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SICAM I/O Unit

7XV5673

Device Manual

E50417-H1040-C484-A3

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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 I/O Unit 7XV5673.

Target group

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

Scope of validity of this manual

This manual is valid for the SICAM I/O Unit 7XV5673.

Further support

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

Hotline

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

Phone: +49 (1805) 24-7000

Fax: +49 (1805) 24-2471

Internet: http://www.siprotec.com

e-mail: support.ic@siemens.com

Training courses

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

Siemens AG

Siemens Power Academy

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Fax: +49 (911) 433-7929

Internet: http://www.siemens.com/energy/power-academy

e-mail: power-academy.energy@siemens.com

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Notes On Safety

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

⚠ DANGER

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

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

⚠ WARNING

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

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

⚠ CAUTION

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

✧ Follow all advice instructions to prevent minor injury.

NOTICE

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

✧ Follow all advice instructions to prevent damage to property.

NOTE

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

Personnel qualified in electrical engineering

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

Use as Prescribed

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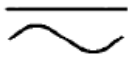
If the device is not used in accordance with the product information and this manual, the scheduled protection is impaired.

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 IEC 60417-5031
2		Alternating current IEC 60417-5032
3		Direct current and alternating current IEC 60417-5033
4		Protective conductor terminal IEC 60417-5019
5		Caution, risk of electric shoc
6		Caution, risk of danger ISO 7000-0434

Statement of Conformity

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 (Lowvoltage Directive 2006/95/EC).

This conformity has been established by means of tests conducted by Siemens AG in accordance of 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 60255-27 for the low-voltage directive.

The device has been designed and produced for industrial use.

Further

IEEE Std.C37.90

This product is UL-certified to Standard UL 508, based on the specification stated in chapter 11 (Technical Data). UL File No.: E194016.	
	IND. CONT. EQ. 69CA

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1 User Information

Application Scope

SICAM I/O Unit 7XV5673 is a digital input/output device and is used by utilities (energy supply companies) in substation environment. The device is also used for industrial sectors and in businesses with increased environmental requirements. It can be used in nearly every application for protection relays or SCADA, e.g. over current protection, teleprotection or Substation Automation. Nearby and remote connection of binary I/O Inputs are possible using this SICAM I/O Unit.

In the manual, the short name **SICAM I/O Unit** is used.

The SICAM I/O Unit can be used as, for example:

- I/O mirror: point-to-point transfer of binary signals between 2 SICAM I/O Units via Ethernet or a serial connection
- I/O expansion: device expansion by binary inputs and outputs
- Contact multiplier: multiplication of signals on one or several binary inputs via relay contacts

Binary Inputs and Relay Outputs

The device contains 2 terminal blocks with 3 binary inputs and 3 relay outputs each, and an Ethernet connection with internal Ethernet switch and a serial interface. Depending on the device variant, the serial interface is designed as RS485 or FO interface (820 nm).

2 binary inputs have a common root on each terminal block. Another binary input is potential free (not connected to potential). The threshold voltage of the binary inputs can be set to DC 19 V, DC 88 V or DC 176 V. Therefore an optimal adjustment to the station battery's voltage of the substation can be achieved and the pickup voltage can be adjusted in the case of increased interference level.

Each terminal block has 2 relay outputs NO (normally open) and one relay output CO (change over). The relays can switch voltages up to AC/DC 250 V and currents up to AC/DC 5 A.

Function

Via binary inputs, all kinds of binary signals of switch gear/protection scheme (for example tripping command, switch position signal, fault and status indications) are securely detected. This information can directly be distributed at this SICAM I/O Unit over relays, or be transmitted over communication ways to further equipment or systems.

The information is transmitted protected about the Ethernet and the serial interface in telegrams.

The parameter setting is simply carried out with a standard Web browser at the PC which is connected by the Ethernet interface. A separate software is not required.

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Communication

For communication with systems control and other substations for process automation, the Ethernet interface and the serial interface (RS485 or optical) are available.

The device parameterization, the transfer of indications and the time synchronization with NTP is supported via Ethernet. The communication protocols are HTTP, Modbus TCP, Modbus UDP, IEC 61850, and NTP. The client or server mode is used for the binary signal transmission.

The serial interface supports the transfer of indications and time synchronization. Depending on parameterization, the Modbus RTU communication protocol is used for communication; and the client or server mode is used for the binary signal transmission.

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 an other Ethernet protocol.

Time Synchronization

In operation, the device needs the date and time for all time relevant processes. This ensures a uniform time basis and a time stamp for the communication with peripheral devices. The following types of time synchronization are performed according to parameterization:

- External time synchronization via Ethernet NTP
- External time synchronization via fieldbus with Modbus RTU, Modbus TCP or Modbus UDP communication protocol
- Internal time synchronization via RTC (if there is no external time synchronization)

2 Overview

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2.1 Versions of SICAM I/O Unit

SICAM I/O Unit 7XV5673 is an input/output device for digital signals. It consists of modules that perform the detection and implementation of signals for the relay outputs.

Uniform Device Properties

All device variants have the following uniform properties:

- Device type:
    - DIN rail mounted device
    - Plastic case 96 mm x 96 mm x 100 mm (W x H x D)
    - Protection class IP20
    - Integrated electrical Ethernet interface (RJ45 connection)
- Binary inputs
    - 3 binary inputs on terminal block N,

      2 of which are binary inputs with a common root and 1 binary input is not connected to common potential (electrically isolated)
    - 3 binary inputs on terminal block P,

      2 of which are binary inputs with a joint root and 1 binary input is not connected to common potential (electrically isolated)
- Binary outputs (relay contacts):
    - 3 relay outputs on terminal block N,

      2 of which are normally open (NO) contacts and 1 is a change over (CO) contact
    - 3 relay outputs on terminal block P,

      2 of which are normally open (NO) contacts and 1 is a change over (CO) contact

Variants

SICAM I/O Unit 7XV5673 is available in different variants:

- Serial communication
    - Without serial communication
    - Via RS485 interface: Modbus RTU communication protocol
    - Via the optical interface (820 nm): Modbus RTU communication protocol
- Communication via Ethernet
    - With integrated Ethernet switch: Modbus TCP or Modbus UDP communication protocol
    - With integrated Ethernet switch: Modbus TCP, Modbus UDP, or IEC 61850 (GOOSE, MMS, reporting) communication protocol

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2.2 Ordering Information, Scope of Delivery and Accessories

Ordering Information

Description	Order No. / MLFB
SICAM I/O Unit	

	1 2 3	4	5	6	7		8	9	10	11	12		13	14	15	16
	7XV	5	6	7	3	-	0	J	J		0	-		A	A	1

SICAM I/O Unit, integrated electrical
Ethernet interface, connection RJ45

Device type
Case 96 mm x 96 mm x 100 mm

Inputs and outputs
3 Binary inputs with adjustable threshold voltage,
3 Relay outputs (2 NO, 1 CO)
3 Binary inputs with adjustable threshold voltage,
3 Relay outputs (2 NO, 1 CO)

Serial interface and communication protocol

Without serial communication	0
RS485 – Modbus RTU, I/O mirror	1
FO 820 nm – Modbus RTU, I/O mirror	2

Protection class
Snap-on mounting unit, protection class IP20

Communication interface and communication protocol

Ethernet interface with Modbus TCP/UDP or I/O mirror	1
Ethernet interface with Modbus TCP/UDP, I/O mirror, or IEC 61850 (GOOSE, MMS, Reporting)	2

Features
Integrated Ethernet switch

Figure 2-1   Order Information

Scope of Delivery

Included in delivery are:

- SICAM I/O Unit 7XV5673 according to order reference (see Figure 2-1)

- PANASONIC C2032 or VARTA 6032 101 501 battery (contained separately in the battery compartment of the device)

- Product Information E50417-B1050-C484

- DVD with the following content regarding the DIGSI operating program and SIPROTEC products with accessories:
  - Catalogs
  - Manuals
  - Updates
  - Device drivers

  Current documentation, updates, and device drivers can also be found on the Internet in the SIPROTEC download area under http://www.siprotec.com.

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Accessories

The following components are optionally available:
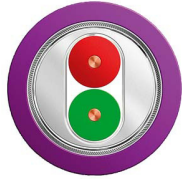
- Device Manual E50417-H1040-C484 (download available at http://www.siprotec.com)

- Y cable, order no. 7KE6000-8GD00-0BA2

- Ethernet patch cables according to table 2-1:

Table 2-1   Ethernet Patch Cable CAT5 for Cabinet-Internal Wiring (Double Shielded (SFTP), LAN Connector Plugs RJ45 on Both Sides)

Cable Length	Order Number
0.5 m	7KE6000-8GD00-0AA5
1.0 m	7KE6000-8GD00-1AA0
2.0 m	7KE6000-8GD00-2AA0
3.0 m	7KE6000-8GD00-3AA0
5.0 m	7KE6000-8GD00-5AA0
10.0 m	7KE6000-8GD01-0AA0
15.0 m	7KE6000-8GD01-5AA0
20.0 m	7KE6000-8GD02-0AA0

- RS485 cables for SIPROTEC devices according to Table 2-2:

Table 2-2   Standard RS485 Cables

Standard RS485 Cable	Cable Length	Order Number
	Maximum 1000 m (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 2-3:

Table 2-3　　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 prepared optical fiber 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.

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3 Device Design

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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 four additional LEDs. At the cover of the battery compartment there is a labeling strip for the 3 configurable LEDs H1, H2, ERROR and a battery symbol that indicates the polarity. On the top, the name plate is affixed. Among other information, it also contains the performance characteristics of the device. A lithium battery is located under the removable cover of the battery compartment.

On the side of the terminal, the terminals for the binary inputs and the relay outputs, the supply voltage, and the protective grounding as well as the plug-in connection for the serial interface (RS485 or FO) are arranged. The terminals and the plug-in connection are described in detail in chapter 4.3.2 and in the Product Information, included in delivery.

The snap-in unit is mounted in the center of the front cover. The IP-Addr. push-button is located in the lower right corner of the front cover. 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.

7XV5673-0JJ10-1AA1

7XV5673-0JJ20-1AA1

7XV5673-0JJ00-1AA1
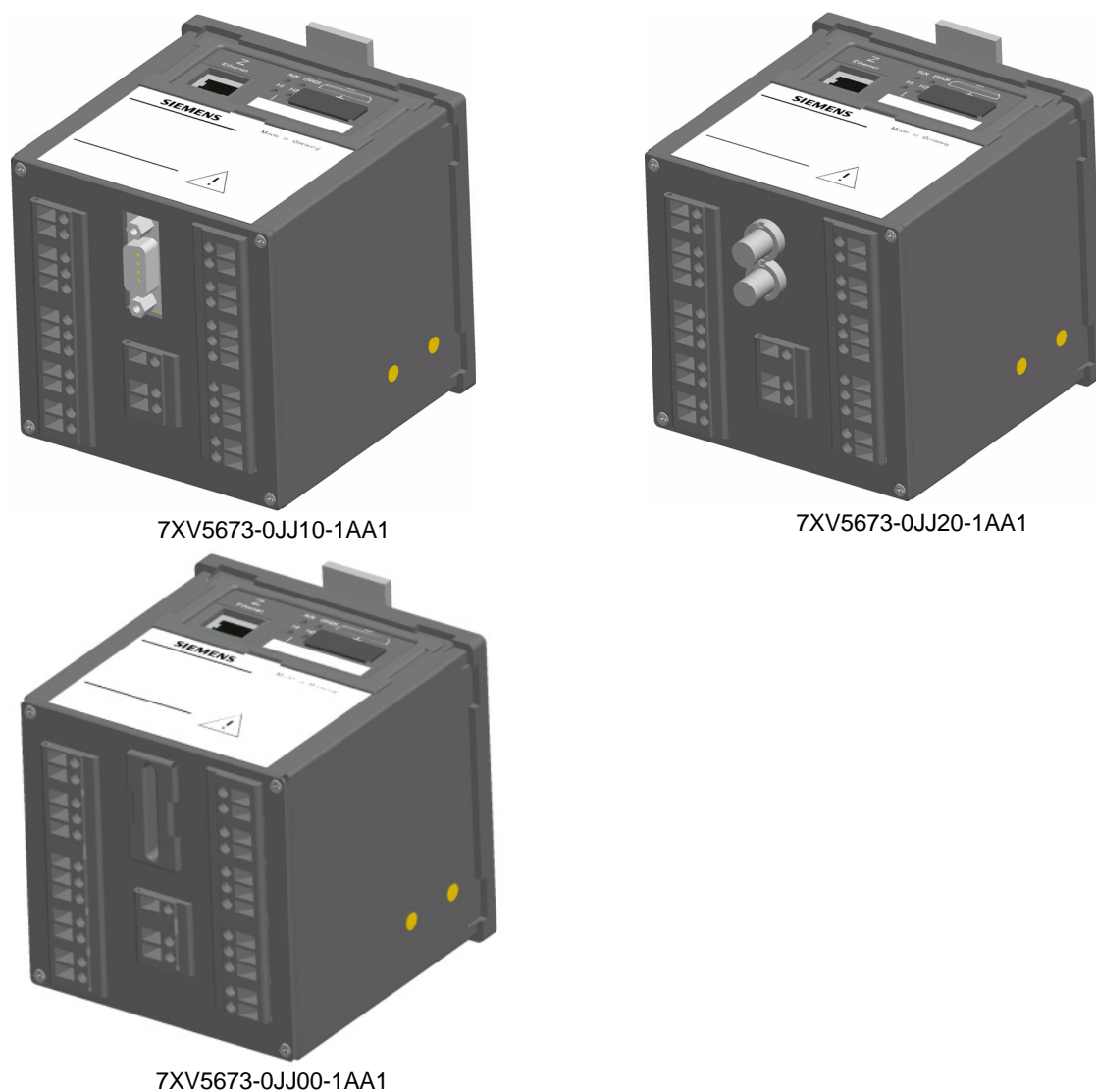
Figure 3-1   Design of the SICAM I/O Unit 7XV5673 with RS485 and Serial FO Interface or without Serial Interface

