desired time into the fields **Day** (format dd), **Month** (format mm), **Year** (format yyyy), **Hour** (format hh) and **Minute** (format mm).

✧ Enter the maintenance password into the **Password** field.

✧ Click the **Set Date/time** button.

The time you have entered is displayed in the fields of the input/output window and applied in the device.

## 7.5.6 Message Logs

### 7.5.6.1 Operational Log

To view and clear the **Operational log** (max. 128), proceed as follows:

**NOTE**

The last 128 operational indications are displayed, older indications are automatically deleted.

✧ In the navigation window, click the **Message Logs** menu and then the **Operational log** menu item.
The **Operational log** input/output window opens.

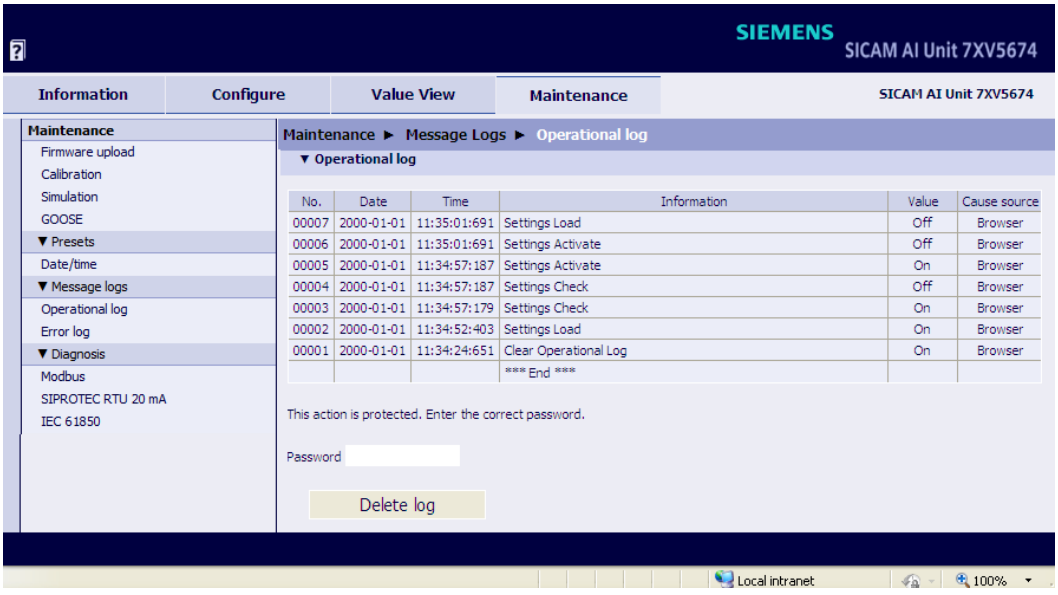



Fig. 7-42 Maintenance Tab, Delete Log

✧ Enter the maintenance password into the **Password** field.

✧ Click the **Delete log** button in the input/output window.
All operational indications in the input/output window are deleted without backup. The indication no. 0001 appears in the log list: "Clear Operational Log".

**NOTE**

If you need the operational indications, for example for subsequent analysis, save or print them out as described in chapter 7.2.5.2.

## 7.5.6.2 Error Logs

**NOTE**

Error messages are service information that you quote to the service department upon request in case of an error.

To view and clear the **Error log** (max. 128), proceed as follows:

✧ In the navigation window, click the **Message Logs** menu and then **Error log**.
The **Error log** input/output window opens.

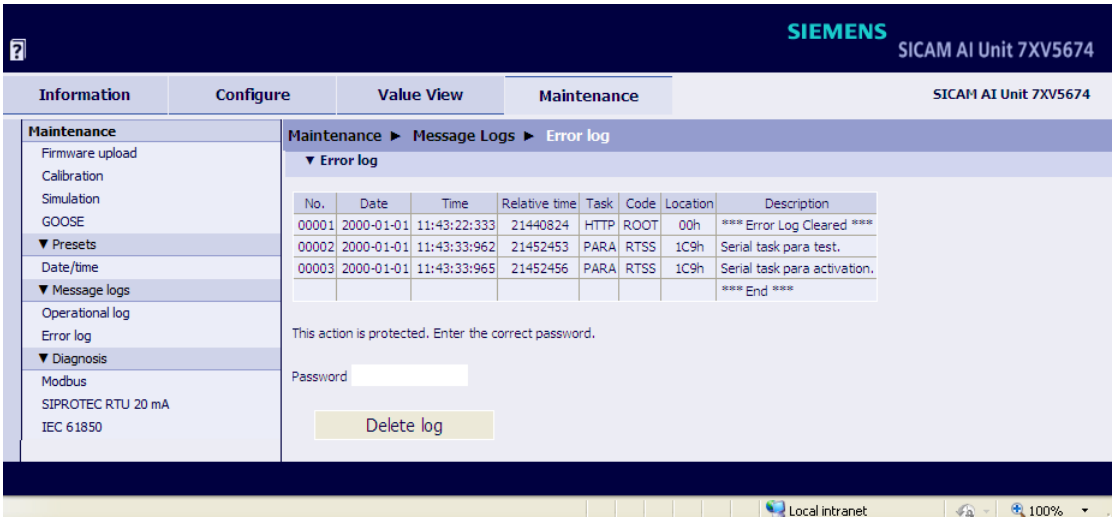



Fig. 7-43 Maintenance Tab, Delete Error Log

✧ Enter the maintenance password into the **Password** field.

✧ Click the **Delete log** button in the input/output window.
All error messages in the input/output window are deleted without backup. The indication no. 0001 appears in the log list: ***Error Log Cleared***.

**NOTE**

If you need the error messages, for example for subsequent analysis, save or print them out as described in chapter 7.2.5.2.

## 7.5.7 Diagnosis

### 7.5.7.1 Diagnosis Modbus

**NOTE**

The data for diagnosing Modbus TCP and/or Modbus RTU are only displayed if you have selected these bus protocols on the **Configure** tab → **Administrative** menu → **Ethernet communication** and **Communication serial** menu items.

For protocols that are not selected, the **Diagnosis Modbus** input/output window shows the entry **-none-**.

✧ In the navigation window, click the **Diagnosis** menu and then **Modbus**.

The **Modbus** input/output window opens and the **Modbus TCP** and **Modbus RTU** protocols are displayed. For Modbus TCP the **Standard server** and the **User-port server** are analyzed, for Modbus RTU the **Serial interface** and the **Serial server** are analyzed.

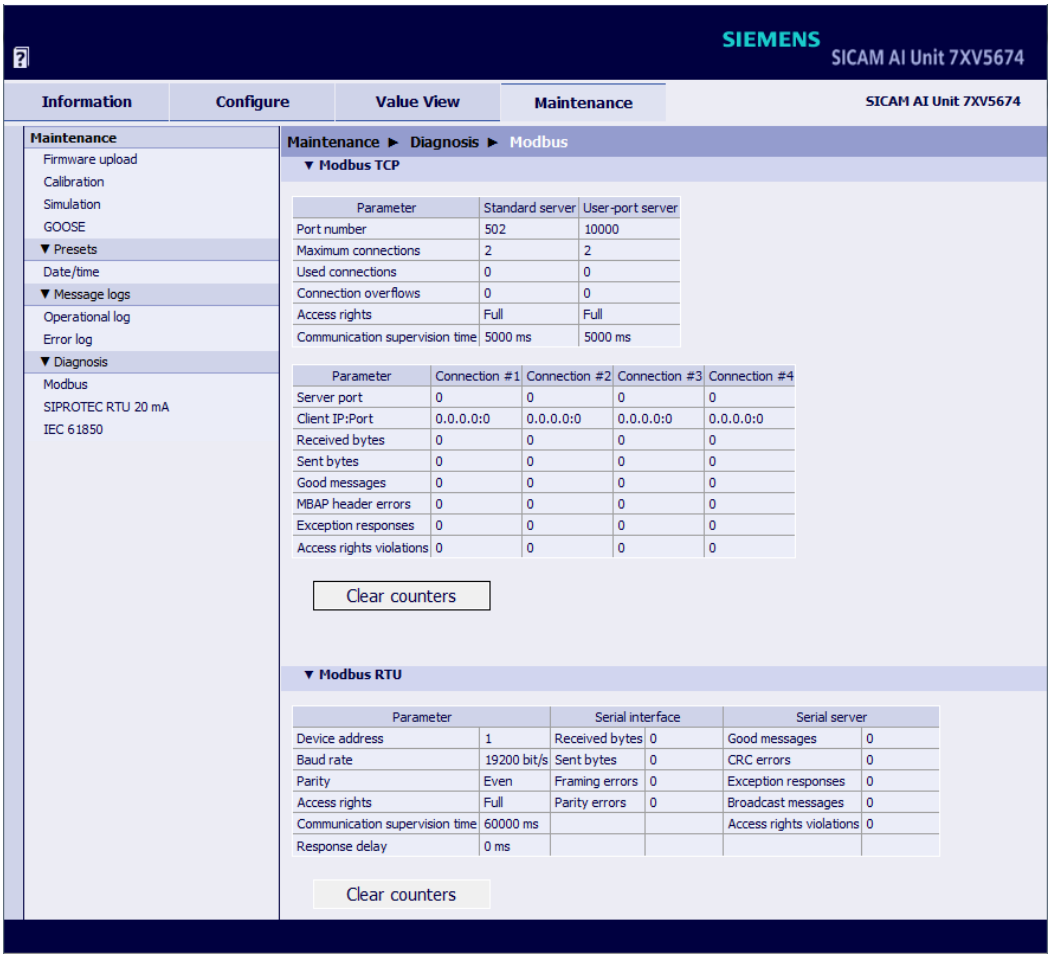



Fig. 7-44 Maintenance Tab, Diagnosis Modbus Input/Output Window with Protocols Modbus TCP and Modbus RTU

✧ To clear the counters for Modbus TCP, click the **Clear counters** button in the **Modbus TCP** section of the input/output window.

All counters in the Modbus TCP section are reset to zero.

✧ To clear the counters for Modbus RTU, click the **Clear counters** button in the Modbus RTU section of the input/output window.

All counters in the Modbus RTU section are reset to zero.

**NOTE**

The chapter 9.2.9 gives more details about diagnosing Modbus.

### 7.5.7.2 Diagnosis SIPROTEC RTU 20 mA

**NOTE**

The diagnostics data of SIPROTEC RTU 20 mA are only displayed if this bus protocol has been selected on the **Configure** tab → **Administrative** menu → **Communication serial** menu item.

If no protocol is selected, the **Diagnosis SIPROTEC RTU 20 mA** input/output window shows the entry **-none-**.

✧ In the navigation window, open the **Diagnosis** menu and click the **SIPROTEC RTU 20 mA** menu item.

The **SIPROTEC RTU 20 mA** input/output window opens and the protocol is displayed. The **Parameter** and the **Counter** are then analyzed.

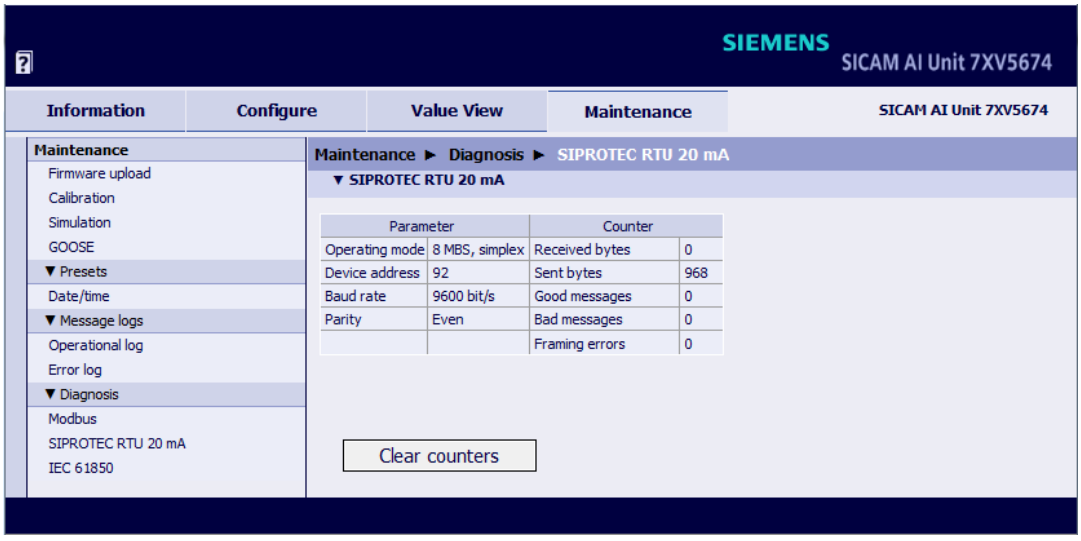



Fig. 7-45 Maintenance Tab, Diagnosis SIPROTEC RTU 20 mA Input/Output Window

✧ To clear the counters for SIPROTEC RTU 20 mA, click the **Clear counters** button.

All counters are reset to 0.

**NOTE**

The chapter 9.3.1 provides more details on diagnosing SIPROTEC RTU 20 mA.

### 7.5.7.3 Diagnosis IEC 61850

**NOTE**

The diagnostics data of IEC 61850 are only displayed if this bus protocol has been selected on the **Configure** tab → **Administrative** menu → **Communication Ethernet** menu item.

If no protocol is selected, the **Diagnosis IEC 61850** input/output window shows the entry **-none-**.

✧ In the navigation window open the **Diagnosis** menu and click the **IEC 61850** menu item.

The **IEC 61850** input/output window opens and the protocol is displayed. The Ethernet interface is then analyzed.

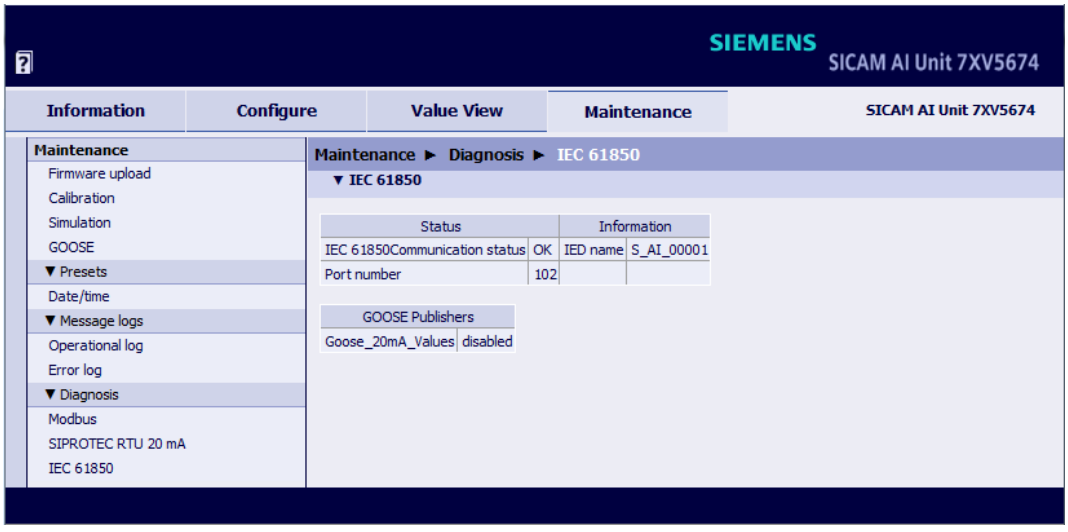



Fig. 7-46 Maintenance Tab, Diagnosis IEC 61850 Input/Output Window

# 8 Time Synchronization

# 8.1 General

During operation, SICAM AI Unit needs the date and time for all time-relevant processes. The term **time** is used throughout this section to refer to both the date and the time.

The time synchronization in the SICAM AI Unit is necessary to guarantee a common time basis for the communication with peripheral devices and time stamping of the process data.

SICAM AI Unit supports both external and internal time synchronization. The type of time synchronization is specified during the parameterization (see chapter 7.3.4.1). The external time synchronization from an NTP server is preferred.

# 8.2 Internal Time Keeping

## 8.2.1 Time Format

The internal time is kept in UTC (Universal Time Coordinated) from 01.01.2000, 00:00 to 31.12.2099, 23:59.

To display the local time e.g. on the HTML pages of the user, you can configure a local time correction factor and the automatic adjustment to daylight saving time during parameterization (see chapter 7.3.4.1).

## 8.2.2 Status Bits

#### FAIL Status Bit

The **FAIL** status bit implemented in the SICAM AI Unit signals with "0" that the time is **valid** and with "1" that the time is **invalid**.

The status of the FAIL bit corresponds to the "Clock error" operational indication, see chapter 14.

The following table lists the time stamps of events or indications for the displayed operational and error logs according to status bit set/not set using the example of *date 2010-09-26, time 13:49.35246*:

Table 8-1 FAIL Status Bit for Time Synchronization via NTP Server

| FAIL | Output |
|---|---|
| 0 | 2010-09-26 13:49.35:246 |
| 1 | 2010-09-26 13?49?35?246 |

#### DST Status Bit

With "1", the **DST** status bit implemented in the SICAM AI Unit signals that the local daylight saving time is active. The operational indication "Daylight saving time" is displayed.

# 8.3 External Time Synchronization via Ethernet NTP

### General

To synchronize the time via an external source, SICAM AI Unit is equipped with an SNTP client (SNTP = Simple Network Time Protocol) that can be connected to 2 NTP servers (NTP = Network Time Protocol), the primary and the secondary (redundant) NTP server.

The chapter 7.3.4.1 describes how to set the parameters of the 2 servers.

NTP is used for external time synchronization via Ethernet. The SNTP client sends a time request to the NTP server once a minute. The time synchronization error is ±5 ms referred to UTC time of the NTP server.

The time stamp of the NTP server has a 64-bit format. Counting is accomplished in seconds and fractions of seconds.

**NOTE**

The time format is described in detail in the RFC 5905 (Request for Comments 5905 for NTP).

### Time Synchronization Procedure

The device was set to external time synchronization (**Ethernet NTP**) during the parameterization. After switching on or resetting the device, the FAIL bit is first set to "1" (=invalid) and the device sends a time request to the NTP server. After receiving the time information from the NTP server via Ethernet, the FAIL bit is set to "0" (=valid) and the internal timer (RTC) is updated. The SNTP client repeats the time request to the NTP server cyclically once every minute.

If the primary NTP server fails (for example, no response to a request twice or one of the criteria at "Redundant NTP server" satisfied) and if the secondary NTP server is operational (always polled in parallel), the device switches to the secondary NTP server. The FAIL bit remains = 0. In this case, the operational indication "Primary NTP Server Error" is displayed, see chapter 14.

If the secondary NTP server is also invalid, the FAIL bit will be set to 1 after the programmable timer **Error indication after** (see Figure 7-26) has expired, and the "Clock Error" indication is output.

### Redundant NTP Servers

The time synchronization supports a primary and a secondary NTP server. Different IP addresses are set for the two NTP servers, see chapter 7.3.4.1.

SICAM AI Unit cyclically polls both NTP servers once every minute, but during normal operation it is synchronized by the primary NTP server. The device automatically switches to the secondary NTP server if one of the following criteria are met:

- No response from the primary NTP server to two successive requests
- The "Alarm" indication is set in the time information of the primary NTP server.
- The primary NTP server responds with zero.
- The message runtime in the network is > 5 ms.
- The stratum of the primary NTP server is 0 (unknown) or > 3.

Switching to the secondary NTP server is prevented if:

- The secondary server does not provide better time information (see criteria that initiate the switch from primary to secondary NTP server; "Secondary NTP Server Error" indication was already output) or
- The secondary server has recently been available for less than 10 minutes.

In these cases, SICAM AI Unit is not synchronized anymore. The device uses the internal clock (on milliseconds time basis) and the last valid drift. After the programmable delay time, the device reports "Clock Error", see chapter 14.

**Switching Back from the Secondary to the Primary NTP Server**

While the device is synchronized by the secondary NTP server, it continues to cyclically poll the primary NTP server. The device will only switch back to the primary NTP server if it receives correct time information and if none of the criteria for **Redundant NTP Servers** are fulfilled anymore.

**NOTE**

The chapter 7.3.4.1, Time Synchronization via Ethernet NTP gives a detailed description of how to parameterize the time. chapter 9.2.7.2 and chapter 9.2.8.2 provide information on the data format.

## 8.4 External Time Synchronization via Fieldbus

The external time synchronization via fieldbus is used if the device is connected to the systems control via protocol **Modbus RTU** using the RS485 or optical interface.

The time information can also be transmitted from the systems control via **Modbus TCP** or **IEC 61850** using Ethernet interface. When using the Ethernet connection, Siemens recommend, however, to synchronize the device from an NTP server, see chapter 8.3.

When using the external time synchronization via fieldbus, the client should send a message containing the time information to the device in 1-minute cycles, see chapter 9.2.8.2.

The time synchronization error using the **Modbus RTU** protocol is ±20 ms max.

**NOTE**

The chapter 7.3.4.1, Time Synchronization via Fieldbus gives a detailed description of how to parameterize the time. chapter 9.2.7.2 and chapter 9.2.8.2 provide information on the data format.

## 8.5 Internal Time Synchronization via RTC

Besides external time synchronization, the internal time synchronization is also possible using the battery-buffered RTC (Real Time Clock). SICAM AI Unit features a quartz oscillator for this purpose.

The time offset of internal time synchronization is 86 ms/day maximum. Due to the reduced accuracy, RTC should only be used in case of failure or unavailability of the external time synchronization.

**NOTE**

The chapter 7.3.4.1, Internal Time Synchronization gives a detailed description of how to parameterize the time. chapter 9.2.7.2 and chapter 9.2.8.2 provide information on the data format.

# 9 Communication

# 9.1 Communication Features

SICAM AI Unit supports the communication via Ethernet. Device versions equipped with a serial interface also support communication via RS485 or optical interface.

Simultaneous communication via the Ethernet port and in parallel via the serial interface is possible with the corresponding parameterization. In this case it is possible, for example, to parameterize and read out data via the Ethernet port while the protocol traffic runs with a client via the serial interface.

## 9.1.1 Ethernet Communication

Via the Ethernet interface the following 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 exchange with connected devices via Modbus TCP or IEC 61850

It is possible to connect 2 devices directly with Ethernet interface due to the integrated Ethernet switch.

### 9.1.1.1 TCP/IP Protocol Stack

SICAM AI Unit supports the following TCP/IP services:

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

### 9.1.1.2 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 comes delivered with a default IP address that can be restored at any time by pressing the IP-Addr. push-button. Each device also has a unique MAC address.

The default IP address and the default subnet mask are imprinted on the side panel, see Figure 9-1:

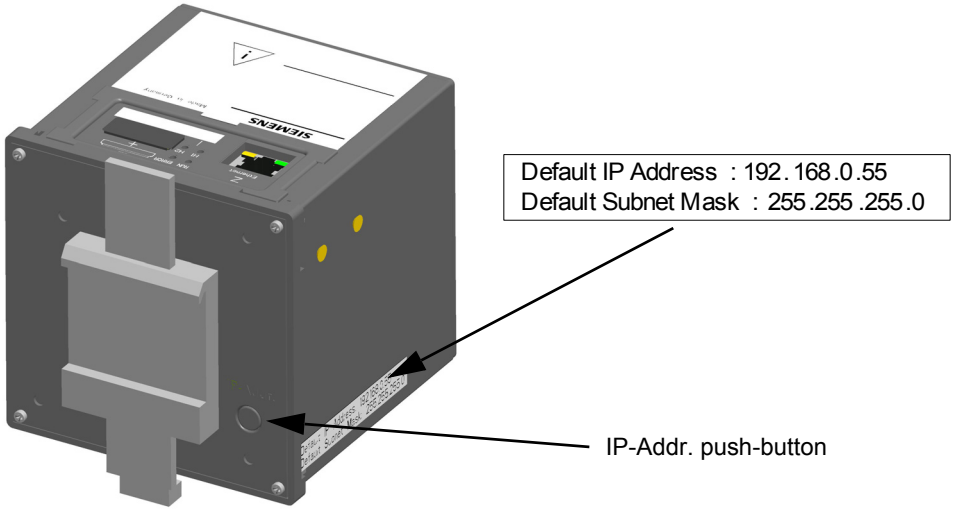



Fig. 9-1 DIN Rail Side with IP-Addr. Push-button

**Default IP Address and IP-Addr. Push-button**

The IP-Addr. push-button is located in the lower right corner of the DIN rail side (see Figure 9-1). When pressed (> 3 s), this button activates the factory-set default IP address. After pressing the IP-Addr. push-button, 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 on an HTML page during the parameterization (see chapter 7.3.4.2). 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 yet used in the network.

Otherwise, the LEDs (see chapter 12.3) 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 (see chapter 7.3.4.2), 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, you have to disconnect the device from the network and start it using the default IP address (see chapter 5.7.3) and assign a permanent IP address.

### 9.1.1.3 Ethernet Interface with Internal Ethernet Switch

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

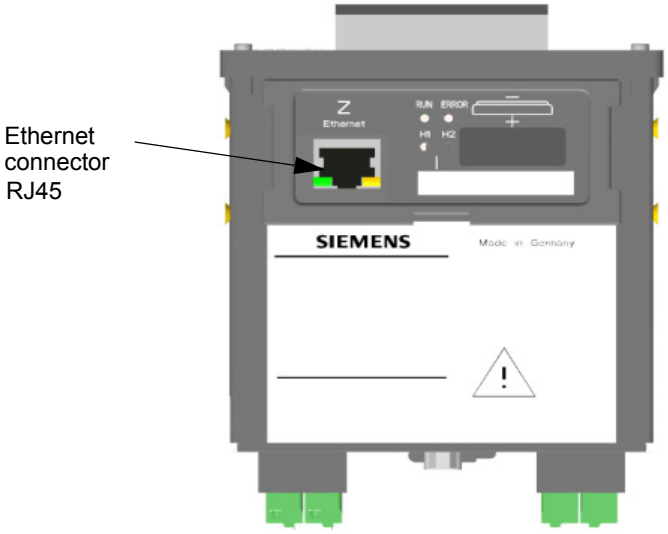



Fig. 9-2 RJ45 Ethernet Plug Connector

Since the SICAM AI Unit is provided with an internal Ethernet switch, 2 devices with Ethernet interface can be connected (cascaded) via a Y cable.

The Ethernet interface is characterized by the following parameters:

- Transmission rate: 10/100 Mbit/s
- Protocol: IEEE802.3
- Connection: 100Base-T (RJ45), pin assignment 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

## 9.1.2 Serial Communication

Devices equipped with an RS485 or optical interface can communicate serially with peripheral devices using the Modbus RTU or SIPROTEC RTU 20 mA fieldbus protocol. The serial interface supports the following actions:

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

#### Data of the RS485 Interface when Using the Modbus RTU Protocol

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: 600 * 100 ms
- Response delay: 0 ms

You can modify these parameters during the parameterization, see chapter 7.3.4.3.

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

#### Data of the RS485 Interface when Using the SIPROTEC RTU 20 mA Protocol

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

- Bus protocol: SIPROTEC RTU 20 mA
- MBS mode [1]: 8 MBS, simplex
- Repeat time [2]: 600 ms
- Device address [3]: 1
- Baud rate [1]: 9600 bit/s
- Parity [1]: even
- Communication supervision time [1]: 600 * 100 ms

The parameters, except for the parity, can be changed during the parameterization, see chapter 7.3.4.3.

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

[1] For possible selection, see chapter 15

[2] Only visible if **MBS mode = 8 MBS, simplex**

[3] Only visible if **MBS mode = 8 MBS, half duplex**

**Data of the Optical Interface when Using the Modbus RTU Protocol**

The optical 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: 600 * 100 ms
- Response delay: 0 ms
- Fiber optical idle state: Light off

You can modify these parameters during the parameterization, see chapter 7.3.4.3.

The connection is an ST connector BFOC/2.5 for sending and receiving, 820 nm.

**Data of the Optical Interface when Using the SIPROTEC RTU 20 mA Protocol**

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

- Bus protocol: SIPROTEC RTU 20 mA
- MBS mode [1]: 8 MBS, simplex
- Repeat time [2]: 600 ms
- Device address [3]: 1
- Baud rate [1]: 9600 bit/s
- Parity [1]: even
- Communication supervision time [1]: 600 * 100 ms
- Fiber optical idle state: Light off

You can modify these parameters during the parameterization, see chapter 7.3.4.3.

The connection is an ST connector BFOC/2.5 for sending and receiving, 820 nm.