3.2 Electrical Design

The SICAM I/O Unit contains the following electrical modules depending on the device version:

- Digital signal processor (DSP)
- 2 terminal blocks with 3 binary inputs and 3 relay outputs each
- Function groups for binary signal processing
- Supply voltage
- RS485 interface or serial FO interface
- Ethernet interface with integrated Ethernet switch
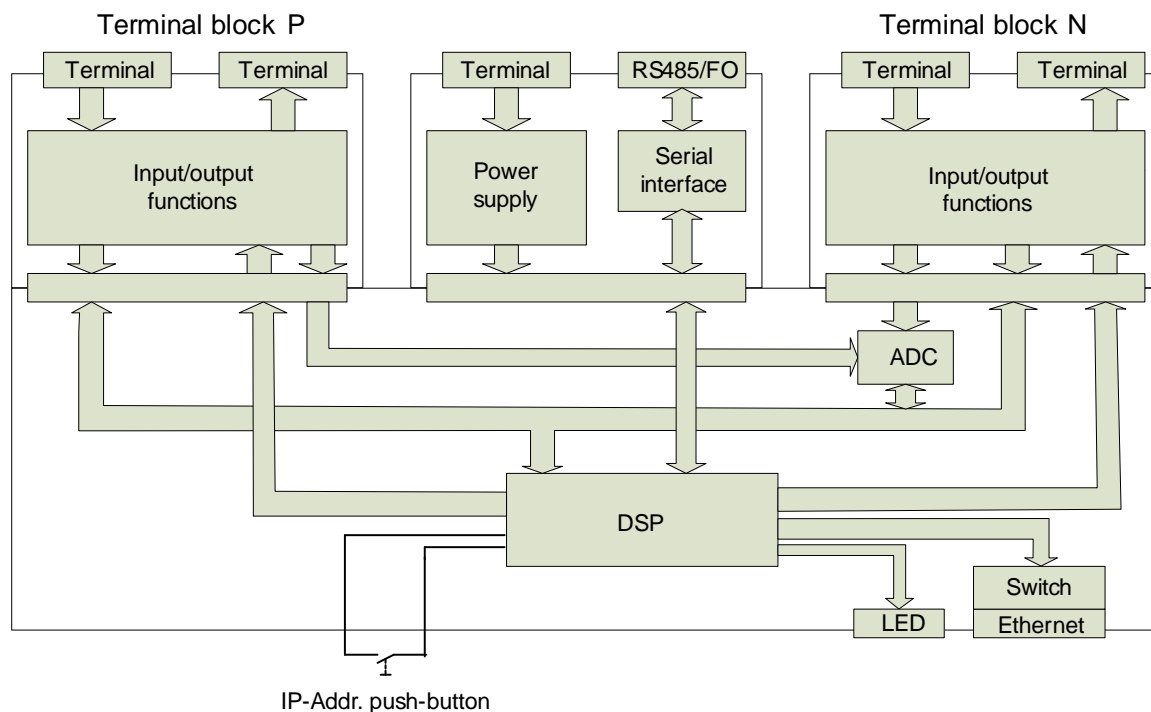
Figure 3-2   Block Diagram SICAM I/O Unit

SICAM I/O Unit, 7XV5673, Device Manual
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4 Getting Started

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4.1 Unpacking, Inspecting the Delivery and Installing the Battery

Unpacking

The SICAM I/O Unit 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-C484 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).
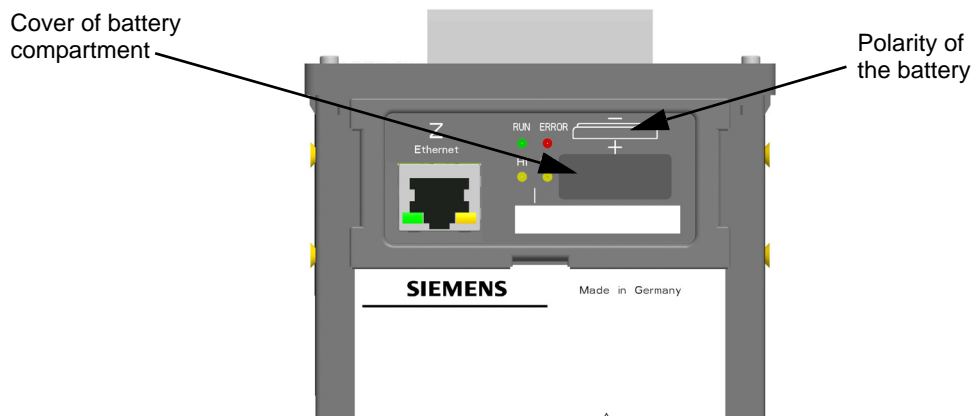
Figure 4-1   Top Side of the SICAM I/O Unit

✧ 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 4-1).

✧ Close the cover of the battery compartment.

NOTE

For additional information on replacing used batteries, refer to the Product Information E50417-B1050-C484. For information on battery life, refer to chapter 11.1.4.

WARNING

Incorrect handling of the lithium battery (type PANASONIC CR2032 or VARTA 6032 101 501) or using an incorrect battery type. In the case of incorrect handling 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.

✧ The lithium battery must only be replaced by a battery type PANASONIC CR2032 or VARTA 6032 101 501.

✧ 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 preface 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.

4.2   Assembly

4.2.1   General Assembly Notes

The SICAM I/O Unit is intended to be installed on a hat rail, for example in a control cabinet.

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.

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- The installation site must be vibration-proof. The permitted ambient temperature must be observed (see the technical data in chapter 11.2.3).

- Operating the device outside the permitted operating temperature range can lead to measuring errors and device failure.

- The terminals are designed for wire cross-sections of 2.5 mm² max. (AWG 14).

- 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.

4.2.2 Assembly

Mount the SICAM I/O Unit to a DIN rail according to EN 60750 in the following way:
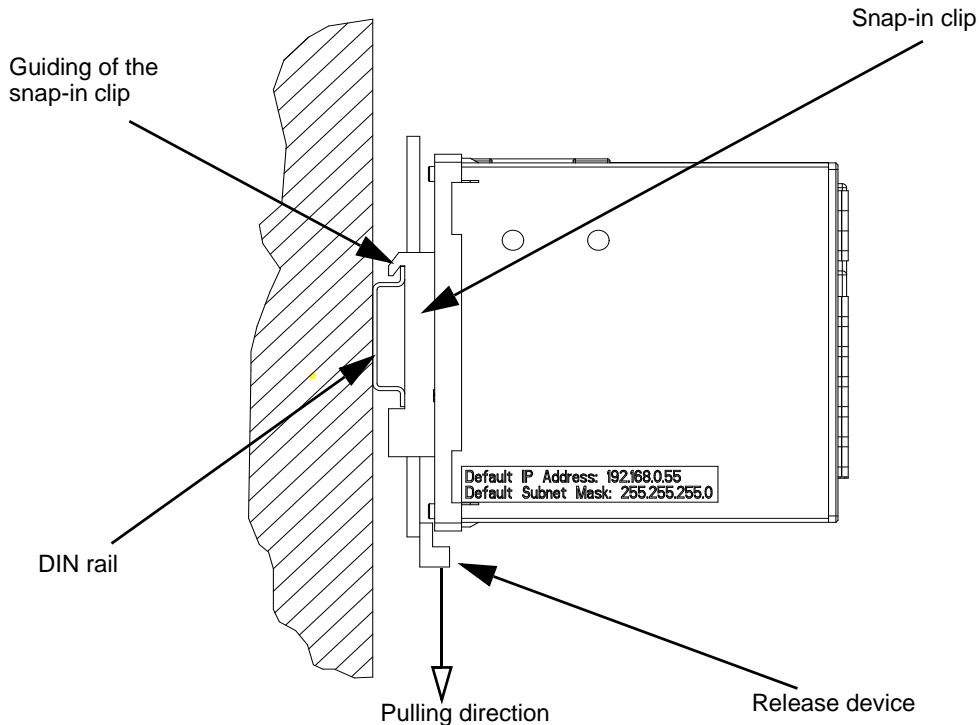
Figure 4-2   Mounting on a DIN Rail

- ✧ 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!

4.3 Electrical Connection

4.3.1 Safety Notes

> **DANGER**
>
> Hazard posed by high contact voltage.
>
> **Non-observance leads to death or serious injury.**
>
> ✧ Only trained personnel (see Preface), who is familiar with the safety requirements and precautions and observes them can carry out the work.
>
> ✧ If there is any dangerous voltage present, work may <u>never</u> be carried out.
>
> ✧ Connect the protective conductor terminal H ⏚ to the protective conductor of the switch panel or of the control cabinet.
>
> ✧ De-energize the device.
>
> ✧ In addition, a suitable isolating device shall be connected upstream in order to be able to disconnect the device from the power supply!
>
> ✧ 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 conductor terminal H ⏚ to the protective conductor of the switch panel or of the control cabinet.
- To allow temperature equalization and to avoid dimness and condensation, Siemens recommends leaving the device for a minimum of 2 hours in the operating room before using it.

> **NOTE**
>
> Before switching on the supply voltage, please check whether the operational data comply with the rated data on the name plate and the technical data according to chapter 11.1. This applies particularly to the U_H supply voltage and the maximum values on the binary inputs and the relay outputs.

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4.3.2 Electrical Connection of SICAM I/O Unit

NOTE

The electrical connections for all devices described in this manual are identical. They are described at the example of SICAM I/O Unit 7XV5673-0JJ10-1AA1.
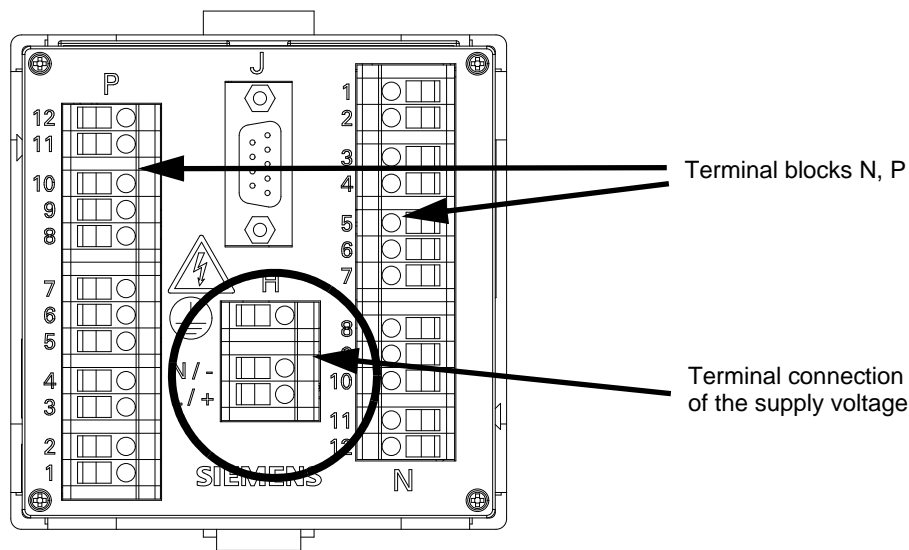
Figure 4-3   Supply Voltage Terminals and Terminal Blocks on the SICAM I/O Unit 7XV5673-0JJ10-1AA1

DANGER

Hazard posed by high contact voltage.