1) For possible selection, see chapter 15

2) Only visible if **MBS mode = 8 MBS, simplex**

3) Only visible if **MBS mode = 8 MBS, half duplex**

**Location of the Serial Interface on the Device**

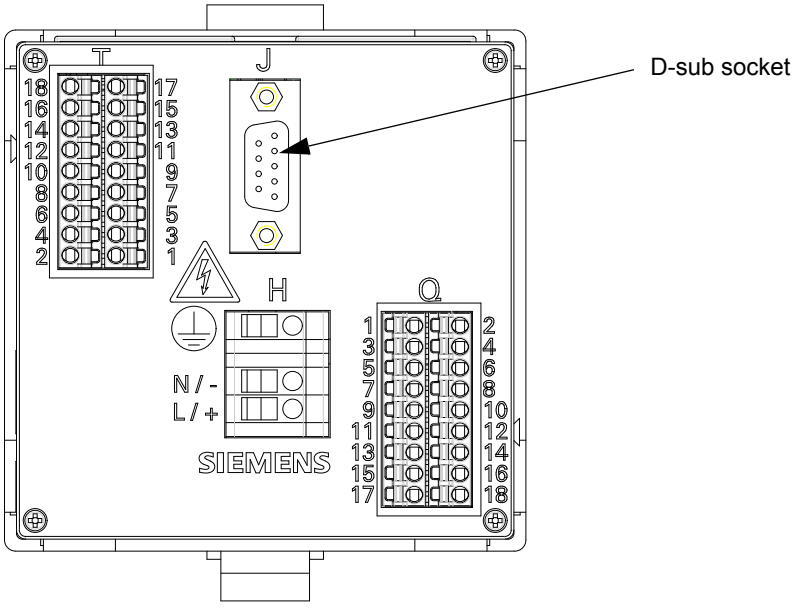



Fig. 9-3 Position of the D-sub Socket (RS485 interface) of SICAM AI Unit

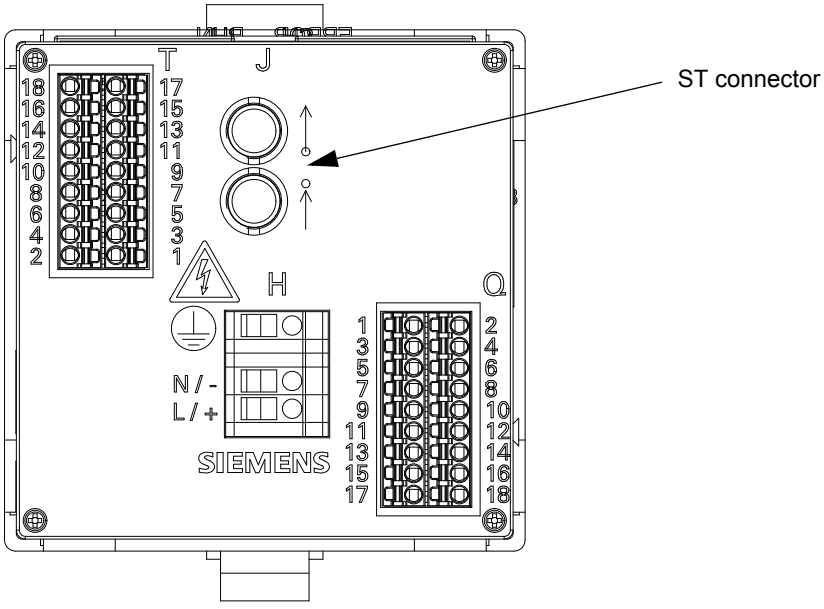



Fig. 9-4 Position of the ST Connector (Optical Interface) of SICAM AI Unit

**NOTE**

The pin assignment of the serial interface is described in chapter 13.1.3.

# 9.2 Modbus

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

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

## 9.2.1 Modbus Functions

**NOTE**

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

The Modbus server of SICAM AI Unit supports the following Modbus functions:

Table 9-1 Supported Modbus Functions

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

## 9.2.2 Exception Responses

**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 (e.g. request to read a nonexistent register) are detected, it generates Modbus exception codes which are signaled to the Modbus client in exception responses messages.

The messages contain the following codes:

**Exception Code 01 ILLEGAL_FUNCTION**

- The Modbus client uses a function that is not supported by the Modbus server of the SICAM AI Unit (the supported Modbus functions are listed in chapter 9.2.1).

**Exception Code 02 ILLEGAL_DATA_ADDRESS**

- An attempt is made to read out or write to a nonexistent Modbus register (see chapter 9.2.8, 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 clients tries to write to a register in the Modbus server for which only read access is allowed according to the Modbus mapping (see chapter 9.2.8).

**Exception Code 03 ILLEGAL_DATA_VALUE**

- The Redundanz client addresses a register that does not allow access to partial data because it is part of a data type with a complex data structure distributed across several registers and can be read or written only as a whole.
- The Modbus client attempts 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).

## 9.2.3 Modbus TCP

**Properties of the Modbus TCP**

- 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 transfer from the server to the client.
  - If the requested data are unavailable, the server sends an exception response 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 chapter 7.3.4.2:

Table 9-2 Modbus TCP Settings

| Parameter | Default Setting | Settings |
|---|---|---|
| IP address | 192.168.0.55 | any,<br>0.0.0.0 for DHCP |
| Subnet mask | 255.255.255.0 | any |
| Default gateway | 192.168.0.1 | any |
| Ethernet switch on | no | no<br>yes |
| Bus protocol / Operating mode | Modbus TCP | - |
| Use a user-port number | no | no<br>yes |
| User-port number<br>(only if *Use a user-port number* **yes** has been parameterized) | 10000 | 10000 to 65535 |
| Access rights for user port 502 | Full | Full<br>Read only |
| Access rights for user port<br>(only if *Use a user-port number* **yes** has been parameterized) | Full | Full<br>Read only |
| Keep Alive time | 10 s | 0 s = switch off<br>1 s to 65 535 s |
| Communication supervision time | 50 * 100 ms | 0 s = none<br>100 ms to 6 553 400 ms |

**Number of Connections**

Up to four TCP connections are possible:

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

## 9.2.4 Modbus UDP

**Properties Modbus UDP**

- Connectionless, asynchronous client-server communication via Ethernet protocol on the basis of UDP/IP
- Use of IP addresses for addressing individual components connected to the Bus (bus stations)
- Use of a parameterized port number (see Table 9-3)
- All data types in the Modbus UDP telegrams that are bigger than 1 byte, are stored in the Big-Endian format, that is, the most significant byte (MSB) is saved on the least significant register address and is transferred first.
- Sequence of the communication:
  - In order to start data transfer from server to client, the client sends a request to the server.
  - If the requested data is not available, the server sends the client the requested data or an error feedback.
- The Modbus data in the UDP telegram has a maximum size of 260 bytes:
  - Maximum of 253 bytes for data and
  - 7 bytes for Modbus UDP header

The following parameters can be set for the Modbus UDP:

Table 9-3 Modbus UDP Settings

| Parameter | Default Setting | Settings |
|---|---|---|
| IP address | 192.168.0.55 | Any,<br>0.0.0.0 for DHCP |
| Subnet mask | 255.255.255.0 | Any |
| Default gateway | 192.168.0.1 | Any |
| Bus protocol | Modbus UDP | - |
| Port number | 51000 | 10000 to 65535 |
| Access rights | Full | Full<br>Read only |
| Communication supervision time | 20 * [10 ms] | 0 s = invalid<br>10 ms to 60 000 ms |

## 9.2.5 Modbus RTU

**Properties of the Modbus RTU**

- 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 bus physics.
- The Modbus RTU data packet 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 9-4 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<br>4800 bit/s, 9600 bit/s<br>19 200 bit/s, 38 400 bit/s<br>57 600 bit/s, 115 200 bit/s |
| Parity | Even | None, 1 stop bit<br>Even<br>Odd<br>None, 2 stop bits |
| Access rights | Full | Full<br>Read only |
| Communication supervision time | 600 * 100 ms | 0 s = none<br>100 ms to 6 553 400 ms |
| Response delay | 0 [ms] | 0 ms to 1000 ms |
| If there is an optical interface:<br>Fiber-optic idle state | Light OFF | Light OFF<br>Light ON |

### 9.2.6 Register Assignment

Only holding registers are used for SICAM AI Unit. All measured values, indications and metered values are stored in these holding registers.

### 9.2.7 Data Types

**NOTE**

The Modbus functions 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 (read only)

**NOTE**

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

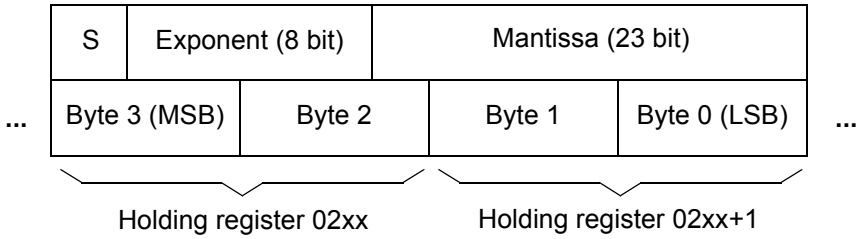
The register with the lowest address contains the most significant byte (MSB), the register with the highest address contains the least significant byte (LSB).

### 9.2.7.1 Data Type - Measured Value

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

#### Structure of the Format

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




#### Value Range

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

#### Value of the Measured Values

The value of a measured value is obtained as follows:

Exponent = 0: Resulting value = 0

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

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

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

#### Status and Quality Information

SICAM AI Unit uses floating-point values with the exponent 255 (Inf, NaN) to display status information of the measured values:

Table 9-5 Floating-point Values

| Floating-point Value (hexadecimal) | | State | Remark |
|---|---|---|---|
| 7F800000H | +Inf | Overflow | Measured value overflow<br>(> 1.2 $V_{rated}$, > 2 $I_{rated}$) |
| 7F800001H | NaN | invalid | For example, frequency not measured because mains voltage too small<br>(< 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**

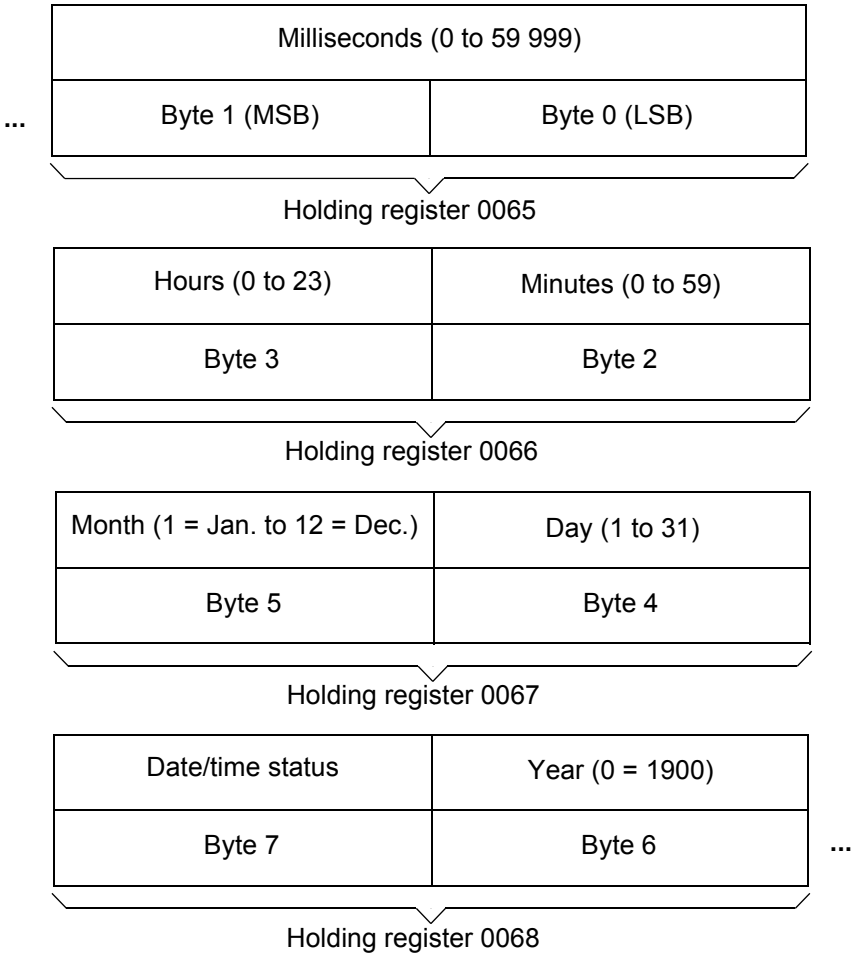
The 32-bit floating-point numbers have a 23-bit mantissa. Integer numbers can be represented in the following ranges without loss of accuracy:

- 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.

### 9.2.7.2 Data Type - Date/Time

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




**Date/time Status**

10H set: Daylight saving time active

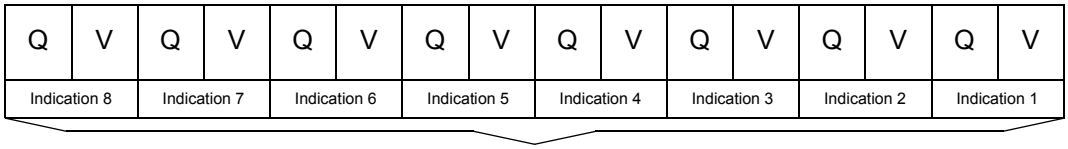
20H set: Date/time error (equivalent to FAIL bit in Table 8-1).

**NOTE**

For the time synchronization via Ethernet, Siemens recommends the use of NTP, see chapter 8.

### 9.2.7.3 Data Type - Indications (Read Only)

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




e.g. Holding register 0101

Where:

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

#### Status or Quality Bit "Q"

An indication is invalid if the result of a calculation is based on an invalid measured value, for example the calculated limit 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 system 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).

## 9.2.8 Data in the Modbus Registers (Data Mapping)

**NOTE**

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

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

- Register 0001 to 0048: Device identification (read only)
- Register 0065 to 0068: Date and time (read and write)
- Register 0071 to 0088: Version information (read only)
- Register 0101: Device status (read only)
- Register 0111 to 0112: Indications concerning limit violations (read only)
- Register 0401 to 0424: Measured values (read only)

### 9.2.8.1 Register 0001 to 0048: Device Identification

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

Table 9-6 Register 0001 to 0048: Device Identification

| Register | Type of Information | Remark |
|---|---|---|
| 0001 to 0008 | Device type<br>(string, max. 16 characters) | "SICAM AI Unit" |
| 0009 to 0024 | Device ordering code<br>(string, max. 32 characters) | Example:<br>"7XV56740KK302AA1" |
| 0025 to 0040 | Device name from the configuration<br>(string, max. 32 characters) | Example:<br>"SICAM AI Unit #1" |
| 0041 to 0048 | Device serial number<br>(string, max. 16 characters) | Example:<br>"BF0704034576" |

### 9.2.8.2 Register 0065 to 0068: Date and Time

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

#### 64-bit Format

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

#### 32-bit Format

The registers are transmitted in two messages. The first message contains the registers 0067 and 0068 (date), the second 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 9-7 Register 0065 to 0068: Date and Time

| Register | Type of Information | Remark |
|---|---|---|
| 0065 | Milliseconds | see chapter 9.2.7.2 |
| 0066 | Hours/minutes | |
| 0067 | Month/day | |
| 0068 | Time status/year | |

### 9.2.8.3 Register 0071 to 0088: Version Information

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

Table 9-8 Register 0071 to 0088: Version Information

| Register | Type of Information | Remark |
|---|---|---|
| 0071 to 0076 | Boot version | e.g. „V01.10.01“ |
| 0077 to 0082 | Firmware version | e.g. „V01.10.01“ |
| 0083 to 0088 | Parameter set version | e.g. „V01.10.01“ |

### 9.2.8.4 Register 0101: Device Status

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

Data type: indication

Table 9-9 Register 0101: Device Status

| Register | Type of Information | Remark |
|---|---|---|
| $0101/2^0$ | Device ready | 1 = Device ready |
| $0101/2^2$ | Battery failure | 0 = Battery OK,<br>1 = Battery failure (exchange battery) |
| $0101/2^4$ | Reserved | = 0 |
| $0101/2^6$ | Reserved | = 0 |
| $0101/2^8$ | Settings Load | 1 = Load settings |
| $0101/2^{10}$ | Settings Check | 1 = Check settings |
| $0101/2^{12}$ | Settings Activate | 1 = Activate settings |
| $0101/2^{14}$ | Reserved | = 0 |

**NOTE**

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

### 9.2.8.5 Register 0111 and 0112: Limit Violation Indications

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

Data type: indication

Table 9-10 Register 0111 and 0112: Limit Violation Indications

| Register | Type of Information | Remark |
|---|---|---|
| $0111/2^0$ | Limit Violation 1 | An indication is output (= 1) if a measured value has exceeded or fallen below a configured limit value, see chapter 7.3.3.2. |
| $0111/2^2$ | 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 limit value, see chapter 7.3.3.2. |
| $0112/2^2$ | 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 | |

### 9.2.8.6 Registers 0401 to 0424: Measured Values

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

Data type: Measured value

Table 9-11 Registers 0401 to 0424: Measured Values

| Register | Type of Information | Remark | Unit |
|---|---|---|---|
| 0401 | DC_measurand_1 | Analog input 1 | mA |
| 0403 | DC_measurand_2 | Analog input 2 | mA |
| 0405 | DC_measurand_3 | Analog input 3 | mA |
| 0407 | DC_measurand_4 | Analog input 4 | mA |
| 0409 | DC_measurand_5 | Analog input 5 | mA |
| 0411 | DC_measurand_6 | Analog input 6 | mA |
| 0413 | DC_measurand_7 | Analog input 7 | mA |
| 0415 | DC_measurand_8 | Analog input 8 | mA |
| 0417 | DC_measurand_9 | Analog input 9 | mA |
| 0419 | DC_measurand_10 | Analog input 10 | mA |
| 0421 | DC_measurand_11 | Analog input 11 | mA |
| 0423 | DC_measurand_12 | Analog input 12 | mA |

## 9.2.9 Modbus Diagnosis

The diagnostics function for Modbus TCP and Modbus RTU, see chapter 7.5.7.1, enables analyzing the parameters and the communication and resetting diagnostics counters.

### 9.2.9.1 Modbus TCP Diagnosis

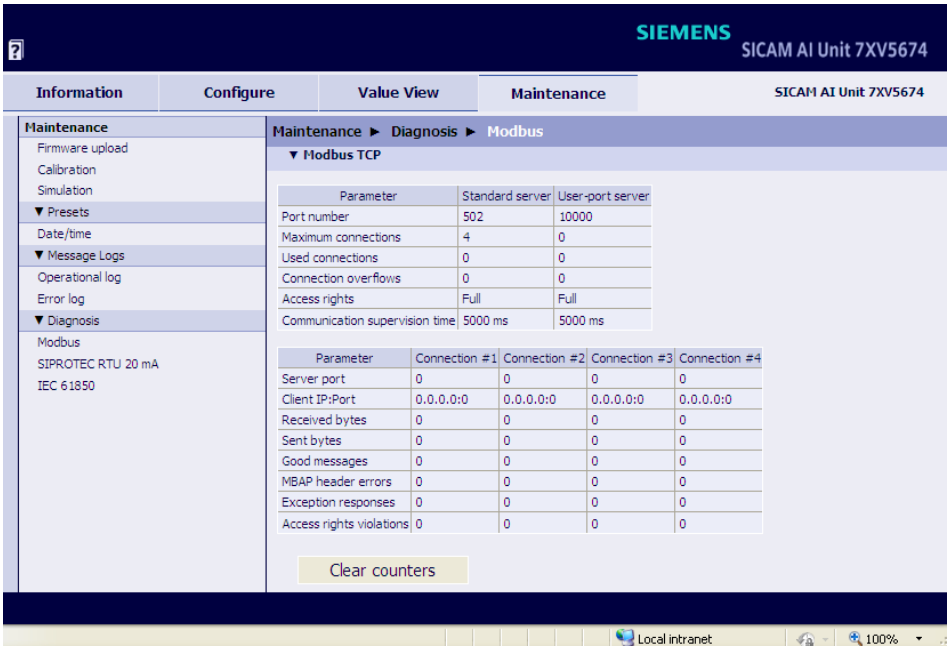



Fig. 9-5 Modbus TCP Diagnosis

**Parameter for Standard Server and User-port Server**

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

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

  Number of allowed connection attempts:

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

  For other user port numbers: ≥ 3 connection attempts via standard port 502 and/or ≥ 3 connection attempts via user port
- Status of the access rights: Factory setting: Full
- Monitoring time of the communication: Factory setting: 5000 ms

**Parameter of Connections**

- Server port: Server port number of the current connection in the respective column; if "0" is displayed, the connection is inactive or down
- Client IP:Port: Last or current IP address and port number of the client
- Received bytes: Total number of bytes received by the TCP port
- Sent bytes: Total number of bytes sent to the TCP port
- Good messages: Total number of messages received that were detected as valid Modbus messages
- MBAP header error: Error in the MBAP header: incorrect protocol ID or implausible length of data
- Exception responses: Counters of the transmitted exception response messages (see chapter 9.2.2)
- Access rights violations: Total number of write accesses received if the parameter **Access rights for port xxx** is set to **Read only** of the associated TCP port (e.g. 502) in the **Communication Ethernet** input/output window (see see chapter 7.3.4.2)

## 9.2.9.2 Modbus RTU Diagnosis

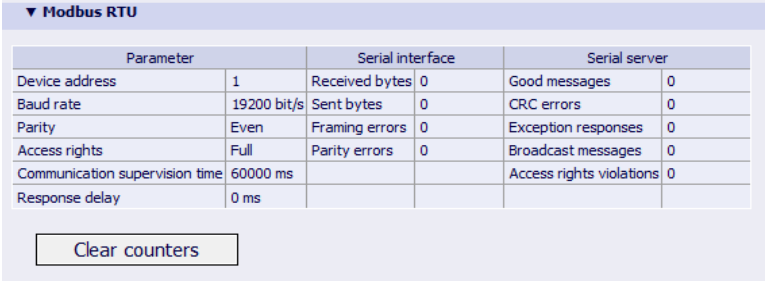



Fig. 9-6 Modbus RTU Diagnosis

**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
- Response delay: Default setting: 0 ms
- Fiber optical idle state (at FO interface): Default: Light OFF

**Serial Interface**

- Bytes received: Total number of bytes received by the RS485 interface
- Bytes sent: Total number of bytes sent to the RS485 interface
- Frame error: Number of detected frame errors (invalid stop bit, e.g. if the baud rate is wrong)
- Parity error: Number of detected parity errors (wrong parity)

**Serial Server**

- Correct messages: Total number of messages received that were detected as valid Modbus messages
- CRC error: Total number of messages received in which CRC errors were detected
- Exception responses: Counters of the transmitted exception response messages (see chapter 9.2.2)
- Broadcast messages: Total number of the broadcast messages received with the server address 0
- Access rights violations: Total number of write accesses received if the parameter **Access rights** is set to **Read only** in the **Communication serial** input/output window (see see chapter 7.3.4.3)

# 9.3 SIPROTEC RTU 20 mA

The SIPROTEC RTU 20 mA protocol can also be applied for communication via RS485 or optical interface.

SIPROTEC RTU 20 mA is an ASCII-based protocol. With this protocol, the communication between SICAM AI Unit and compatible SIPROTEC 4 devices (6MD66) is realized.

## 9.3.1 Diagnosis SIPROTEC RTU 20 mA

The diagnosis for SIPROTEC RTU 20 mA, see chapter 7.5.7.2, allows an analysis of the parameters and communication as well as a reset of the diagnosis counters.

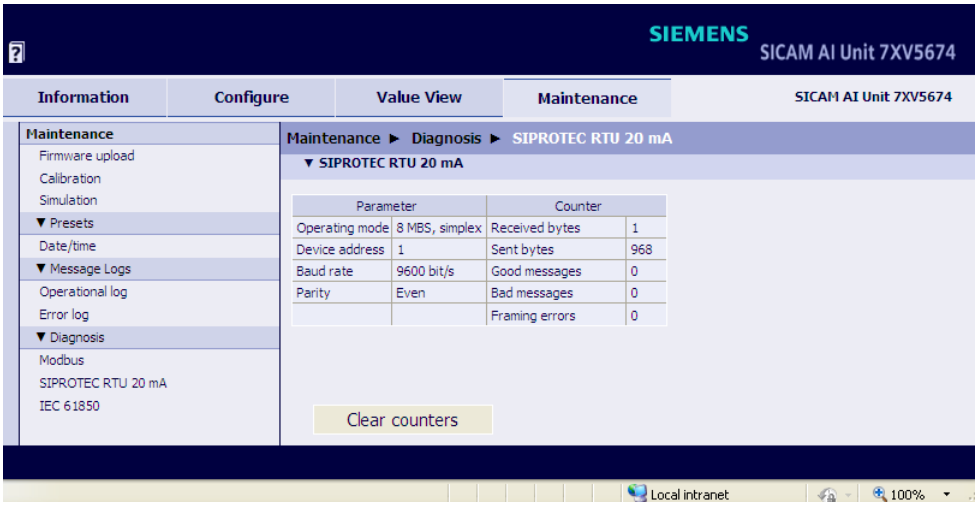



Fig. 9-7 SIPROTEC RTU 20 mA Diagnosis

**Parameter**

With SIPROTEC RTU 20 mA, the following parameters are displayed:

- Operating mode: Default setting: 8 MBS, simplex
- Device address: Default setting: 1
- Baud rate: Default setting: 9600 Bit/s
- Parity: Default setting: Even

**Counter**

For the counter, the following parameters are displayed:

- Received bytes: Total number of bytes received by the serial port
- Sent bytes: Total number of bytes sent to the serial port
- Good messages: Total number of protocol messages
- Bad messages: Number of defective protocol messages
- Framing errors: Number of detected frame errors (invalid stop bit, for example if the baud rate is wrong)

# 9.4 IEC 61850

**NOTE**

The IEC 61850 specification is described in the manual ***SICAM AI Unit 7XV5674, IEC 61850, PIXIT, PICS, TICS***, order number E50417-C1040-C484; see Internet: http://www.siprotec.com.

## 9.4.1 General I/O Processes

Table 9-12 Limit Violations

| | | |
|---|---|---|
| **inst** | | **1** |
| **desc** | | **Limit violations** |
| **InClass** | | **GGIO** |
| **InName** | | **MEAS/GGIO1** |
| **Data Objects** | **CDC** | |
| **Status Information** | | |
| Alm1~16 | SPS | Limit violations 1 to 16 |

Table 9-13 Group Indications

| | | |
|---|---|---|
| **inst** | | **2** |
| **desc** | | **Group indications** |
| **InClass** | | **GGIO** |
| **InName** | | **MEAS/GGIO2** |
| **Data Objects** | **CDC** | |
| **Status Information** | | |
| Ind1~4 | SPS | Group indications 1 to 4 |

Table 9-14 Analog Inputs

| | | |
|---|---|---|
| **inst** | | **1** |
| **desc** | | **Analog inputs** |
| **lnClass** | | **GGIO** |
| **lnName** | | **MEAS/ma20/GGIO1** |
| **Data Objects** | **CDC** | |
| **Status Information** | | |
| AnIn1~12 | MV | Analog inputs 1 to 12 |

Table 9-15 10-s Mean Value of the Analog Input Values

| | | |
|---|---|---|
| **inst** | | **1** |
| **desc** | | **10-s mean value of the analog input values** |
| **lnClass** | | **GGIO** |
| **lnName** | | **MEAS/m10sGGIO1** |
| **Data Objects** | **CDC** | |
| **Status Information** | | |
| AnIn1~12 | MV | 10-s mean value of the analog input values 1 to 12 |

Table 9-16 1-min Mean Value of the Analog Input Values

| | | |
|---|---|---|
| **inst** | | **1** |
| **desc** | | **1-min mean value of the analog input values** |
| **lnClass** | | **GGIO** |
| **lnName** | | **MEAS/m1minGGIO1** |
| **Data Objects** | **CDC** | |
| **Status Information** | | |
| AnIn1~12 | MV | 1-min mean value of the analog input values 1 to 12 |

Table 9-17 1-h Mean Value of the Analog Input Values

| | | |
|---|---|---|
| **inst** | | **1** |
| **desc** | | **1-h mean value of the analog input values** |
| **lnClass** | | **GGIO** |
| **lnName** | | **MEAS/m1hGGIO1** |
| **Data Objects** | **CDC** | |
| **Status Information** | | |
| AnIn1~12 | MV | 1-h mean value of the analog input values 1 to 12 |

Table 9-18 24-h Mean Value of the Analog Input Values

| | | |
|---|---|---|
| **inst** | | **1** |
| **desc** | | **24-h mean value of the analog input values** |
| **InClass** | | **GGIO** |
| **InName** | | **MEAS/m1dGGIO1** |
| **Data Objects** | **CDC** | |
| **Status Information** | | |
| AnIn1~12 | MV | 24-h mean value of the analog input values 1 to 12 |

Table 9-19 Battery

| | | |
|---|---|---|
| **inst** | | **1** |
| **desc** | | **Battery status** |
| **InClass** | | **ZBAT** |
| **InName** | | **MEAS/ZBAT1** |
| **Data Objects** | **CDC** | |
| **Status Information** | | |
| Vol | MV | Battery voltage (not available, invalid) |
| BatLo | SPS | Battery failure (undervoltage or battery is missing) |

## 9.4.2 Diagnosis IEC 61850

The diagnosis for IEC 61850, see chapter 7.5.7.3, allows the analysis of parameters and communication.