Non-observance leads to death or serious injury.

✧ Only trained personnel (see Preface), who is familiar with the safety requirements and precautions and observes them can carry out the work.

✧ If there is any dangerous voltage present, work may <u>never</u> be carried out.

✧ De-energize the device.

✧ In addition, a suitable isolating device shall be connected upstream in order to be able to disconnect the device from the power supply!

✧ 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.

Connect the lines of the supply voltage on the terminal side of the device with **terminal 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

Supply from a Direct Voltage Source

Terminal N/-:	Negative supply voltage
Terminal L/+:	Positive supply voltage
Terminal ⊕ :	Protective grounding

NOTE

The grounding on the SICAM I/O Unit always has to be connected to the terminal for protective conductor ⊕ (terminal block H).

Terminal blocks N and P

Table 4-1   Terminals on Terminal Blocks N and P

Terminal	Circuit	Description
Terminal block N		
N1 N2		Relay output 1, root Relay output 1, NO
N3 N4		Relay output 2, root Relay output 2, NO
N5 N6 N7		Relay output 3, NC Relay output 3, NO Relay output 3, root
N8 N9 N10		Binary input 1 Binary inputs 1+2 Binary input 2
N11 N12		Binary input 3 Binary input 3
Terminal block P		
P1 P2		Relay output 1, root Relay output 1, NO
P3 P4		Relay output 2, root Relay output 2, NO
P5 P6 P7		Relay output 3, NC Relay output 3, NO Relay output 3, root
P8 P9 P10		Binary input 1 Binary inputs 1+2 Binary input 2
P11 P12		Binary input 3 Binary input 3

Interference suppression capacitors at the relay contacts: ceramic, 4.7 nF, 250 V

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Terminals for supply voltage (H), binary inputs; and relay outputs (N, P) on the terminal side:

Conductor cross-section, rigid max.	2.5 mm² (AWG 14)
Conductor cross-section with ferrule	1.5 mm² (AWG 16)
Tightening torque	0.4 Nm to 0.5 Nm (3.5 in-lb to 4.5 in-lb)

Communication Interfaces

RS485 interface (J) on the terminal side:	RS485 cable with plug connector
820 nm fiber-optic interface (J) on the terminal side:	Fiber-optic cable with prepared ST plug (for example 6XV8100)

DANGER

Danger due 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 top:	Patch cable, crossover cable, or a Y cable, when using the internal Ethernet switches

4.4 System Requirements

To operate SICAM I/O 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

4.5 Access Rights

Access Rights for Configuration and Maintenance

Access rights are controlled by setting up passwords during the device configuration. For this purpose, you have to assign an activation password and a maintenance password. The setting up of passwords is described in chapter 6.3.3.9.

If parameter changes are to be activated in the device, the activation password is required. If changes are to be made in the device via the maintenance tab, the maintenance password is required.

NOTE

If you do not set up new passwords, the passwords automatically implemented by default (see chapter 6.3.3.9) will be valid.

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Access Rights for Communication

Access rights for the communication via **Ethernet** with **Modbus TCP** protocol are controlled for port 502 and for the user port (default setting 10000), for the communication with the **Modbus UDP** protocol for default port 51000. For both protocols, you can either assign full access rights or read-only rights.

Access rights for the **serial communication** with **Modbus RTU** protocol are also controlled. You can either assign full access rights or read-only rights.

4.6   Meaning of the LEDs

SICAM I/O Unit automatically monitors the functions of its hardware and software components. The LEDs on the top side of the housing indicate the current device status.
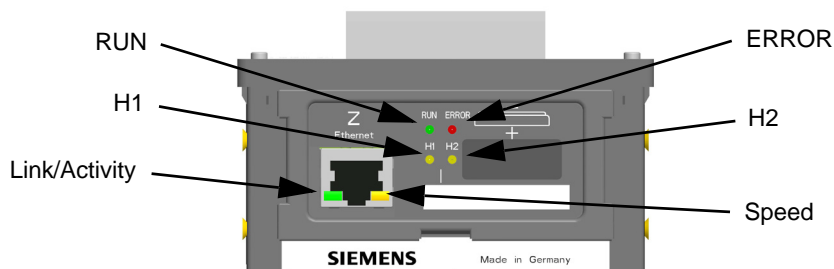
Figure 4-4   Designation of the LEDs

Depending on the status, the LEDs can be permanently on, flash or off. The states are described in chapter 10.3. The meaning of the LEDs during normal operation is explained in the following table:

Table 4-2   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
Link/Activity	LED on: Ethernet link is up LED flashing: Ethernet link is up and data are transferred LED off: no Ethernet devices connected
Speed	LED on: 100 Mbit/s LED off: 10 Mbit/s

4.7 Commissioning

4.7.1 Initial and Current Commissioning

DANGER

Hazard posed by high contact voltage.

Non-observance leads to death or serious injury.

✧ Only trained personnel (see Preface), who is familiar with the safety requirements and precautions and observes them can carry out the work.

✧ If there is any dangerous voltage present, work may <u>never</u> be carried out.

✧ De-energize the device.

✧ For disconnecting the voltage and current, a suitable separator is connected in series to de-energize 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

Only wire the terminals that are necessary for this purpose.

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 label and the technical data of the device (see chapter 11.1). This applies in particular to the supply voltage.

✧ On the side of the terminal of the device, connect the transmission lines to the terminal blocks N and P.

✧ Connect the lines, for example for systems control, on connection J (RS485 or serial FO interface) on the side of the terminals of the device.

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

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

✧ Switch on the connected peripheral devices (for example PC).

✧ Switch on the supply voltage of the device.

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.

> **NOTE**
>
> The operation requires JavaScript. If JavaScript is not yet enabled, activate it as described in chapter 6.2.2.

The device is designed for continuous operation.

If you want to change the interfacing on the device, for example by wiring terminals that have so far not been used, please observe the above mentioned safety instructions.

4.7.2 Starting the Device with the Default IP Address

SICAM I/O Unit has the following internal default IP address **192.168.0.55** and default subnet mask **255.255.255.0**.

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 device front for at least 3 s.

IP-Addr. push-button for default IP address

Default IP Address : 192.168.0.55
Default Subnet Mask : 255.255.255.0
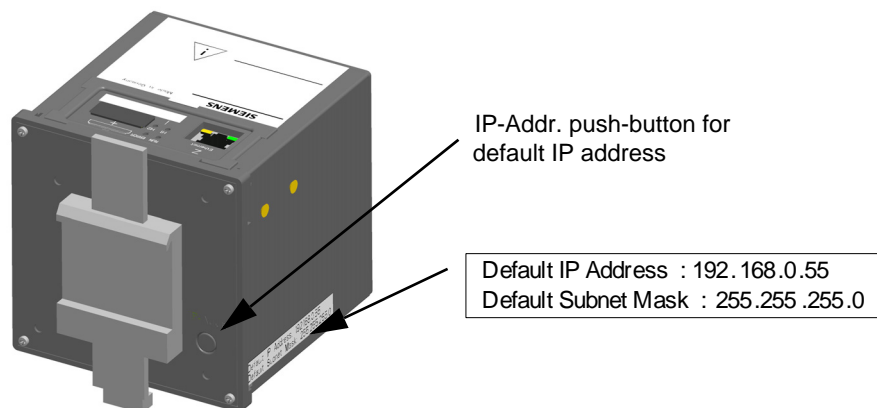
Figure 4-5   Location of the Push-button for Activating the Default IP Address

When you press the IP-Addr. push-button, SICAM I/O 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**
>
> Changing 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 chapter 10.3).
> In this case, the parameterized IP address and the default IP address are displayed on the **Information** tab, **Device information** item (see chapter 6.2.5.1).
>
> When the device has started with the default IP address, the factory-set default passwords are also active (see chapter 6.3.3.9).

4.8   SICAM I/O Mapping Tool Installation

The SICAM I/O Mapping Tool is used for implementing the IEC 61850 GOOSE Subscriber configuration (see section **Configuration Using DIGSI 4**). When the configuration has been completed, the thus generated SCD file can be loaded into the SICAM I/O Mapping Tool, and a binary IEC 61850 parameter set can be created (proprietary format). The result can then be uploaded via the HTML page.

Perform the following steps for installing the SICAM I/O Mapping Tool:

✧   Insert the supplied CD-ROM in the drive of your PC.

✧   Execute the **Setup_SicamIO_7XV5673.msi** file on the supplied CD-ROM.
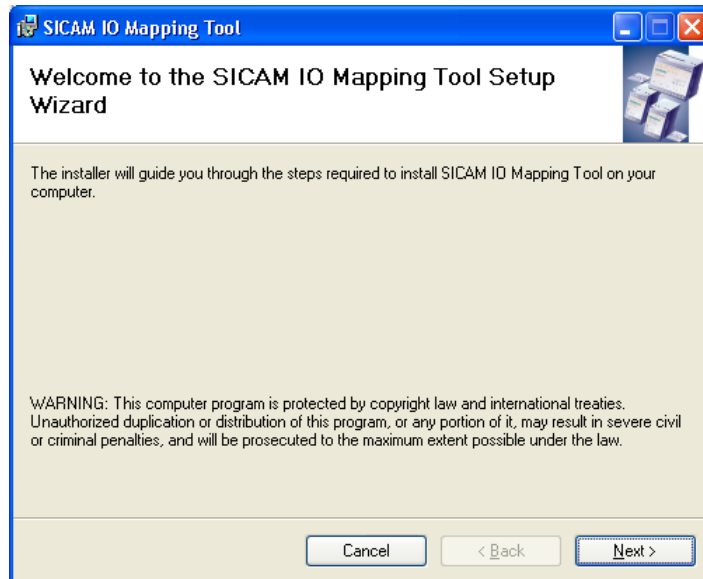
Figure 4-6   Setup Wizard

✧   Click the **Next** button.