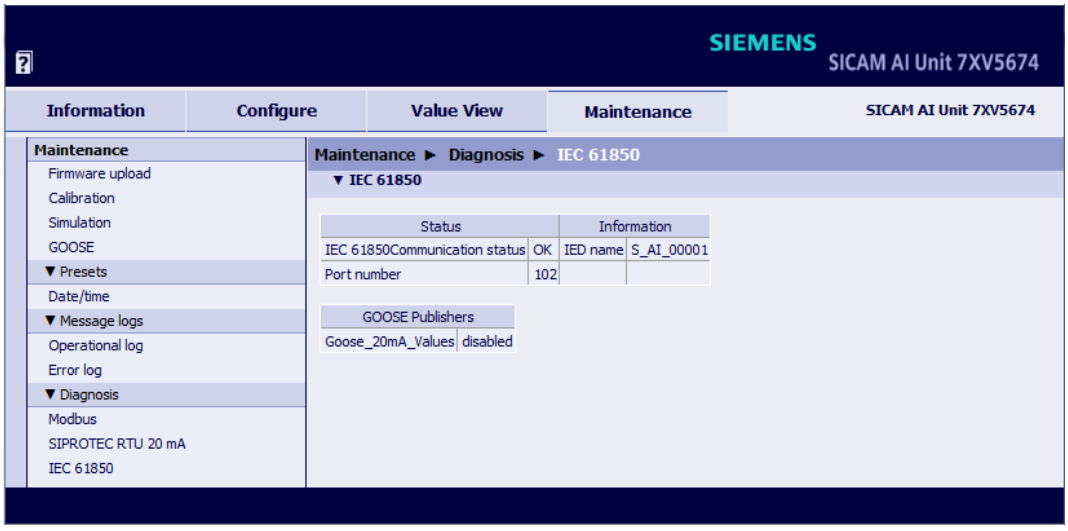



Fig. 9-8 Diagnosis IEC 61850

**Statuses**

With IEC 61850, the following statuses are displayed:

| | |
|---|---|
| IEC 61850 Communication status: | Status of communication: OK or Fail |
| Port number: | Set port number, for example 102 |

**Information**

| | |
|---|---|
| IED Name: | Default: S_AI_00001 |

**GOOSE Publishers**

| | |
|---|---|
| Goose_20mA_Values | Default: disabled |

# 10 Calibration

# 10.1 General

### Calibration Due to Internal Requirements

The device comes calibrated from the factory and does not have to be calibrated again throughout its entire operation period. The calibration is only carried out if this is necessary due to internal requirements.

### Direct-Current Reference

To calibrate the SICAM AI Unit, a DC supply as reference is required which generates direct currents with a tolerance of max. 0.02 % of the rated current of infeed.

**NOTE**

Measured values are entered or displayed with a decimal point separating the integral and the fractional parts, for example 19.8 mA.

**NOTE**

You have to observe the specifications and execution instructions of the accident prevention regulation BGV A3. Use appropriate electric tools.

# 10.2 Calibrating the Direct-Current Measuring Range

### Measurement Setup

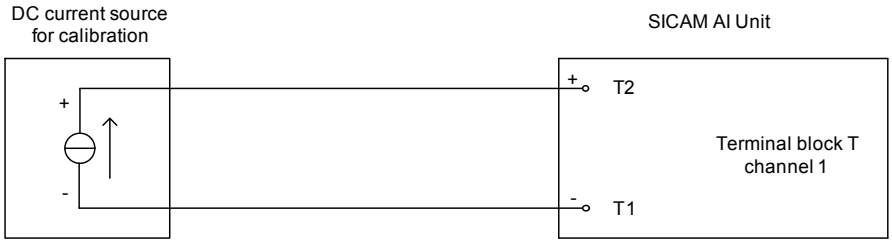



Fig. 10-1 Measurement Setup for Calibrating the Direct-Current Measuring Range

To calibrate a channel, a DC supply with the reference current between 19 mA and 21 mA is connected to the respective channel of the terminal block.

The setup for channel 1 of the terminal block T (as shown in figure 10-1) can be applied to calibrate all other channels of the terminal blocks T and Q.

### Calibration

To calibrate the direct-current measuring ranges, proceed as follows:

✧ Set up the measurement as shown in figure 10-1 for each channel.

---

**DANGER**

Danger by high contact voltages when attaching the measuring lines to the terminal blocks

**Non-observance will lead to death or serious injury.**

- Work may only be carried out by trained personnel (see Preface) who are familiar with and observe the safety requirements and precautions.
- Work may never be carried out if there is any hazardous voltage present.
- Deenergize the device.
- **Circuit breaker:** A suitable isolating device shall be connected upstream in order to permit disconnection of the device from the power supply. The circuit breaker must be mounted close to the device, be easily accessible to the user and marked as a circuit breaker for the device.
- Secure the supply voltage with an approved (UL/IEC) fuse: 1.6 A, type C.
- If a melting fuse is used, a suitable approved (UL/IEC) fuse holder has to be used.

---

✧ On the rear plate of the device, connect the supply voltage at the terminal block H acc. to chapter 5.3.2.

✧ Start the device as described in chapter 5.7.

✧ Activate the 20-mA Channels to be calibrated in the **Configure** tab → **20-mA Inputs** element:

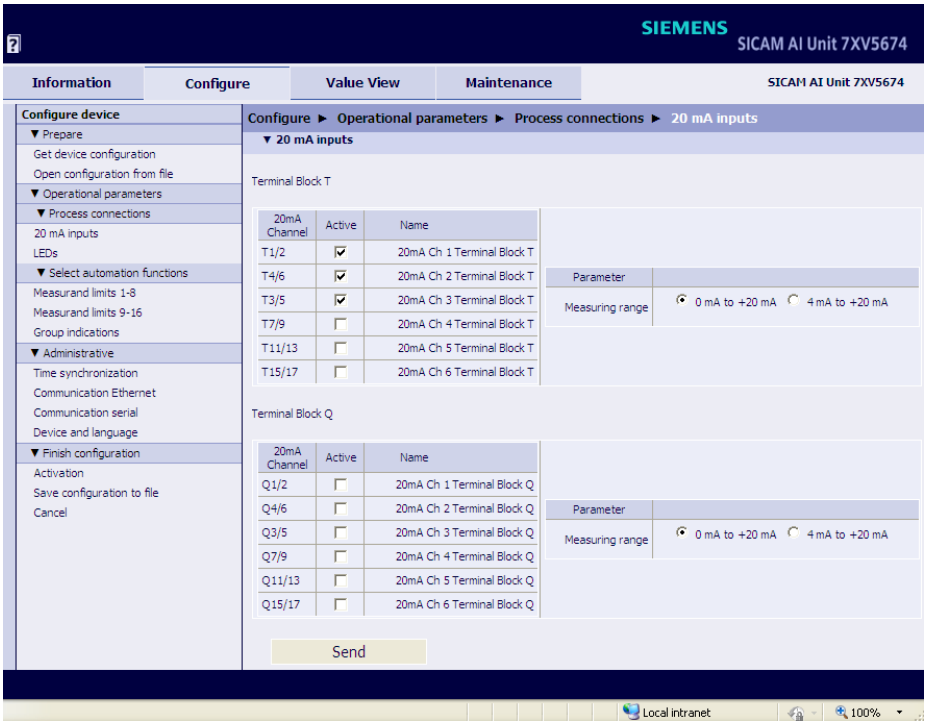



Fig. 10-2 Activation of 20-mA Inputs for the Calibration

✧ Click the **Maintenance** tab on the User Interface.
The **Maintenance** tab opens.

✧ Click the **Calibration** element in the navigation window.
The **Calibration** input/output window opens.

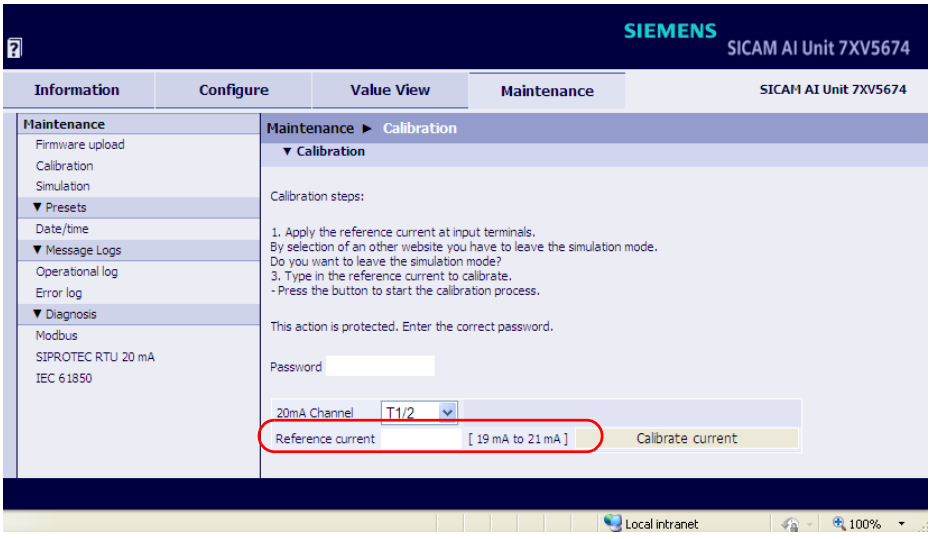



Fig. 10-3 Calibrating the Direct-Current Measuring Range

- ✧ Enter the maintenance password into the **Password** field.
- ✧ Select the channel to be calibrated in the **20-mA Channel** list box.
- ✧ Enter the reference current between 19 mA and 21 mA into the **Reference current** field.
- ✧ Click the **Calibrate current** button.

  The device executes the calibration and in case of successful calibration, an appropriate status indication appears after a few seconds.
- ✧ Check the calibrating values in the **Value View** tab→ **20-mA Inputs** element.

**NOTE**

Carry out the operation for all other active 20-mA Channels.

# 11 Maintenance, Storage, Transport

## 11.1 Maintenance

Except for a battery replacement, the SICAM AI Unit is maintenance-free.

Wipe the device using a clean, dry and soft cloth if necessary. Do not use solvents.

The product information enclosed with the device describes how to replace the battery.

## 11.2 Storage

Store the device in a dry and clean location. Store the device within a temperature range from -25 °C to +70 °C (-13 °F to +158 °F).

The relative humidity must not lead to condensation or ice formation.

To avoid premature aging of the electrolytic capacitors, store the device within the recommended temperature range of +10 °C to +35 °C (+50 °F to +95 °F).

Siemens furthermore recommends connecting the device to supply voltage once a year for 1 to 2 days in order to form the inserted electrolytic condensers. This procedure should also be carried out before operating the device.

**NOTE**

In this context, pay attention to the commissioning notes in chapter 5.7.

The Lithium-batteries in our equipment are subject to Special Provision 188 of the UN Recommendations on the Transport of Dangerous Goods Model Regulations and Special Provision A45 of the IATA Dangerous Goods Regulation and the ICAO Technical Instructions. This is only valid for the original battery or original spare batteries.

## 11.3 Transport

If devices are to be shipped elsewhere, you can reuse the transport packaging. When using different packaging, you must ensure that the transport requirements according to ISO 2248 are adhered to. The storage packing of the individual devices is not adequade for transport purposes.

# 12 Failures and LED Indications

# 12.1 General Inspection

### Visual Inspection

If function failures occur, first check the device visually. Observe the following points when inspecting the device visually:

- Correct installation of the device as described in chapter 5.2 at the intended location
- Compliance with the ambient conditions specified in chapter 13.1.4 of the technical data
- Correct connection of supply voltage and grounding conductors according to chapter 5.3
- Correct connection of measuring and communication lines according to chapter 5.7.1

### Function Checks

Additionally, check the following aspects:

- Correct functioning of peripheral devices (e.g. connected PC, series-connected current transformers)
- Compliance with the system requirements specified in chapter 5.4
- Compliance with the access rights according to chapter 5.5
- Compliance with the commissioning sequence of the device according to chapter 5.7
- Evaluation of the LED failure indications, see chapter 12.3.

# 12.2 Commissioning during Failures

## 12.2.1 Automatic Start of the Boot Loader

If a firmware update has failed or the device startup was unsuccessful, Internet Explorer will automatically open the HTML page **Boot Loader**, see Figure 12-1.


Fig. 12-1 Boot Loader

**Starting User Interface <u>without</u> Loading a New/Different Firmware**

✧ Click the **Run Application** button. The following message appears:

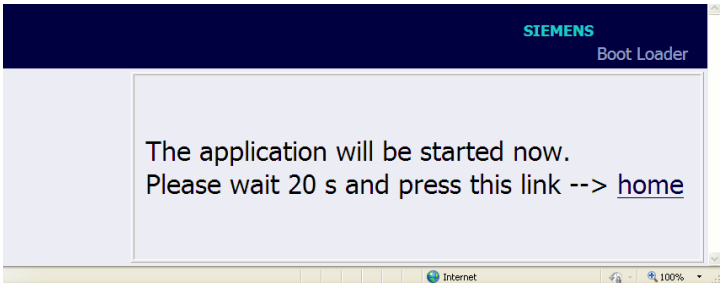



Fig. 12-2 Boot Loader Message of Run Application

✧ Wait for at least 20 s and then click the **home** link.

The User Interface opens.

**Starting User Interface with Loading a New/Different Firmware**

✧ Click the **Browse...** button.

The **Choose file** dialog box opens.

✧ In the **Choose file** dialog box select the current firmware update (file extension .pck) in the **Look in:** list box and click the **Open** button.

The path appears in the **Browse...** field.

✧ Click the **upload** button.

The firmware is uploaded from the device to the PC and the following information is displayed in the Boot Loader window:

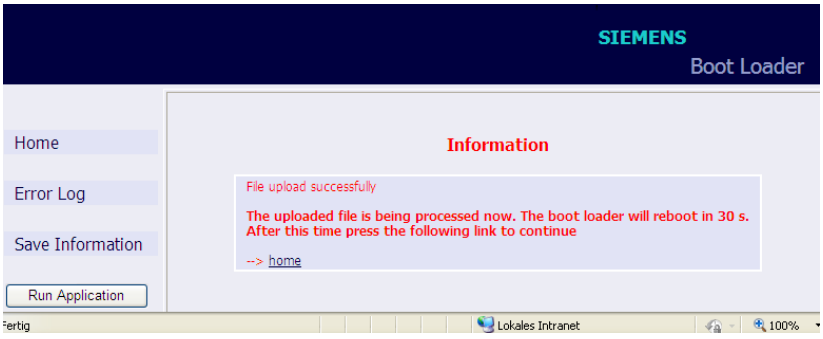



Fig. 12-3 Information in the Boot Loader

✧ Wait for at least 30 s and then click the **home** link.

The User Interface opens.

## 12.2.2 Manual Start of the Boot Loader

If it is necessary to start the Boot Loader manually, proceed as follows:

✧ If the SICAM AI Unit is still energized by the supply voltage, switch off the supply voltage.