✧   Select a folder in which the program is to be stored, and specify whether the installation is to be made just for you or also for other users.
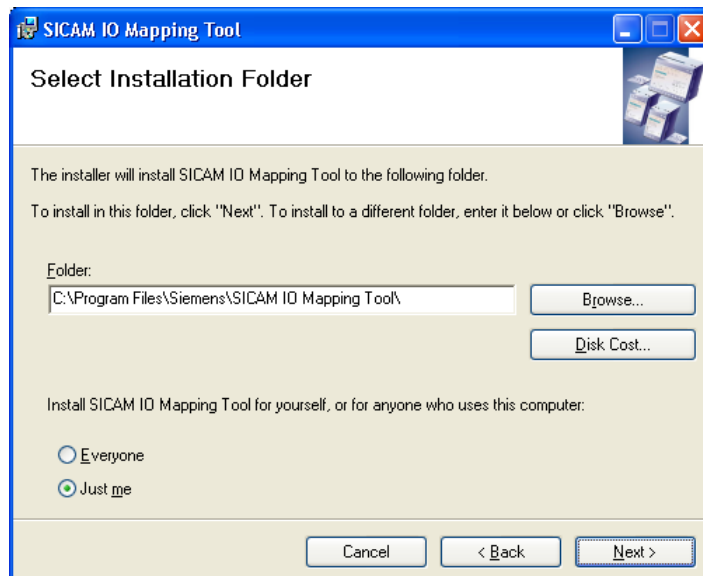
Figure 4-7   Select Installation Folder

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                                                                                                                    E50417-H1040-C484-A3, Edition 05.2012

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✧ Click the **Next** button in this and also in the subsequent window.
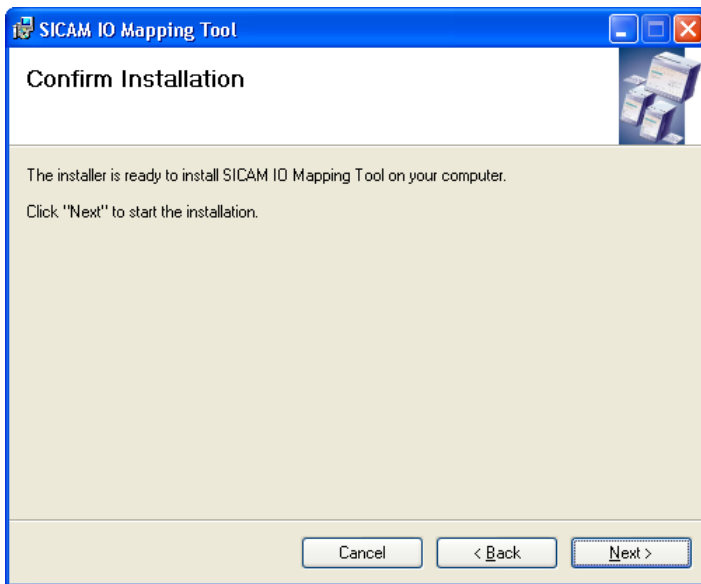
Figure 4-8   Confirm Installation

✧ When the program has been installed successfully, click the **Close** button to exit the installation.
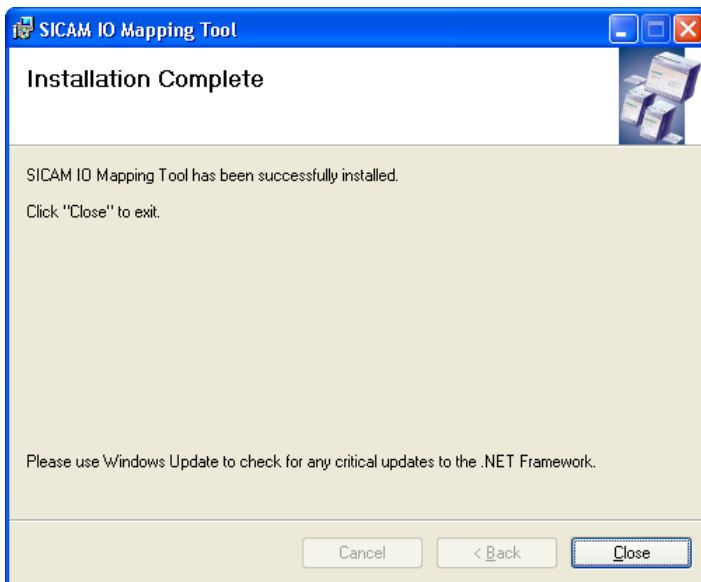
Figure 4-9   Installation Complete

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5 Applications

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5.1 Basic Applications

5.1.1 I/O Mirror

When using the SICAM I/O Units as I/O mirror according to Figure 5-1, the devices transmits the binary signals bi-directional. The transmission takes place between a server and a client.
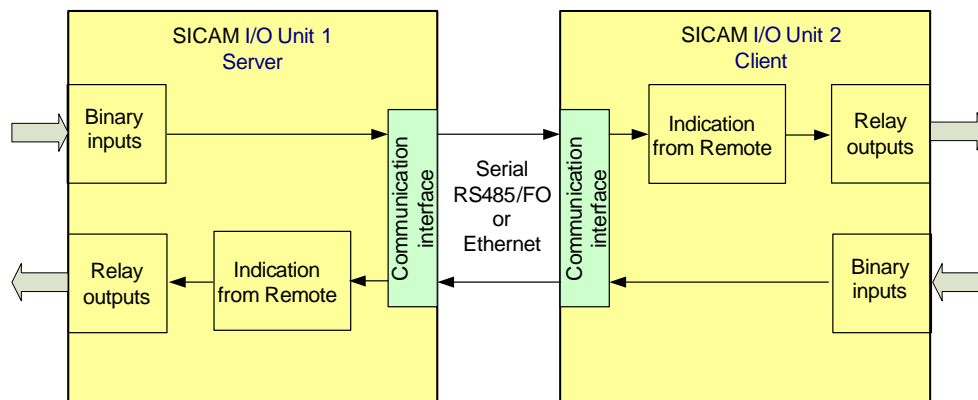
Figure 5-1   I/O Mirror, Bidirectional Transmission between Server and Client

I/O Mirror Server – Client

The binary signals get from the binary inputs of the SICAM I/O Unit 1 (server) to the parameterized communication interface (FO, electrical RS485, or Ethernet). The converted signal is transmitted from the connected lines to the SICAM I/O Unit 2 (client).

The signal is lead to the relay module via the communication interface of the client. Depending on the parameterization, the relay contacts control the relay outputs. Therefore the parameterized indications correspond to the switching states of the relays.

Via the relay contacts, voltages up to AC/DC 250 V and currents up to AC/DC 5 A can be switched.

I/O Mirror Client – Server

The transmission of the binary signals is performed from the SICAM I/O Unit 2 (client) to the SICAM I/O Unit 1 (server) in the same way as from server to client. From the user view, a simultaneous transmission of the binary states takes place in both directions via a sure communication protocol via the respective connection between the devices.

Extension of the transmission route

An extension of the transmission route for the binary signal transmission is possible. The following devices may be used for example:

• Optical Repeater 7XV5461
• RS485-FO Converter 7XV5650
• Communication Converter 7XV5662 (KU-KU, X.21/G.703.1, G.703.6).

> **NOTE**
>
> Please note additional time delays of devices (see their documentation) within the transmission route.

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5.1.2 Unidirectional Binary Signal Transmission

When using the SICAM I/O Units for unidirectional binary signal transmission according to Figure 5-2, the devices transfer binary signals unidirectional from one client to several servers. Their number depends on the network topology. In this application, the transmission only takes place in one direction. The device has to be set to this mode.
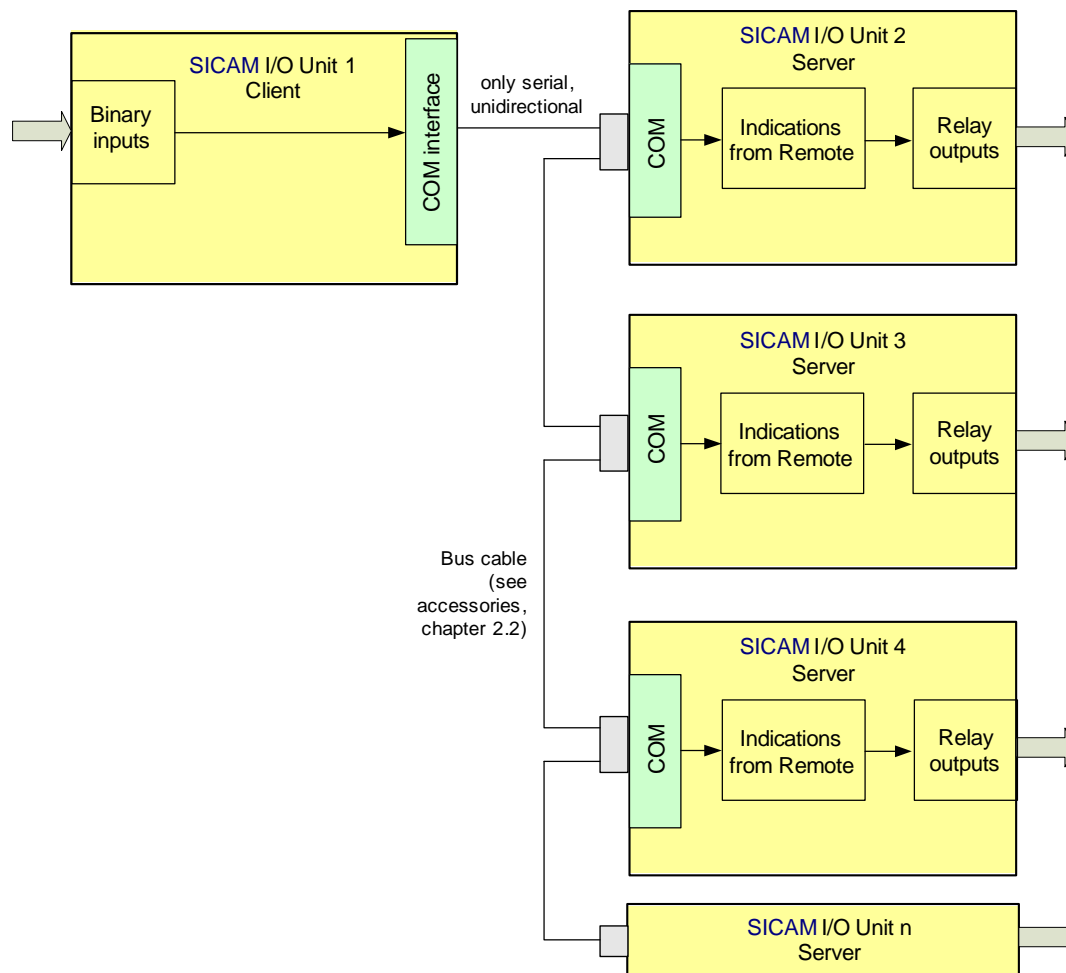
Figure 5-2   I/O Mirror, Unidirectional Transmission between Client and Servers

The binary signals get from the binary inputs of the SICAM I/O Unit 1 (client) to the parameterized serial communication interface (FO or electric RS485). The converted signal is transmitted from the connected lines to the SICAM I/O Units 2 to n (server) simultaneous.

The signal is transmitted to the relay modules via the serial communication interfaces of the SICAM I/O Units 2 to n (server). Depending on the parameterization, the relay contacts control the relay outputs. Therefore the parameterized indications correspond to the switching status of the relays.

If using n devices, up to n × 6 relay outputs can be used.

> **NOTE**
>
> A star coupler is required for serial optical transmission. Also compare Figure 5-8 with optical repeaters.

5.1.3 I/O Expansion for the Connection to Systems Control, a Central Controller, or a Protection Device (Electric)

If SICAM I/O Units are used as I/O expansion, according to Figure 5-3, binary signals are exchanged between a device (systems control with Modbus TCP/UDP) and the devices connected to the SICAM I/O Units.

In this application, the SICAM I/O Unit can also be used by systems control across a larger distance (remote I/O connection). In this case, transmission takes place, for example via a long-range Ethernet connection (for example LAN). Usable cables see chapter 2.2, section Accessories. Examples for remote transmission see chapter 5.2.
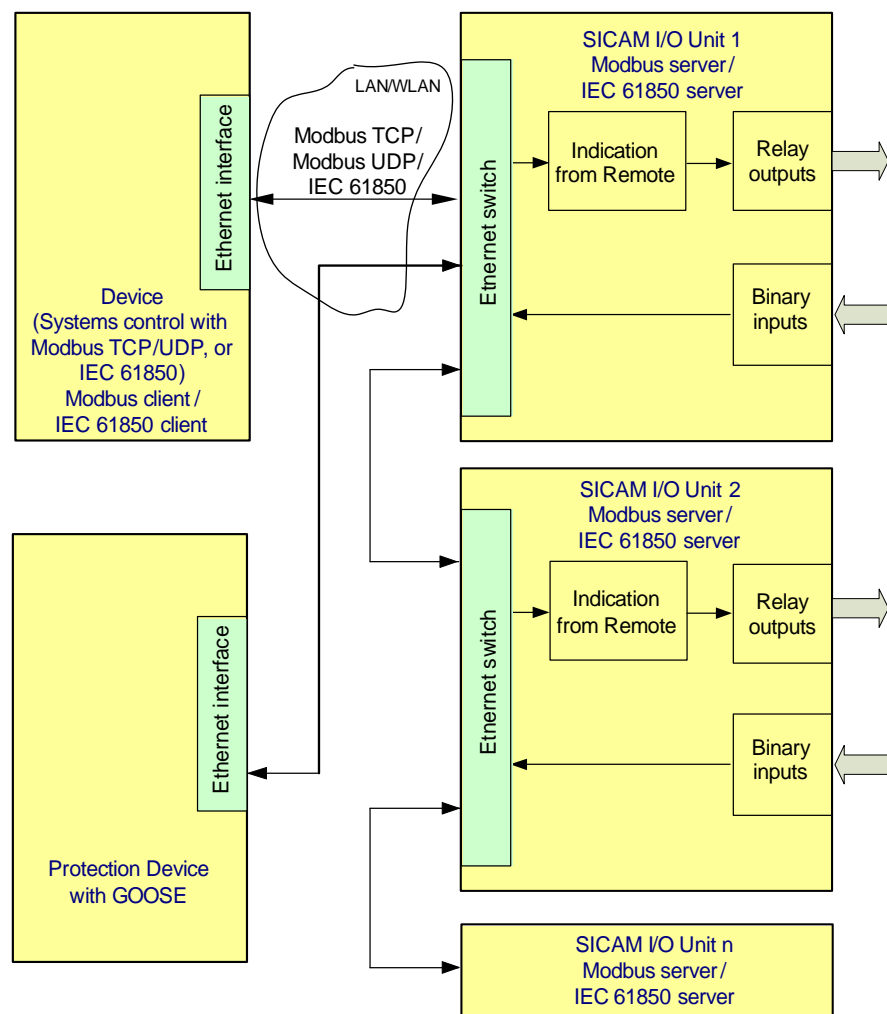
Figure 5-3   I/O Expansion for the Connection to Systems Control, Using Integrated Switch

NOTE

In this application, the SICAM I/O Unit can only be operated in multipoint-partyline configuration. Operation in multipoint-ring configuration is not possible.