✧ Press the IP-Addr. push-button at the SICAM AI Unit (see chapter 5.7.3), and holding the IP-Addr. push-button down, switch on the supply voltage.

✧ Hold the IP-Addr. push-button down until the LEDs ERROR (red) and H2 (yellow) on the device top side are lit (LEDs RUN (green) and H1 (yellow) are off).

✧ Release the IP-Addr. push-button.

SICAM AI Unit starts the Boot Loader with the **Boot Loader** HTML page (see figure 12-1).

# 12.3 Indications Signaled by LEDs

SICAM AI Unit automatically monitors the functions of its hardware, software, and firmware components. The LEDs on the top side of the housing indicate the current device status.

### Designation of the LEDs

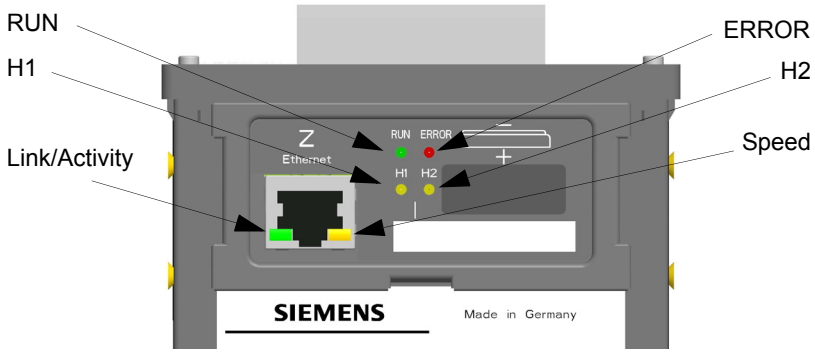



Fig. 12-4 Designation of the LEDs

### Meaning of the LEDs

LED (green, red, yellow): on

LED (green, red, yellow): flashes

LEDs H1/H2/ERROR: as set by the user

LED: off

**Ethernet switch off**:

LED Speed (yellow):

off: 10 Mbit/s

on: 100 Mbit/s

LED Link/Activity (green):

LED on: Ethernet link is up

LED flashing: Ethernet link is up and data is transferred

LED off: no Ethernet partners connected

**Ethernet switch on**:

LED Link/Activity channel 1 (yellow):

LED Link/Activity channel 2 (green):

LED on: Ethernet link is up

LED flashing: Ethernet link is up and data is transferred

LED off: no Ethernet partners connected

Table 12-1 Indications Signaled by LEDs

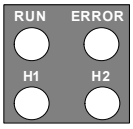
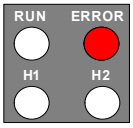
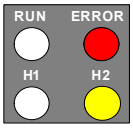
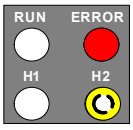
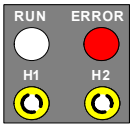
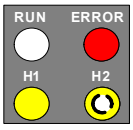
| LED | Meaning |
|---|---|
|  | Device switched off |
|  | No firmware loaded |
| **Boot Loader** | |
|  | IP-Addr. push-button pressed during power-on |
|  | Boot loader started after IP-Addr. push-button was pressed during power-on |
|  | DHCP active (H1 switches off after receiving the IP address via DHCP) |
|  | Default IP address by pressing IP-Addr. push-button |

Table 12-1 Indications Signaled by LEDs (cont.)

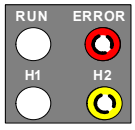
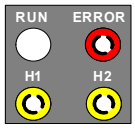
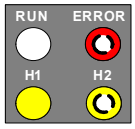
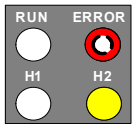
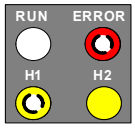
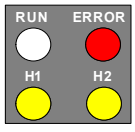
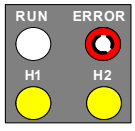
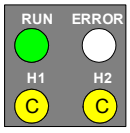
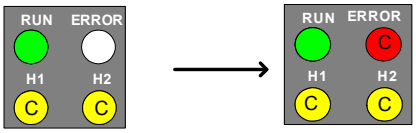
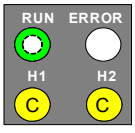
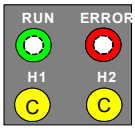
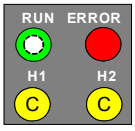
| LED | Meaning |
|---|---|
|  | Boot loader started; no process application exists |
|  | DHCP active (LED H1 switches off after receiving the IP address via DHCP) |
|  | Default IP address by pressing the IP-Addr. push-button |
|  | Boot loader was started because an error occurred in the process application. |
|  | DHCP active (LED H1 switches off after reception of the IP address via DHCP) |
|  | Boot loader started, process application is being loaded. |
|  | Double IP address is detected |

Table 12-1 Indications Signaled by LEDs (cont.)

| LED | Meaning |
|---|---|
| **Process Application** | |
|  | Normal mode:<br>IP address has been configured or received from DHCP. |
|  | Parameterization of the ERROR LED:<br>The ERROR LED can only be assigned to Error messages. |
|  | DHCP:<br>LED RUN (green) is lit after the IP address was received by the DHCP server. |
|  | Default IP address is applied by pressing the IP-Addr. push-button. |
|  | Double IP address is detected. |

# 12.4 Troubleshooting and Repair

### General Troubleshooting

The user is not authorized to troubleshoot the defective device beyond the measures described in chapter 12.1 and chapter 12.3 or make repairs himself. Special electronic modules are inserted in the SICAM AI Unit which can only be replaced by the manufacturer according to the guidelines for Electrostatic sensitive devices (ESD).

If you suspect any damage on the device, Siemens recommends sending the entire device to the manufacturer. For this purpose, it is best to use the original transport packaging or similar packaging.

### Troubleshooting Based on Error Messages

**NOTE**

Error messages are service information that you quote to the service department upon request in case of an error.

The error messages can be saved as described in chapter 7.2.5.2, section **File download → Save**.

The error messages can be printed as described in chapter 7.2.5.2, section **File download → Open**.

# 13 Technical Data

# 13.1 General Device Data

## 13.1.1 Power Supply

**Direct Voltage**

| | |
|---|---|
| Rated input voltages | 24 V to 250 V |
| Admissible input voltage tolerance | ±20 % |
| Permitted ripple of the input voltage<br>at 24 V, 48 V, 60 V, 110 V, 220 V, 250 V | 15 % |
| | |
| Maximum inrush current | |
| At ≤ 110 V | < 15 A |
| At 220 V to 300 V | after 250 µs: < 5 A |
| | |
| Maximum power consumption | 5 W |

**Alternating Voltage**

| | |
|---|---|
| Rated input voltages | 110 V to 230 V |
| System frequency at AC | 45 Hz to 65 Hz |
| Admissible input voltage tolerance | ±20 % |
| | |
| Maximum inrush current | |
| At ≤ 115 V | < 15 A |
| At 230 V | after 250 µs: < 5 A |
| | |
| Maximum power consumption | 16 VA |

## 13.1.2 Inputs and Outputs

**Inputs for Direct-Current Measurements (Terminal Block T and Q)**

| | |
|---|---|
| Input AC currents | |
| Rated input current range | DC 0 mA to 20 mA<br>DC 4 mA to 20 mA |
| | |
| Further information about the current measuring inputs | |
| Max. input voltage at DC measurements | 5 V |
| Max. power consumption | 150 mW per channel |
| Input impedance | 140 Ω |
| Measuring error | Max. 1.0 % of rated current |
| Measuring error (with calibration) at 23 °C ± 1 °C | Max. 0.2 % of rated current |

## 13.1.3 Communication Interfaces

**Ethernet (Connector Z)**

| | | |
|---|---|---|
| Ethernet, electrical | Operation | With device internal software |
| | Connection<br><br>Ethernet switch turned off:<br><br><br><br><br><br>Ethernet switch turned on:<br><br><br><br><br> | Device top side<br>RJ45 connector socket<br>100BaseT acc. to IEEE802.3<br>LED speed (yellow): 10/100 Mbit/s (off/on)<br>LED Link/Activity (green):<br>• lit: Ethernet link is up<br>• flashes: Ethernet link is up, data transmission<br>• off: no Ethernet partners connected<br>LED Link/Activity channel 1(yellow)<br>LED Link/Activity channel 2 (green):<br>• lit: Ethernet link is up<br>• flashes: Ethernet link is up, data transmission<br>• off: no Ethernet partners connected |
| | Protocols | Modbus TCP<br>IEC 61850 |
| | Voltage strength | DC 700 V |
| | Transmission rate | 10/100 Mbit/s |
| | Cable for 100Base-T | 100 Ω to 150 Ω STP, CAT6 |
| | Maximum cable length 100Base-T | 20 m |

**Serial Interface (Connector J)**

| | | | |
|---|---|---|---|
| RS485 | Connection | Terminal side, 9-pin D-sub socket | |
| | | | |
| | Protocol | Modbus RTU | SIPROTEC RTU 20 mA |
| | Baud rate (adjustable) | Min. 1200 bit/s<br>Max.115 200 bit/s;<br>Default setting 19 200 bit/s | Min. 4800 bit/s<br>Max. 38 400 bit/s;<br>Default setting 9600 bit/s |
| | Parity | None, 1 stop bit<br>Even<br>Odd<br>None, 2 stop bit | None, 1 stop bit<br>Even<br>Odd<br>None, 2 stop bit |
| | | | |
| | Maximum distance of transmission | Max. 1 km (depending on transmission rate) | |
| | Transmission level | low: -5 V to -1.5 V<br>high: +1.5 V to +5 V | |
| | Reception level | low: ≤ -0.2 V<br>high: ≥ +0.2 V | |
| | | | |
| | Measured value ranges | - | - |
| | | | |
| | Bus termination | Not integrated, bus termination using plugs with integrated bus terminating resistors (see figure 13-1) | |
| Optical | SICAM AI Unit 7XV5674-0KK40-xAA1 | | |
| | Connection | Terminal side,<br>ST connector, 820 nm<br>Bending radiuses: According to fiber-optic cable used | |
| | | | |
| | Protocol/Operating mode | Modbus RTU | SIPROTEC RTU 20 mA |
| | Baud rate | Min. 1200 bit/s<br>Max. 115 000 bit/s;<br>Default setting 19 200 bit/s | Min. 4800 bit/s<br>Max. 38 400 bit/s;<br>Default setting 9600 bit/s |
| | Parity | None, 1 stop bit<br>Even<br>Odd<br>None, 2 stop bit | None, 1 stop bit<br>Even<br>Odd<br>None, 2 stop bit |
| | | | |
| | Maximum distance of transmission | Max. 2000 m at 62.5 μm/125 μm multimode optical fiber<br>Max. 1500 m at 50 μm/125 μm multimode optical fiber | |
| | Receiver sensitivity | -24 dBm at 62.5 μm/125 μm multimode optical fiber | |
| | Optical budget | Min. 8 dB at 62.5 μm/125 μm multimode optical fiber | |

**Recommended Termination of the RS485 Interface (Connector J)**

The RS485 bus requires at least the bus termination shown in the figure below, with pullup/pulldown resistors:

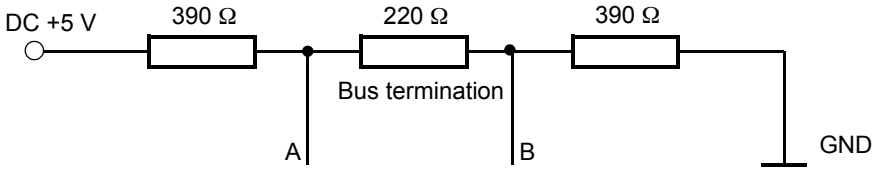



Fig. 13-1 Termination of the RS485 Interface

The bus termination must be respectively carried out at the first and last RS485 device interface of the bus. No terminating resistor may be used at all other devices in this line.

Siemens recommends the use of a bus termination plug with integrated (activatable) resistors in accordance with figure 13-1, for example plugs with 35°-cable outlet type 6ES7972-0BA42-0XA0 (see chapter 2.2). Use a 2-wired, twisted and shielded cable (see chapter 2.2). In case of outdoor mounting Siemens recommends a rodent protection. You can find current installation material at SIEMENS IS in the "Catalog for Industrial Communication", chapter "PROFIBUS", see also:
http://www.automation.siemens.com/mcms/automation/en/industrial-communications/Pages/Default.aspx.

The 9 pin D-sub socket of the RS485 interface is connected as follows:

| Pin No. | Assignment | Pin No. | Assignment |
|---|---|---|---|
| 1 | Shield | 6 | DC +5 V<br>Supply voltage for terminating resistors (max. 100 mA) |
| 2 | Not assigned | 7 | RTS<br>Direction control<br>(if required for an external conversion) |
| 3 | A<br>RS485 connection pin A | 8 | B<br>RS485 connection pin B |
| 4 | Not assigned | 9 | Not assigned |
| 5 | GND<br>(towards DC +5 V) | | |

### 13.1.4 Environmental Data

| | | |
|---|---|---|
| Temperature data | | |
| | Operating temperature | -25 °C to +70 °C<br>-13 °F to +158 °F |
| | Temperature during transport | -25 °C to +70 °C<br>-13 °F to +158 °F |
| | Temperatur during storage | -25 °C to +70 °C<br>-13 °F to +158 °F |
| | Maximum temperature gradient | 20 K/h |
| | | |
| Air humidity data | | |
| | Mean relative air humidity per year | ≤ 75 % |
| | Maximum relative air humidity | 95 % 30 days a year |
| | Condensation during operation | Not permitted |
| | Condensation during transport and storage | Permitted |

### 13.1.5 General Data

| | | |
|---|---|---|
| Battery | Type | PANASONIC CR2032 or<br>VARTA 6032 101 501 |
| | Voltage | 3 V |
| | Capacity | 230 mAh |
| | Typical life | 10 years<br>In operation with continuous supply voltage |
| | | 2 months within 10 years;<br>In operation where supply voltage is not applied continuously |
| | | |
| Protection class acc. to IEC 60529 | DIN rail side | IP20 |
| | Terminal side (terminals) | IP20 |
| | Top side | IP20 |

# 13.2 Test Data

**Reference Conditions for Determining the Test Data**

| | |
|---|---|
| Input current of reference source | Rated current ± 0.02 % |
| Curve shape | Direct current |
| Ambient temperature | 23 °C ± 1 °C |
| Supply voltage | $V_{HN}$ ± 5 % |
| Frequency of supply voltage | 45 Hz to 65 Hz |
| Warm-up time | ≥ 15 min |
| Interfering fields | None |

## 13.2.1 Electrical Tests

**Standards**

| | |
|---|---|
| Standards: | IEC 60688 and IEC 60255<br>IEEE Std C37.90, see individual functions<br>VDE 0435<br>For more standards see also individual functions |

**Insulation Test according to IEC 61010-1 and IEC 61010-2-030**

| Inputs/Outputs | Insulation | Rated Voltage | ISO Test Voltage | Category |
|---|---|---|---|---|
| Current measuring inputs | Reinforced | < 50 V | AC 2.3 kV<br>DC 3.6 kV | Cat. III |
| Supply voltage | Reinforced | 300 V | DC 3.125 kV | Cat. III |
| Ethernet interface | Function | < 50 V | DC 700 V | Cat. III |
| RS485 interface | Function | < 50 V | DC 700 V | Cat. III |

**EMC Tests for Immunity (Type Tests)**

| | | |
|---|---|---|
| Standards: | | IEC 60255-6 and -22, (product standards)<br>IEC/EN 61000-6-2<br>VDE 0435<br>For more standards see also individual functions |
| 1 MHz test, Class III, IEC 60255-22-1, IEC 61000-4-18, IEEE C37.90.1 | | 2.5 kV (peak); 1 MHz; $\tau$ = 15 µs;<br>Repetition rate of 400/s;<br>Test duration 2 s; $R_i$ = 200 Ω |
| Electrostatic discharge, Class III<br>IEC 60255-22-2, IEC 61000-4-2 | | 4 kV contact discharge; 8 kV air discharge, both polarities; 150 pF; $R_i$ = 330 Ω |
| Radio frequency electromagnetic field, amplitude-modulated, Class III<br>IEC 61000-4-3, IEC 60255-22-3 | | 10 V/m; 80 MHz to 2.7 GHz; 80 % AM;<br>1 kHz |
| Fast transient bursts, Class III<br>IEC 61000-4-4, IEC 60255-22-4, IEEE C37.90.1 | | 2 kV; 5 ns/50 ns; 5 kHz;<br>Burst length = 15 ms;<br>Repetition rate 300 ms;<br>Both polarities;<br>$R_i$ = 50 Ω;<br>Test duration 1 min |
| High energy surge voltages (SURGE), Installation Class III<br>IEC 61000-4-5, IEC 60255-22-5 | | Impulse: 1.2 µs/50 µs |
| | Auxiliary voltage | Common mode: 2 kV; 12 Ω; 9 µF<br>Diff. mode:1 kV; 2 Ω; 18 µF |
| | Measuring inputs, binary inputs and relay outputs | Common mode: 2 kV; 42 Ω; 0.5 µF<br>Diff. mode: 1 kV; 42 Ω; 0,5 µF |
| Immunity to conducted disturbances, inducted by radio-frequency fields, Class III<br>IEC 61000-4-6, IEC 60255-22-6 | | 10 V; 150 kHz to 80 MHz; 80 % AM; 1 kHz |
| Power frequency magnetic field immunity test<br>IEC 61000-4-8, Class IV; | | 30 A/m continuous; 300 A/m for 3 s |

**EMC Test for Radio-Frequency Disturbance Characteristics**

| Standard: | IEC/EN 61000-6-4 |
|---|---|
| Radio-Frequency Disturbance Characteristics<br>IEC-CISPR 22 (conducted emission) | 150 kHz to 30 MHz Limit Class B |
| Radio-Frequency Disturbance Characteristics<br>IEC-CISPR 11 (radiated emission) | 30 MHz to 1000 MHz Limit Class A |

## 13.2.2 Mechanical Stress Tests

**Vibration and Shock Stress during Stationary Operation**

| Standards: | IEC 60255-21 and IEC 60068 |
|---|---|
| Vibration tests<br>IEC 60255-21-1, Class II;<br>IEC 60068-2-6 test Fc | Oscillation: Sinusoidal<br>10 Hz to 60 Hz: ±0.075 mm amplitude; 60 Hz to 150 Hz: 1 g acceleration<br>Frequency sweep rate 1 octave/min 20 cycles in 3 orthogonal axes. |
| Shock<br>IEC 60255-21-2, Class I;<br>IEC 60068-2-27 test Ea | Semi-sinusoidal<br>5 g acceleration, duration 11 ms, each 3 shocks in both directions of the 3 axes |
| Seismic Vibration<br>IEC 60255-21-3, Class II;<br>IEC 60068-3-3 test Fc | Sinusoidal<br>1 Hz to 8 Hz: ±7.5 mm amplitude (horizontal axis)<br>1 Hz to 8 Hz: ±3.5 mm amplitude (vertical axis)<br>8 Hz to 35 Hz: 2 g acceleration (horizontal axis)<br>8 Hz to 35 Hz: 1 g acceleration (vertical axis)<br>Frequency sweep 1 octave/min<br>1 cycle in 3 orthogonal axes |

**Vibration and Shock Stress during Transport**

| Standards: | IEC 60255-21 and IEC 60068 |
|---|---|
| Vibration tests<br>IEC 60255-21-1, Class 2;<br>IEC 60068-2-6 test Fc | Oscillation: Sinusoidal<br>5 Hz to 8 Hz: ±7.5 mm amplitude;<br>8 Hz to 150 Hz: 2 g acceleration<br>Frequency sweep 1 octave/min<br>20 cycles in 3 orthogonal axes |
| Shock<br>IEC 60255-21-2, Class 1;<br>IEC 60068-2-27 test Ea | Semi-sinusoidal<br>15 g acceleration, duration 11 ms,<br>each 3 shocks (in both directions of the 3 axes) |
| Bump<br>IEC 60255-21-2, Class 1;<br>IEC 60068-2-29 test Eb | Semi-sinusoidal<br>10 g acceleration, duration 16 ms,<br>each 1000 shocks (in both directions of the 3 axes) |
| Free fall<br>IEC 60068-2-32 test Ed | 1 m |

### 13.2.3 Climatic Stress Tests

| Standards: IEC 60068 and IEEEC37.90 |
|---|
| Cold:<br>IEC 60068-2-1 test Ad<br>IEEE C37.90-2 |
| Dry heat during operation, storage and transport:<br>IEC 60068-2-2 test Bd |
| Damp heat:<br>IEC 60068-2-3 test Ca |
| Change of temperature:<br>IEC 60068-2-14 test Na and Nb |
| Individual gastest, industrial atmosphere, sequential gas test:<br>IEC 60068-2-42 test Kc<br>IEC 60068-2-43 |
| Flowing mixed gas:<br>IEC 60068-2-60 method 4 |
| Salt mist test<br>IEC 60068-2-11 test Ka |

### 13.2.4 Safety Standards

| Standards: EN 61010 |
|---|
| EN 61010-1 |

## 13.3 Dimensions

| | |
|---|---|
| Mass | approx. 0.5 kg |
| Dimension (W x H x D) | 96 mm x 96 mm x 100 mm<br>3.78 in x 3.78 in x 3.94 in |

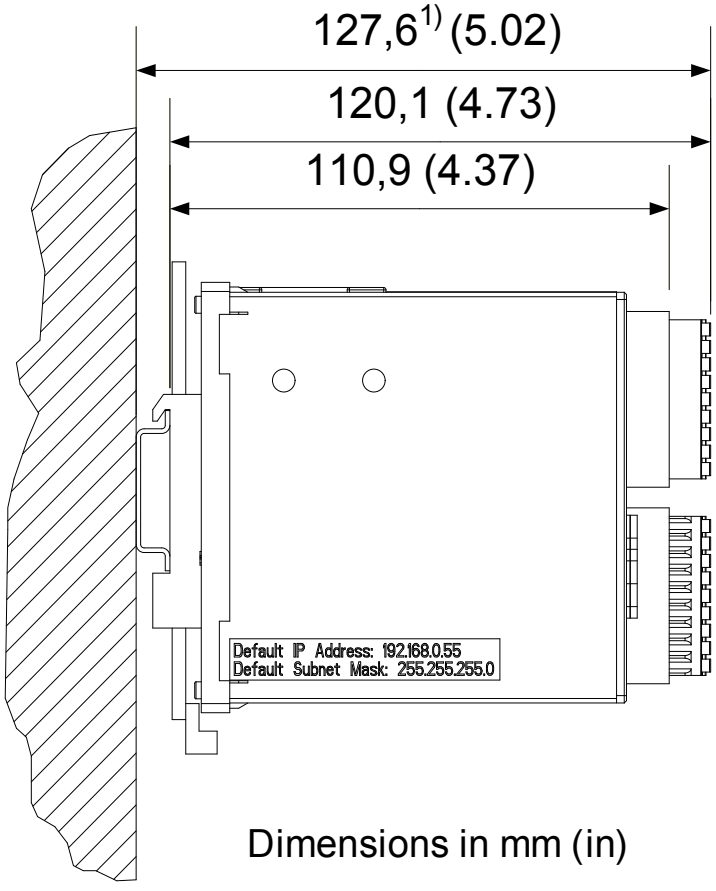



Fig. 13-2 Dimensional Drawing of the SICAM AI Unit

1) Dimensional drawing is valid for DIN rail DIN EN 50022-35 x 7.5

# 14 Operational Indications

| Indication | Description | Notes |
|---|---|---|
| Device OK | The device startup was successful. | Indication on: Device ready |
| Start Up | Device startup or device restart | Indication on: Device startup successful |
| Battery Failure | Battery voltage < 2.7 V or no battery inserted | Indication on: Battery failure |
| Clear operational log | The operational indications were deleted. | Indication on: Operational indications deleted |
| Time Synchronization Error | Error during the time synchronization from the NTP server or fieldbus | Indication off: At least one time message was received during the set timer ("**Error indication after**"). The time stamp is set when the first valid time information or time synchronization is received.<br><br>Indication on: No time message was received during the set timer ("**Error indication after**").<br>The time stamp is set after the "**Error indication after**" timer has expired and no synchronization message was received.<br><br>Parameter range: see chapter 7.3.4.1<br><br>Error sources with RTC:<br>- no valid time after device startup<br>Error sources with NTP or fieldbus:<br>- „**Error indication after**" timer expires and no synchronization message was received |
| | Error during internal time synchronization | Indication on: RTC time invalid<br>Indication off: After setting the clock via HTML (see chapter 7.3.4.1)<br><br>During battery failure at device startup |
| Time Set | The time was set. | Indication on: Time set<br><br>Only when setting the clock via HTML |
| Default IP Address | The IP-Addr. push-button has been pressed for more than 3 s. | Indication on: IP-Addr. push-button was pressed<br><br>The device restarts and applies the default IP address. |

| Indication | Description | Notes |
|---|---|---|
| Primary NTP Server Error | Faulty or no response from the primary NTP server | Indication on: Error<br>Indication off: Valid time messages has been received for a period of 10 min<br><br>Only for time synchronization via Ethernet NTP (see chapter 7.3.4.1) |
| Secondary NTP Server Error | Faulty or no response from the secondary NTP server | Indication on: Error<br>Indication off: Valid time messages has been received for a period of 10 min<br><br>Only for time synchronization via Ethernet NTP (see chapter 7.3.4.1) |
| Daylight Saving Time | Switching between daylight saving time/standard time | Indication on: Daylight saving time<br>Indication off: Standard time |
| Ethernet Link Error | Ethernet connection error | Indication on: Error<br>Indication off: Ethernet link recognized |
| Modbus TCP OK<br><br>(Modbus TCP Server) | At least one Modbus TCP link has received Modbus messages. | Indication on: At least one Modbus message was received during the set monitoring time. The time stamp is set when the first valid message is received.<br><br>Indication off: No Modbus message was received during the set monitoring time.<br><br>See chapter 7.3.4.2 |
| Modbus Serial OK<br><br>(Modbus RTU Slave) | The Modbus serial communication has received a valid Modbus message. | Indication on: At least one serial message was received during the set monitoring time. The time stamp is set when the first valid message is received.<br><br>Indication off: No serial message was received during the set monitoring time.<br><br>See chapter 7.3.4.3 |
| Settings Load | Starting to change the parameters of the passive set of parameters. | Indication on: Start of changes<br>Indication off: Changes complete |
| Settings Check | The passive set of parameters is to be activated; the internal parameter check is running. | Indication on: Check started<br>Indication off: Check complete |
| Settings Activate | The passive set of parameters is enabled and the device works with these parameters. | Indication on: Activation started<br>Indication off: Activation complete |

| Indication | Description | Notes |
|---|---|---|
| Limit Violation x | Indication that a parameterized limiting value has been violated | Indication on: The limit of the monitored measured value has been violated or no measured value is parameterized as input of the limiting value.<br>Indication off: The limit of the monitored measured value is not violated.<br>Message invalid: The monitored measured value is invalid<br>(e.g. negative value or a value greater than 20 mA ).<br><br>x = 1 to 16 |
| Group indication x | Up to 16 single-point indications can be linked logically and combined to a group indication. | A total of 4 group indications (x = 1 to 4) can be parameterized. |
| Modbus UDP OK | The Modbus UDP communication has received a valid Modbus message. | Indication on: At least one valid Modbus message was received.<br><br>Indication off: No Modbus message was received during the set monitoring time.<br><br>See chapter 7.3.4.2 |
| Ethernet Link 2 Error | Ethernet connection error on port 2 of the Ethernet switch<br>(available only with Y-cable) | Indication on: Error<br>Indication off: Ethernet link recognized |
| Out of Range Tx/y and Qx/y | Out of range | - |
| Wire Broken Tx/y and Qx/y | Wire broken | - |
| Input not Active Tx/y and Qx/y | Input not active | - |
| MBS Serial OK | MBS mode is correct | - |

# 15 Operating Parameters



**NOTE for user on the online help**

This chapter is integrated as an online help in the user interface.

The description of parameterization of the operating parameters can be found in the manual SICAM AI Unit, order number E50417-G1140-C492-A2.