Transmission Modbus TCP/UDP Client or IEC 61850 Client − Server

The binary signals transmit from the Ethernet interface of a device (Modbus client) to the Ethernet interface of the SICAM I/O Unit 1 (Modbus server). Modbus TCP, Modbus UDP, or IEC 61850 is used as communication protocol.

The signal for the relay module is being transmitted to the SICAM I/O Unit 1. Depending on the parameterization, the relay contacts control the relay outputs. Therefore the parameterized indications correspond to the switching states of the relays.

The SICAM I/O Unit 2 can be connected via the Ethernet switch to the SICAM I/O Unit 1. If using several SICAM I/O Units, n × 6 binary inputs and n × 6 relay outputs can be used. If the integrated switch in the SICAM I/O Unit is not used, the device can also be connected to systems control by using an external switch. Additional hardware is required for this purpose. This may be necessary in the case of redundant operation.

Transmission Modbus Server − Modbus Client (valid only at use of internal switches)

The transmission of binary signals from the SICAM I/O Units to the device also takes place via the integrated Ethernet switch in the SICAM I/O Unit.

> **NOTE**
>
> The I/O expansion application can also be electric via serial communication (for example RS485 Bus System 7XV5103) or FO (for example Star Coupler 7XV5450) with Modbus RTU protocol.

5.1.4 I/O Expansion for the Connection to Systems Control or a Central Controller (Optical)

If the SICAM I/O Units are used as I/O expansion, binary signals are exchanged between a device (systems control with Modbus RTU) and the devices connected to the SICAM I/O Units. In case of cascading, up to 3 SICAM I/O Units can be connected to each mini star coupler 7XV5450 via fiber-optic cables (see Figure 5-4). Without cascading, up to 4 SICAM I/O Units can be connected to a mini star coupler.
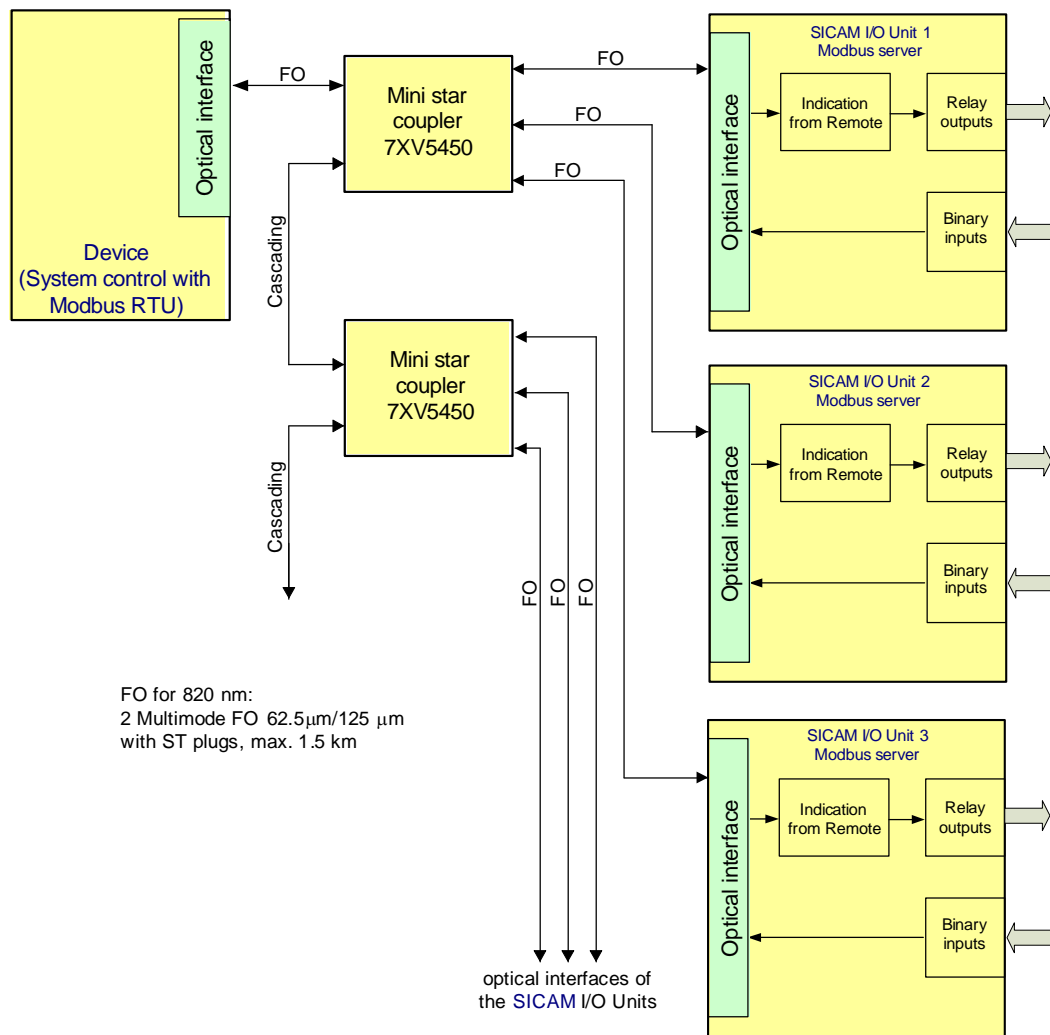
Figure 5-4   I/O Expansion for the Connection to Systems Control, Using Mini Star Couplers

5.1.5　Contact Multiplier

The application of the SICAM I/O Unit as contact multiplier according to Figure 5-5 is for example used for the multiplication of signals on one or several binary inputs (BI1 to BI3) for additional contacts. In the case of longer supply lines, the pickup value of the threshold value voltage can be parameterized to increase the signal-to-noise ratio for binary inputs (dependent on the adjusted binary input voltage).

Input signals on terminal block N can be either parameterized on relay outputs on terminal block N or on terminal block P. The same is the case for inputs signals on terminal block P.
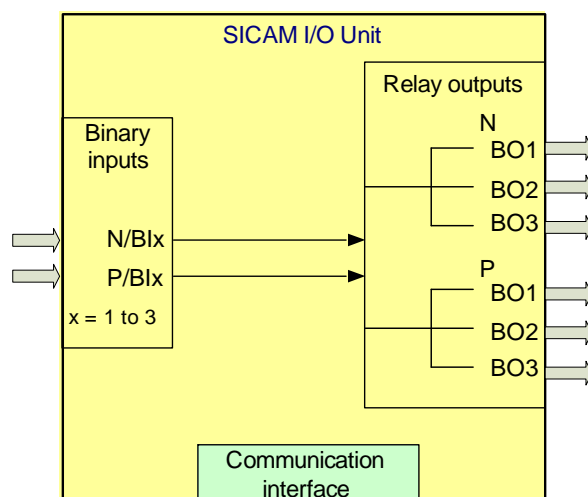
Figure 5-5　　Contact Multiplier

1 Binary Signal on up to 6 Relay Outputs

The binary signal gets to the relay module via the selected binary input of the SICAM I/O Unit. Depending on parameterization, the relay contacts are controlled simultaneously and parallel by up to 6 relay outputs. This allows, for example, an indication to be output to up to 6 different users simultaneously.

Several Binary Signals on Relay Outputs

Several binary signals get to the relay module via the selected binary inputs of the SICAM I/O Unit. Depending on parameterization, they are assigned simultaneously and parallel to the parameterized relay outputs.

5.2 Applications for Remote Transmission of Binary Signals

5.2.1 Binary Signal Transmission via Synchronous Leased Line with G703.1/X.21 Connection
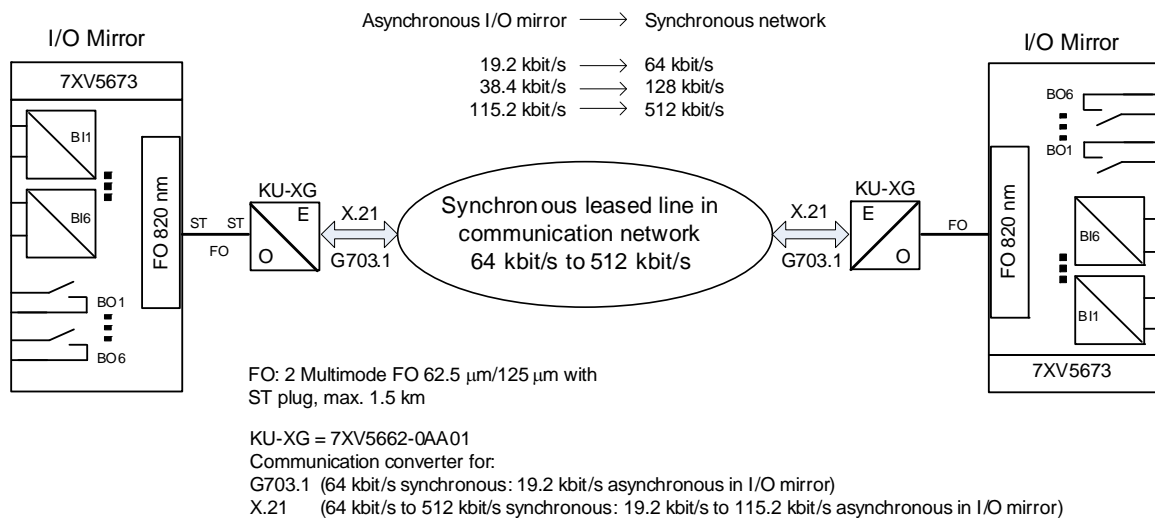
Figure 5-6   Binary Signal Transmission via Synchronous Leased Line with G703.1/X.21 Connection

The application shows the optical connection of an I/O mirror to a communication converter (KU-XG) 7XV5662-0AA01, which establishes a connection to a multiplexer with G703.1 interface (64 kbit/s) or X.21 interface (64 kbit/s up to 512 kbit/s).

Transmission between the binary signal transmission with the KU-XG takes place interference-free via 62.5 μm/125 μm multimode fiber optic cable. The fiber-optic cables are prepared with ST plugs. The electric G703.1 or X.21 connection to multiplexer takes place via short distances.

KU-XG has a wide-range power supply unit DC 24 V up to 250 V and AC 115 V/AC 230 V.

The asynchronous baud rate of the binary signal transmission depends on the available synchronous band width of the transmission route. This also essentially influences transmission time.

A maximum of 6 binary single signals can be transmitted bidirectionally.