# 15.1 Process Connections

The following process connections are available:

- 20-mA inputs
- LEDs

## 15.1.1 20-mA Inputs

| Parameter | Default Setting | Setting Range |
|---|---|---|
| T1/2<br>(20-mA Channel 1 terminal block T) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| T4/6<br>(20-mA Channel 2 terminal block T) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| T3/5<br>(20-mA Channel 3 terminal block T) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| T7/9<br>(20-mA Channel 4 terminal block T) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| T11/13<br>(20-mA Channel 5 terminal block T) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| T15/17<br>(20-mA Channel 6 terminal block T) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| Q1/2<br>(20-mA Channel 1 terminal block Q) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| Q4/6<br>(20-mA Channel 2 terminal block Q) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| Q3/5<br>(20-mA Channel 3 terminal block Q) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |

| Parameter | Default Setting | Setting Range |
|---|---|---|
| Q7/9<br>(20-mA Channel 4 terminal block Q) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| Q11/13<br>(20-mA Channel 5 terminal block Q) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| Q15/17<br>(20-mA Channel 6 terminal block Q) | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |
| Measuring range | 0 mA to +20 mA | 0 mA to +20 mA<br>4 mA to +20 mA |

### 15.1.2 LEDs

| LED | Default Setting | Setting Range |
|---|---|---|
| RUN | Device ready | Not settable |
| H1<br><br>H2 | -none- | -none-<br>Device OK<br>Battery Failure<br>Settings Load<br>Settings Check<br>Settings Activate<br>Modbus TCP OK<br>Ethernet Link Error<br>Modbus Serial OK<br>Time Synchronization Error<br>Primary NTP Server Error<br>Secondary NTP Server Error<br>Daylight Saving Time<br>Ethernet Link 2 Error<br>Default IP Address<br>Limit Violation y<br>Out of range z<br>Wire broken z<br>Input not active z<br>Group Indication x<br>MBS Serial OK |
| ERROR<br>(Error signalization and signalization according to parameterization)<br>Note:<br>Only error messages can be assigned to the ERROR LED. | -none- | -none-<br>Battery Failure<br>Ethernet Link Error<br>Time Synchronization Error<br>Primary NTP Server Error<br>Secondary NTP Server Error<br>Ethernet Link 2 Error |

x = 1 to 4

y = 1 to 16, user-defined name, if assigned (see chapter 15.2)

z = T1/2, T4/6, T3/5, T7/9, T11/13, T15/17 → and → Q1/2, Q4/6, Q3/5, Q7/9, Q11/13, Q15/17

## 15.2 Automation Functions

The following automation functions are available:

- Limit violation 1-8
- Limit violation 9-16
- Group indication 1-4

**Limit Violation 1-8 and 9-16**

| Parameter | Default Setting | Setting Range |
|---|---|---|
| Measurand | -none- | -none-<br>20 mA Ch x Terminal Block T<br>(x = 1 to 6)<br>20 mA Ch x Terminal Block Q<br>(x = 1 to 6) |
| Limit | 0.00 | 0.00 mA to 20.00 mA |
| Limit type | Lower | Lower<br>Upper |
| Hysteresis (%) | 1.00 | 0.00 to 20.00 |
| Violation indication | Limit Violation x<br>(x = 1 to 16) | The name of the limit value indication is customizable. |

**Group Indications**

| Parameter | Default Setting | Setting Range |
|---|---|---|
| **Indication (selectable for Group Indication 1 to 4):**<br><br>Device OK<br>Battery Failure<br>Modbus TCP OK<br>Ethernet Link Error<br>Modbus Serial OK<br>Time Synchronization Error<br>Primary NTP Server Error<br>Secondary NTP Server Error<br>Daylight Saving Time<br>Ethernet Link 2 Error<br>Default IP Address<br>Limit Violation y<br>Out of range z<br>Wire broken z<br>Input not active z<br>MBS Serial OK | No<br>(no checkmark set) | No<br>(no checkmark set)<br>Yes<br>(checkmark set) |

x = 1 to 4

y = 1 to 16

z = T1/2, T4/6, T3/5, T7/9, T11/13, T15/17 → and → Q1/2, Q4/6, Q3/5, Q7/9, Q11/13, Q15/17

# 15.3 Administrative

The following administrative settings are available:

- Time Synchronization
- Ethernet Communication
- Communication Serial
- Device and Language

## 15.3.1 Time Synchronization

| Parameter | Default Settings | Setting Range |
|---|---|---|
| Source time synchronization | Internal | Internal<br>Ethernet NTP<br>Fieldbus |
| Time zone offset to UTC | +00:00 | -12 to +13 (hours)<br>(in increments of 0.5 h) |
| Daylight Saving Time switchover | yes | no<br>yes |
| DST offset to UTC | +01:00 | 0 to + 2 (hours)<br>(in increments of 0.5 h) |
| Start of DST | March<br>Last week<br><br><br><br>Sunday<br>02:00 AM | January to December<br>First week<br>Second week<br>Third week<br>Fourth week<br>Last week<br>Sunday to Saturday<br>0:00 to 23:00 (full hour) |
| End of DST | October<br>Last week<br><br><br><br>Sunday<br>03:00 AM | January to December<br>First week<br>Second week<br>Third week<br>Fourth week<br>Last week<br>Sunday to Saturday<br>0:00 to 23:00 (full hour) |
| **Additional Parameters if the Source is Ethernet NTP (Modbus TCP and IEC 61850)** | | |
| Primary NTP server IP Address | 192.168.0.254 | Any |
| Secondary NTP server IP Address | 192.168.0.253 | Any<br>No polling of the NTP server if 0.0.0.0 was entered |
| Error indication after | 10 min | 2 min to 120 min |
| **Additional Parameters if Source is Fieldbus** | | |
| Error indication after | 10 min | 2 min to 120 min |

## 15.3.2 Ethernet Communication

| Parameter | Default Settings | Setting Range |
|---|---|---|
| IP address [1] | 192.168.0.55 | Any<br>0.0.0.0 = DHCP |
| Subnet mask [1] | 255.255.255.0 | Any |
| Default gateway [1] | 192.168.0.1 | Any |
| Ethernet switch on | no | no<br>yes |
| Bus protocol | Modbus TCP | Modbus TCP<br>IEC 61850<br>-none- |
| **Bus Protocol Modbus TCP** | | |
| Use a user-port number [2] | no | no<br>yes |
| User-port number [2]<br>(can only be set when *Use a user-port number* is parameterized with *yes*) | 10000 | 10000 to 65535 |
| Access rights for user port<br>(can only be set when *Use a user-port number* is parameterized with *yes*) | Full | Full<br>Read only |
| Access rights for user port 502 | Full | Full<br>Read only |
| Keep Alive time | 10 s | 0 s = switch off<br>1 s to 65 535 s |
| Communication supervision time | 50 * 100 ms | 0 s = none<br>100 ms to 6 553 400 ms |
| **Bus Protocol Modbus UDP** | | |
| Port number | 51000 | 10000 to 65535 |
| Access rights | Full | Full,<br>Read only |
| Communication supervision time | 20 [* 10 ms] | 0 ms = invalid<br>10 ms to 60 000 ms |
| **Bus Protocol IEC 61850 [3]** | | |
| IEC 61850 Edition | Edition 1 | Edition 1<br>Edition 2 |
| IED name number | 1 | 0 to 65 534 |
| Deadband percentage | 2.0 | 0.0 % to 10.0 % |
| Multicast MAC address | 01-0C-CD-01-00-01 | [xx-xx-xx-xx-xx-xx]<br>hexadecimal |
| App ID | 3001 | [xxxx] hexadecimal |

| Parameter | Default Settings | Setting Range |
|---|---|---|
| VLAN ID | 000 | [xxx] hexadecimal |
| VLAN priority | 4 | 0 to 7 |
| Retransmit MIN | 10 | 1 ms to 500 ms |
| Retransmit MAX | 2000 | 500 ms to 65 534 ms |

1) After the parameter changes have been enabled, the device resets.

2) After enabling the parameter changes, any currently active Modbus TCP connections will be closed. The Modbus TCP client must later re-open these connections.

3) After having selected IEC 61850 or having changed the IEC 61850 settings with the following activation, the device is automatically restarted.

### 15.3.3 Communication Serial

| Parameter | Default Settings | Setting Range |
|---|---|---|
| Bus protocol | Modbus RTU | -none-<br>Modbus RTU<br>SIPROTEC RTU 20 mA |
| **Bus Protocol Modbus RTU** | | |
| Device address | 1 | 1 to 247 |
| Baud rate | 19 200 bit/s | 1200 bit/s, 2400 bit/s<br>4800 bit/s, 9600 bit/s<br>19 200 bit/s, 38 400 bit/s<br>57 600 bit/s, 115 200 bit/s |
| Parity | Even | None, 1 stop bit<br>Even<br>Odd<br>None, 2 stop bit |
| Access rights | Full | Full<br>Read only |
| Communication supervision time | 600 * 100 ms | 0 s = none<br>100 ms to 6 553 400 ms |
| Response delay | 0 [ms] | 0 ms to 1000 ms |
| If there is an optical interface:<br>Fiber-optic idle state | Light OFF | Light OFF<br>Light ON |
| **Bus Protocol SIPROTEC RTU 20 mA** | | |
| MBS mode | 8 MBS, simplex | 8 MBS, simplex<br>8 MBS, half duplex<br>16 MBS, half duplex |
| Repeat time [1)] | 600 ms | 0 ms to 65 534 ms |
| Device address [2)] | 1 | 1 or 2 |
| Baud rate | 9600 Bit/s | 4800 bit/s<br>9600 bit/s<br>19 200 bit/s<br>38 400 bit/s |

| Parameter | Default Settings | Setting Range |
|---|---|---|
| Parity | Even | None, 1 stop bit<br>Even<br>Odd<br>None, 2 stop bit |
| Communication supervision time | 600 * 100 ms | 0 s = none<br>100 ms to 6 553 400 ms |
| If there is an optical interface:<br>Fiber-optic idle state | Light OFF | Light OFF<br>Light ON |

1) Only visible, if **8 MBS, simplex** is selected as **MBS mode**.

2) Only visible, if **8 MBS, half duplex** is selected as **MBS mode**.

### 15.3.4 Device and Language

| Parameter | Default Settings | Setting Range |
|---|---|---|
| Device name | SICAM AI Unit 7XV5674 | Max. 32 characters |
| Language | ENGLISH (US) | ENGLISH (US)<br>DEUTSCH (DE) |
| Date/time format | YYYY-MM-DD,<br>Time with 24 hours | YYYY-MM-DD, Time with 24 hours<br>YYYY-MM-DD, Time with 12 h AM/PM<br>DD-MM-YYYY, Time with 24 hours<br>DD-MM-YYYY, Time with 12 h AM/PM<br>MM/DD/YYYY, Time with 24 hours<br>MM/DD/YYYY, Time with 12 h AM/PM |
| Activation password | 000000 | Any 6 to 14 characters |
| Maintenance password | 311299 | Any 6 to 14 characters |

# Glossary

**A**

| | |
|---|---|
| AC | **A**lternating **C**urrent |
| ACSI | **A**bstract **C**ommunication **S**ervice **I**nterface |
| ARP | **A**ddress **R**esolution **P**rotocol: Network protocol |

**B**

| | |
|---|---|
| Big-Endian format | The most significant byte is stored first, that is at the memory location with the lowest address. |
| Boot Application | Starting a device with the firmware required for the microcontroller |
| Broadcast message | Message in the network where data packets are transmitted to all devices on the network from one point |

**C**

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|---|---|
| CDC | **C**ommon **D**ata **C**lass (IEC 61850) |
| Client | Device in the communication network that sends data requests or commands to the server devices and receives responses from them |
| CRC | **C**yclic **R**edundancy **C**heck: The cyclic redundancy check is a method of determining a test value for data (e.g. for data transmission in computer networks) with the purpose to detect errors during the transmission or duplication of data. |

**D**

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

**E**

| | |
|---|---|
| Ethernet | Cable-based data network technology for local data networks |

**F**

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

**G**

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

**H**

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|---|---|
| Holding register | Area for representing data in Modbus communication |

**I**

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|---|---|
| ICD file | **I**ED **C**apability **D**escription: Contains the standardized description of the device configuration |
| IEC | **I**nternational **E**lectrotechnical **C**ommission, standards organization; Communication standard for substations and protection equipment |
| IED | **I**ntelligent **E**lectronic **D**evice |
| Indication off | The status of the indication changes from ON to OFF, that is the indication is deleted. |
| Indication on | The status of the indication changes from OFF to ON, that is the indication is currently present. |
| +Inf | Stands for *Infinity* and denotes a counter overflow. Extremely large number or infinitely positive number |
| IP | **I**nternet **P**rotocol |
| IP address | Addresses in computer networks based on the Internet protocol |

**J**

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|---|---|
| JavaScript | Script language mainly used by Web browsers |

**K**

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

**L**

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

**M**

| | |
|---|---|
| MAC-Address | **M**edia **A**ccess **C**ontrol address: Hardware address that clearly identifies the device on the network. |
| MBAP | **M**od**b**us **A**pplication **P**rotocol |
| MBAP Header | Header of a Modbus TCP message consisting of these 4 parts: Transaction identifier (2 bytes), protocol identifier (2 bytes), length (2 bytes), unit identifier (1 byte). |
| Modbus | The Modbus protocol is a communication protocol based on a client-server architecture. |
| Modbus RTU | Modbus **R**emote **T**erminal **U**nit: Modbus protocol type for transmitting data over serial networks (e.g. RS485) |
| Modbus TCP | Modbus **T**ransmission **C**ontrol **P**rotocol: Modbus protocol type for transmitting data as TCP/IP packets; TCP port 502 is reserved for Modbus TCP. |
| MSB | **M**ost **S**ignificant **B**it |

**N**

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

**P**

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|---|---|
| PIXIT | **P**rotocol **I**mplementation **Ex**tra Information for **T**esting |

**R**

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|---|---|
| Response delay | According to the Modbus specification the bus silent time between receiving the Modbus request from the Modbus master and sending the response must be at last 3.5 character times. This is ensured by the Modbus slave in the SICAM device.<br>For some reasons (for example communication media converters in the line that need a certain direction switchover time) the 3.5 character times is too short and must be extended in order to ensure a correct receiving of the response by the Modbus master.<br>With this parameter a resonse delay (additionally to the 3.5 character times) may be defined. |
| RJ45 | Ethernet plug connector |
| RS485 | Interface standard for digital, wire-based, differential, serial data transmission |
| RTC | **R**eal-**T**ime **C**lock |
| RTU | See Modbus **R**emote **T**erminal **U**nit |

**S**

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|---|---|
| Server | Sends data upon request by the client |
| SNTP | **S**imple **N**etwork **T**ime **P**rotocol: Simplified version of the NTP |
| SW | **S**oft**w**are: Program executed on a computer |
| STP | **S**hielded **t**wisted-**p**air is the cable for 100Base-T (Ethernet) |
| Stratum | Each NTP server is synchronized by a high-precision time standard or by another NTP server. The stratum is the position of the NTP server in the hierarchy of NTP servers polled by the device. The best stratum is 1, each further level in the NTP server hierarchy increases the stratum by 1. |
| Subnet mask | Bit mask in the network protocol that defines how many IP addresses the computer network encompasses. Together with the IP address of a device, the subnet mask defines which IP addresses the device searches in its own network and which IP addresses it tries to reach via routers in other networks. |

**T**

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

**U**

| | |
|---|---|
| UTC | **U**niversal **T**ime **C**oordinated: Universal time standard referred to the time at the prime meridian |

# Index

## N



## O



## P



## R



## S



## T



## U



## V