5.2.2   Binary Signal Transmission via Two-Wire Copper Cable with Blocking
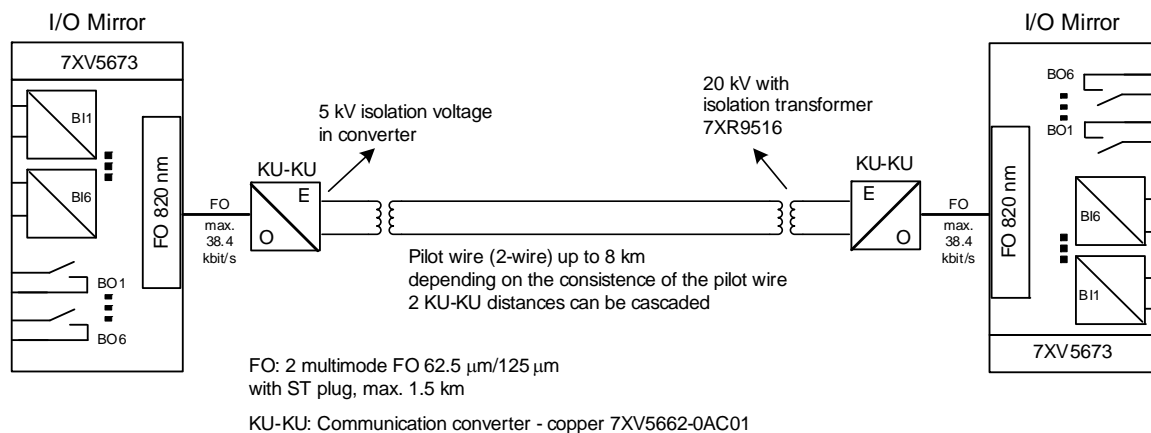
Figure 5-7   Binary Signal Transmission of 6 Signals via Two-Wire Copper Cable with Blocking

The application shows the optical connection of an I/O mirror to a communication converter 7XV5662-0AC01 (KU-KU) for transmission via copper cable, which establishes a connection to a two-wire copper cable (for example telephone cable). 5-kV blocking is integrated in KU-KU. An additional blocking transformer makes 20 kV possible.

Transmission between the binary signal transmission and KU-KU takes place interference-free via 62.5 μm/ 125 μm multimode fiber optic cables. The fiber-optic cables are prepared with ST plugs.

KU-KU has a wide-range power supply unit of DC 24 V up to 250 V and AC 115 V/AC 230 V.

The asynchronous baud rate of max. 38.4 kbit/s of the binary signal transmission depends on the available synchronous bandwidth of the transmission route which is 128 kbit/s. For larger distances, 2 KU-KU distances can be cascaded.

Further information can be found in the manual for the device 7XV5662-0AC01. A maximum of 6 binary single signals can be transmitted bidirectionally.

A typical application is the directional comparison of a **directional overcurrent protection** via economical pilot wires, where the **definite time-overcurrent protection** is connected to the binary signal transmission via contact and binary input.

5.2.3 Binary Signal Transmission Across Large Distances via Optical Fiber
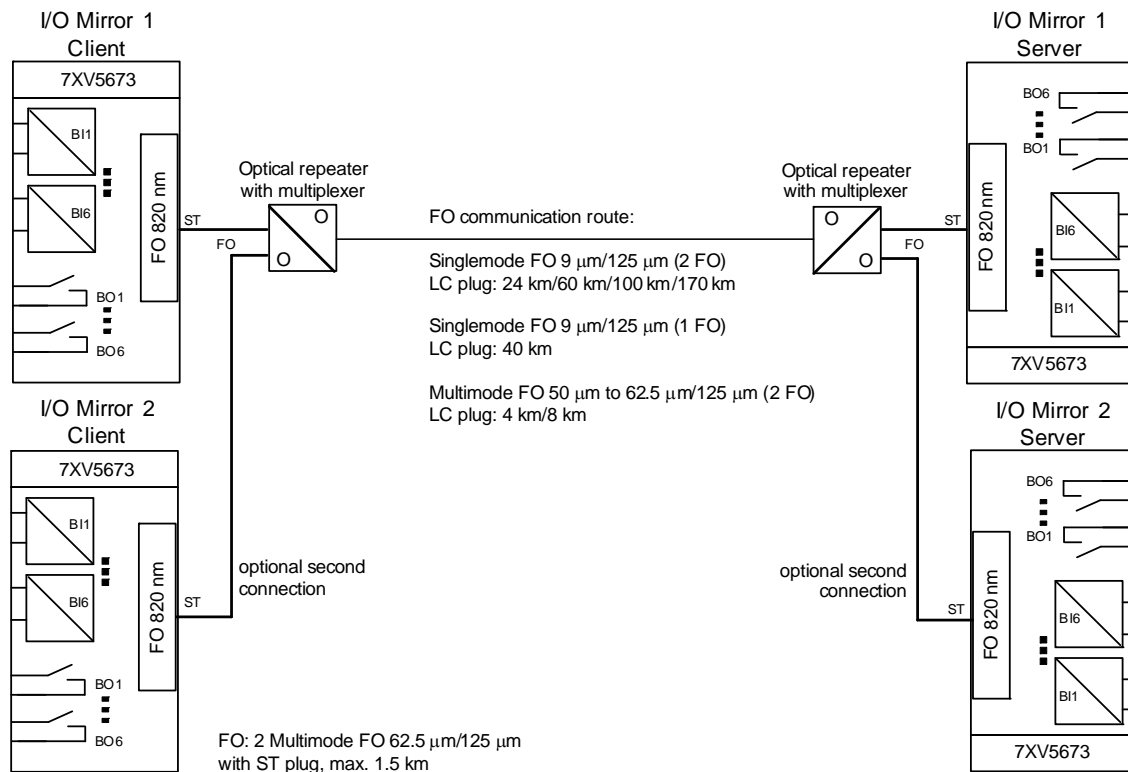
Figure 5-8   Binary Signal Transmission of a Maximum of 12 Signals Across Large Distances via Optical Fiber by Amplification with Optical Repeater

The application shows the optical connection of an I/O mirror to a serial optical repeater 7XV5461-0Bx00. It establishes a connection to an optical wide area distance, consisting of 1 or 2 optical fibers. The optical repeater multiplexes or demultiplexes synchronous or asynchronous serial signals of up to 2 optical inputs on an optical fiber remote connection. More information on this matter can be found in the manual of the device 7XV5461.

The optical connection on the remote-side is via LC plugs.

Transmission between the binary signal transmission and repeater takes place interference-free via 62.5 μm/125 μm multimode fiber-optic cables. The optical cables are prepared with ST plugs.

The binary signals of the I/O mirror 1 client will transfer only to the I/O mirror 1 server. The binary signals of the I/O mirror 2 client will as well transfer only to the I/O mirror 2 server.

The repeater has a wide-range power supply unit of DC 24 V up to 250 V and AC 115 V/AC 230 V.

The asynchronous baud rate in the binary signal transmission can be set to 57.6 kbit/s. The repeater has 2 optical 820-nm inputs so that a maximum of 2 binary signal transmissions can be connected. A maximum of 12 binary signals can be exchanged via wide optical fiber connections, for example **permissive overreaching transfer trip protection of the distance protection**. Additionally, for evaluation purposes, the locations of the remote circuit-breakers and separators can be transmitted in the local device. This makes the realization of smart grid applications across large distances possible in order to exchange interference-free binary signals.

5.2.4 Binary Signal Transmission via Synchronous Leased Line with G703.6 Connection
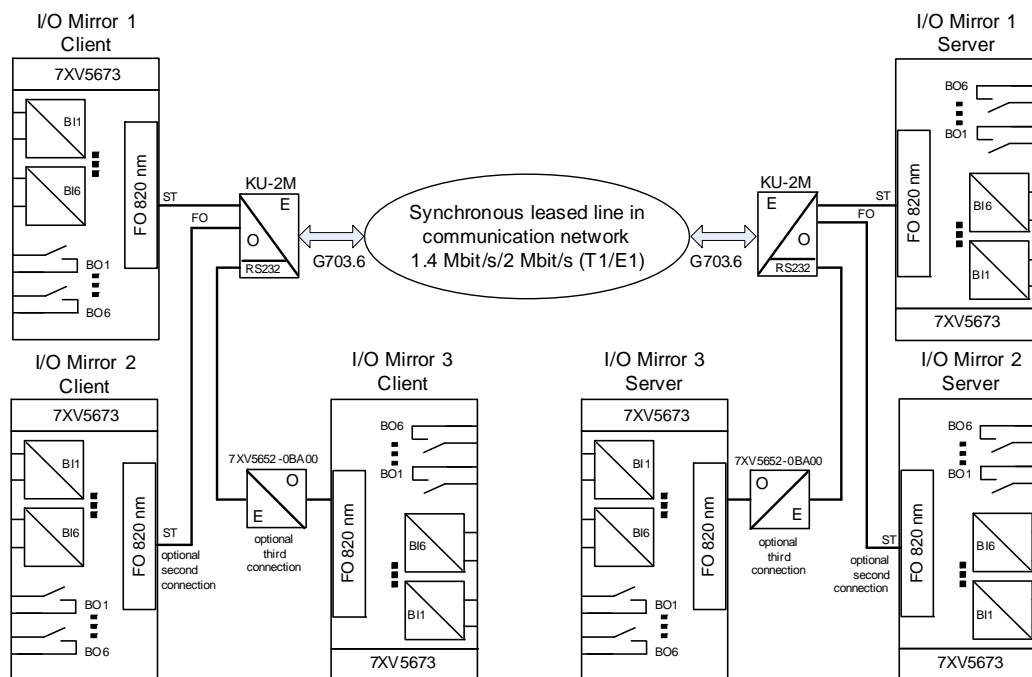
FO: 2 Multimode FO 62.5 μm/125 μm with
ST plug, max. 1.5 km

KU-2M = 7XV5662-0AD00
Communication converter for:
G703.6 (2 Mbit/s synchronous: 115.2 kbit/s asynchronous in I/O mirror)

Figure 5-9   Binary Signal Transmission via Synchronous Leased Line with G703.6 Connection; Optical Connection for 2 Binary Signal Transmissions and RS232 Connection for 1 Binary Signal Transmission

The application shows the optical connection of an I/O mirror to a communication converter (KU-2M) 7XV5662-0AD00, which establishes a connection to a multiplexer with G703.6 interface (1.44 kbit/s/2 Mbit/s, T1/ E1). The KU-2M multiplexes and demultiplexes synchronous or asynchronous serial signals on up to 3 inputs on a 2 Mbit/s remote connection.

Transmission between binary signal transmission and KU-2M takes place interference-free via 62.5 μm/ 125 μm multimode optical fiber. The fiber-optic cables are prepared with ST plugs. Additionally, the KU-2M is provided with an electrical RS232 interface. On this interface, an additional binary signal transmission with a max. of 115.2 kbit/s can be connected via an optoelectronic converter. This ensures that 18 binary signals can be exchanged bidirectional via a G703.6 connection. The electric G703.6 connection to a multiplexer is performed via short distances.

KU-2M has a wide-range power supply unit of DC 24 V up to 250 V and AC 115 V/AC 230 V.

The asynchronous baud rate in the binary signal transmission can be set to 115.2 kbit/s.

The KU-2M has 2 optical input interfaces. This makes it possible to transmit a maximum of 12 individual signals. In addition, the device also has a RS232 interface. Via a RS232/optical converter 7XV5652-0BA00, a binary signal transmission can be additionally connected. The distance between converter and KU-2M must not exceed 3 m, since it is a serial electrical RS232 connection (you should preferably use visual interfaces). Using all input interfaces (2 FO, 1 RS232) of the KU-2M, a maximum of 18 individual signals can be exchanged bidirectionally.

Siemens recommends the 7XV5100-4 cable (DIGSI cable) with gender changer (9 pin male/male) as RS232 - KU-2M connecting cable.

5.2.5 Binary Signal Transmission via Optical Fiber or Wireless Connection
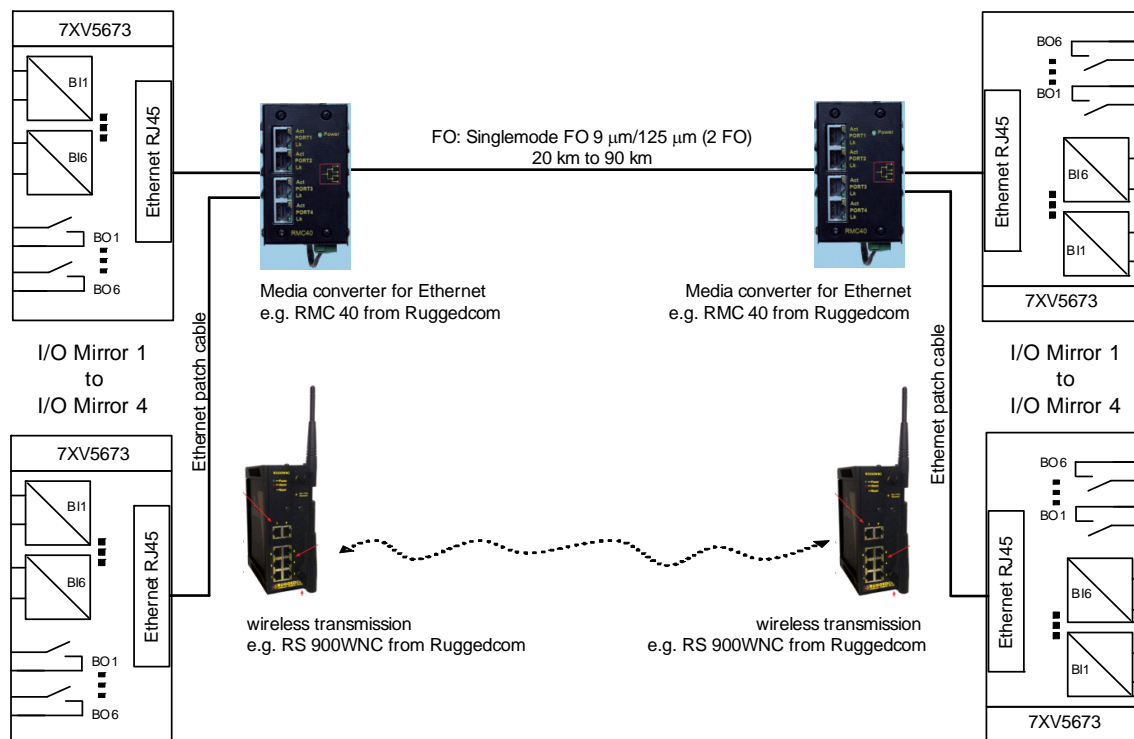
Figure 5-10   Binary Signal Transmission via Optical Fibers or Wireless Connection; Connection via the Integrated Ethernet Interface to External Transmission Devices

The application shows the electric connection of an I/O mirror to Ethernet-based transmission devices via patch cable, which establish a connection via optical on the remote side or a wireless connection. The connection could also be realized via switches with long-distance modules or via IP networks.

If using a media converter by Ruggedcom for Ethernet RSM 40, 4 binary signal transmissions can be connected via Ethernet. This ensures that a maximum of 24 binary individual signals can be exchanged bidirectional via optical connection. For direct optical connections, this is an alternative to the serial configuration in Figure 5-8.

Since client and server communicate with each other via IP addresses, any IP networks can be used, using the Modbus UDP protocol. When connecting via routed network components, the ports for the protocol have to be released. An encryption of the data on unsecured IP networks has to be performed via external devices.

6 Operation

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6.1 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 GUI, 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 6-1   Control functions

Control Element	Control Function
○ no ● yes	Option button: selects one option
▼	List box: selects an item from a list
Send	Button: a click on the button executes an action
Configure	Active tab (light blue)
Value View	Inactive tab (dark blue)
🖑	Selects and opens the item to be activated, for example a tab
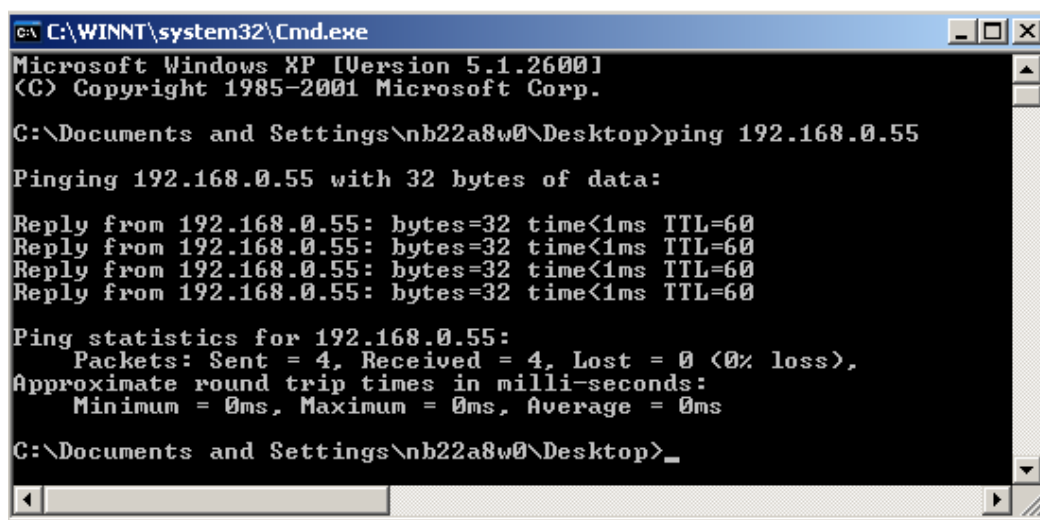
6.2 Start and Design of the User Interface

6.2.1 Initial Start of the User Interface

Requirements

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

✧ Assemble the SICAM I/O Unit as described in chapter 4.2.

✧ Observe the safety requirements when connecting the binary inputs and the relay outputs as well as the supply voltage and the communication lines (patch cable or crossover cable) according to chapter 4.3.

✧ Switch on the necessary devices.

✧ Switch on the supply voltage of the SICAM I/O Unit ein.

✧ Check whether the LEDs at the SICAM I/O Unit indicate that the device is ready (see chapter 10.3).

✧ 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:


```
C:\WINNT\system32\Cmd.exe

Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\nb22a8w0\Desktop>ping 192.168.0.55

Pinging 192.168.0.55 with 32 bytes of data:

Reply from 192.168.0.55: bytes=32 time<1ms TTL=60
Reply from 192.168.0.55: bytes=32 time<1ms TTL=60
Reply from 192.168.0.55: bytes=32 time<1ms TTL=60
Reply from 192.168.0.55: bytes=32 time<1ms TTL=60

Ping statistics for 192.168.0.55:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Documents and Settings\nb22a8w0\Desktop>_
```

Figure 6-1 Ping Test

✧ Start Microsoft Internet Explorer.

✧ Enter the IP address in Microsoft Internet Explorer (for example default IP Address: 192.168.0.55) of the SICAM I/O Unit and press **Enter**.

The user interface opens with the **Information** tab → **Show device information** (see Figure 6-4).

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NOTE

When starting the device for the first time, a parameter set with factory settings is loaded. You can modify these settings during the parameterization (see chapter 6.3).

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 6.3.3.9.

NOTE

If the user interface does not open or the displayed user interface does not show the view depicted in Figure 6-3, JavaScript may be the cause. The operation of user interface requires JavaScript. You may have to activate JavaScript as described in chapter 6.2.2.

6.2.2 Enabling JavaScript

The operation of the SICAM I/O Unit 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.
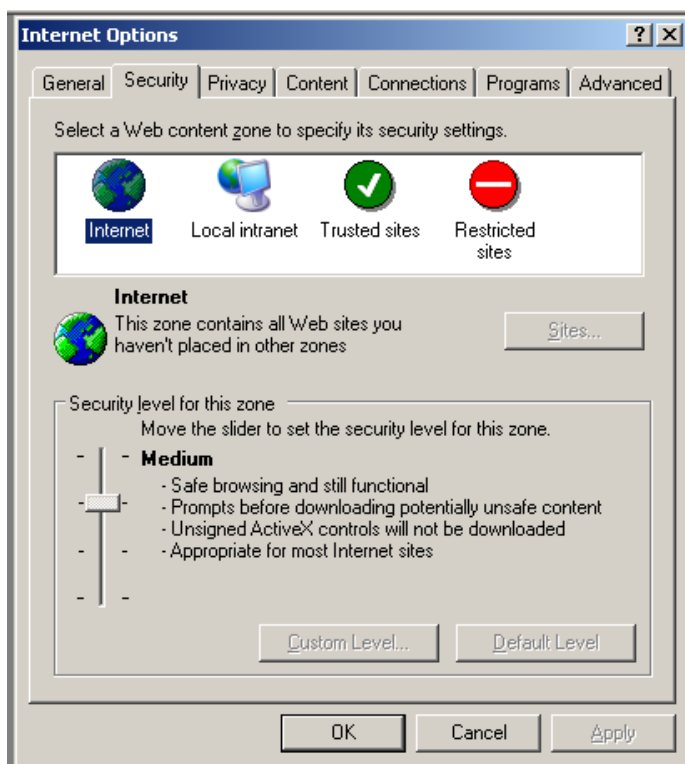
Figure 6-2   Enabling JavaScript

✧ 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.

6.2.3   Number of Connections via HTTP

3 users maximum can connect with the device via HTTP.

6.2.4 Layout of the User Interface

The user interface has the following layout:
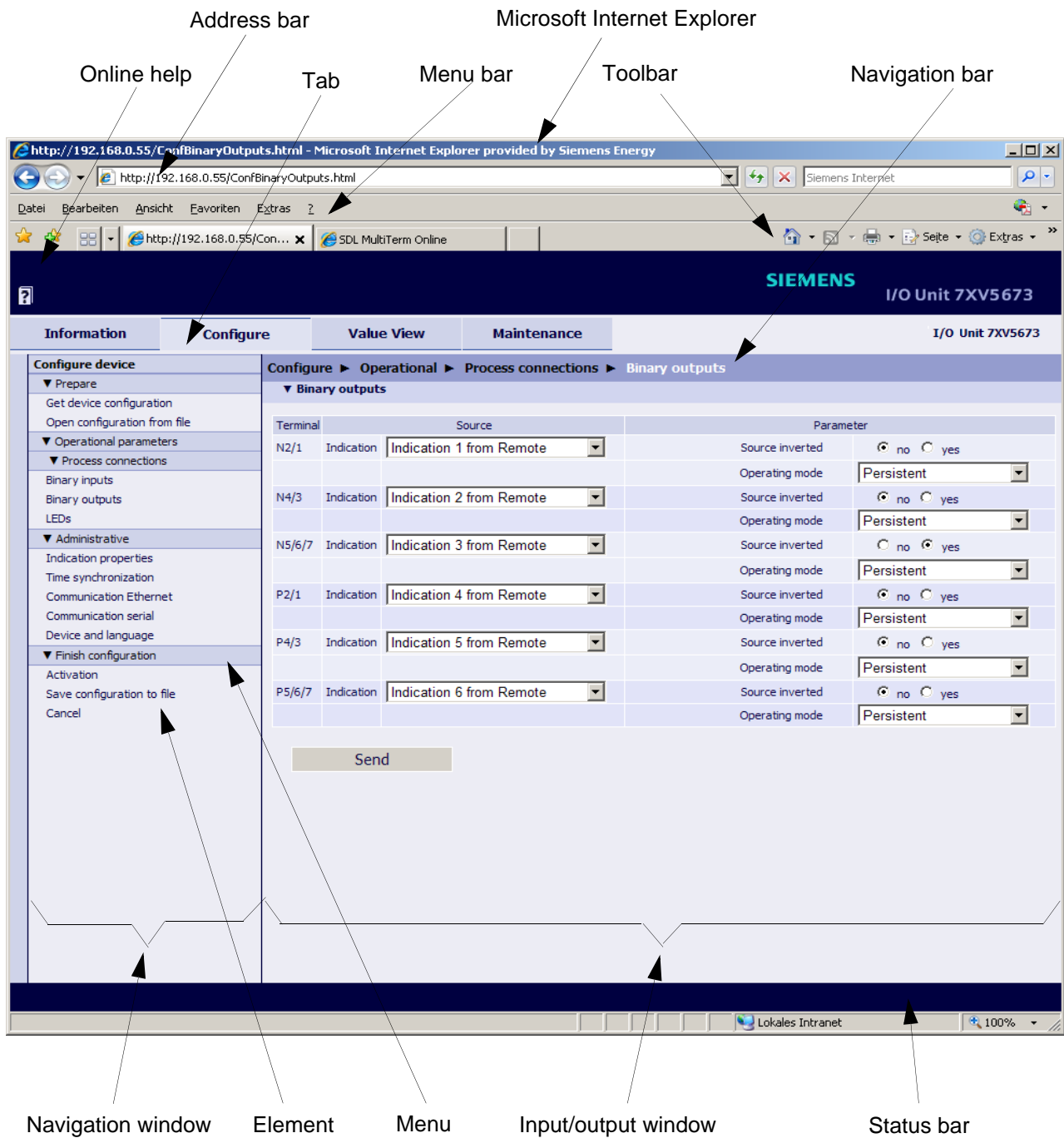
Figure 6-3   Designation in the User Interface

6.2.5 Starting the User Interface during Operation
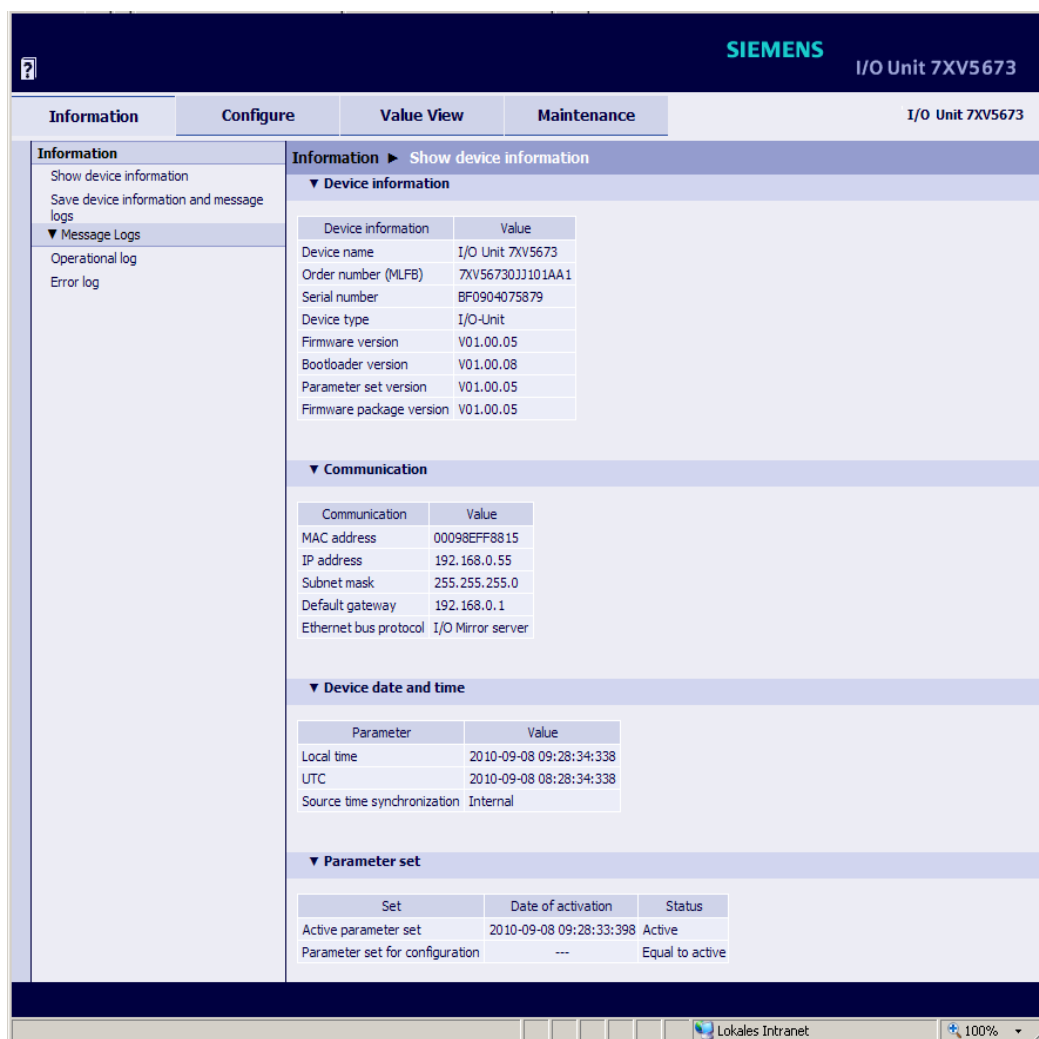
Starting the User Interface

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 the device. If the user interface does not open up on its own, press the **Enter** button.

The user interface opens with the **Information** tab → **Show device information** input/output window (see Figure 6-4).

Information Tab

Figure 6-4   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**.

6.2.5.1 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 6-4):

– **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 parameter set

6.2.5.2 Save Device Information and Message Logs

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

The **Save device information** input/output window opens.

Figure 6-5   Information Tab, Save Device Information Input/Output

Save Device Information and Logs as Text File

✧ Click the **Save .TXT** button

The **File Download** dialog opens.
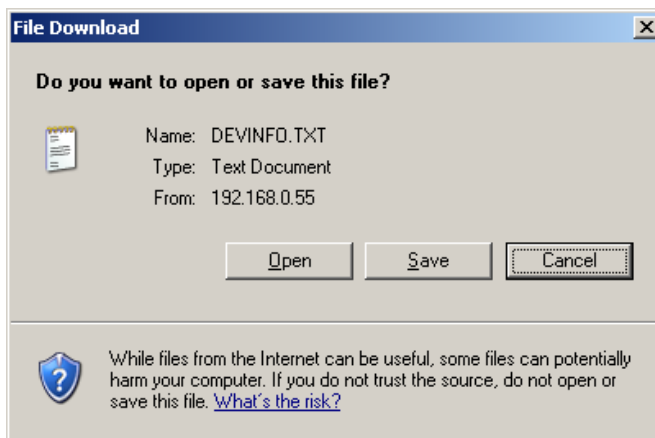
Figure 6-6   File Download Dialog, Save .TXT

File Download → Save

✧ Click the **Save** button.

The **Save As** dialog opens..
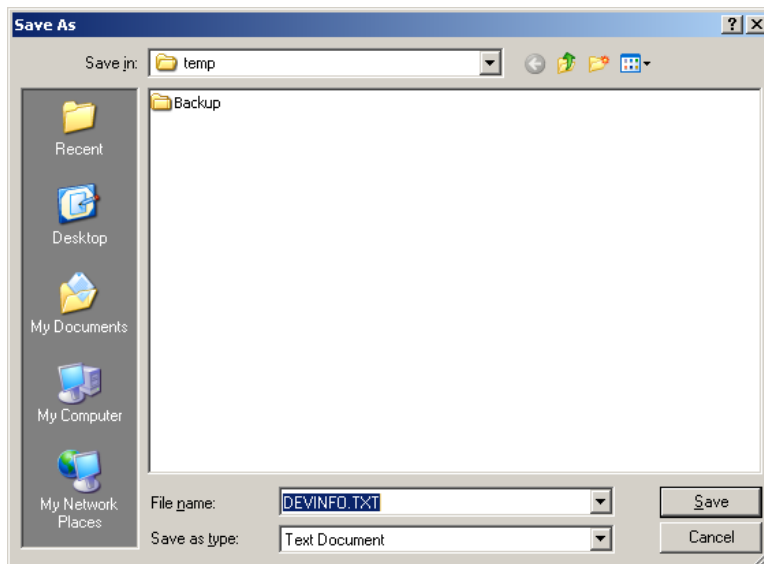
Figure 6-7   Save As Dialog

✧ 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
  .TXT.

✧ 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 logs on the screen and print them if needed. Proceed as
follows:

✧ In the **File Download** dialog (see Figure 6-6), click the **Open** button.

This action opens a text editor containing the DEVICE INFORMATION, the operational indications
(OPERATIONAL LOG) and the error messages (ERROR LOG).

✧ On the menu bar of the text editor, click **File → Print...**.

✧ Select the desired printer in the following **Print** dialog.

✧ Click the **Print** button.

The list is printed on the connected printer.

✧ Close the text editor.

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

Save Operational Log as CSV file

✧ Click the **Save .CSV** button

The **File Download** dialog opens..
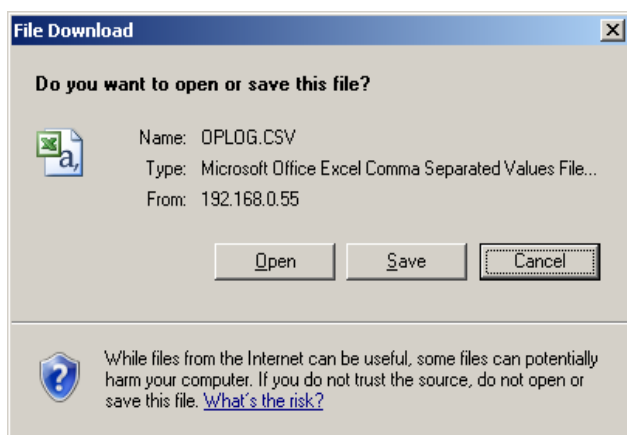
Figure 6-8   File Download Dialog, Save .CSV

File Download → Save

✧ Click the **Save** button.

The **Save As** dialog opens.

Figure 6-9   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
.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 logs on the screen and print them if needed. Proceed as follows:

✧ In the **File Download** dialog (see Figure 6-8), click the **Open** button.

The spreadsheet program (for example Excel) installed on the PC opens up and the operational logs (OPERATIONAL LOG) are shown in a table.

✧ On the menu bar of the spreadsheet program, click **File** → **Print...**.

✧ Select the desired printer in the following **Print** dialog.

✧ Click the **Print** button.

The list is printed on the connected printer.

✧ Close the spreadsheet program.

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

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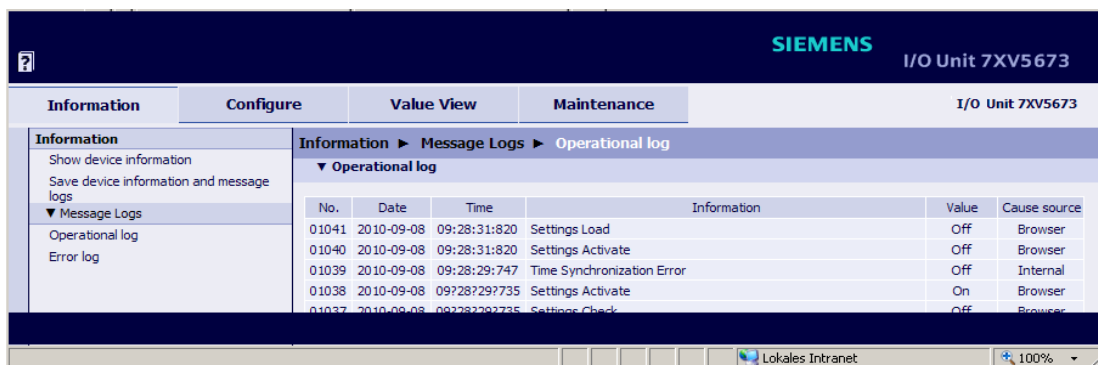
The **Message Logs** menu contains operational indications and error messages registered and saved by the device during operation. The device can save up to 128 operational indications and up to 128 error messages. When the storage capacity is exceeded, the oldest indications will be overwritten successively.

Operational Log

To show the operational indications, proceed as follows:

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

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

Figure 6-10   Information Tab, Operational Indications

‒ 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 (for example Internal, Browser)

NOTE

The operational indications can be printed as described in chapter 6.2.5.2.

The chapter 6.5.3.1 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:

Figure 6-11   Information Tab, Error Log

- Serial **No.**
- **Date** of registration
- **Time** of registration
- **Relative time** (referring to the start of operation, output in format h:min:s:ms)
- **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 6.2.5.2.

The chapter 6.5.3.2 explains how to delete the error messages manually.

6.3 Configuration of the Device

> **NOTE**
>
> For typical examples in the device parameterization, refer to chapter 6.6.

> **NOTE**
>
> The device contains two parameter sets. The parameter set currently used for device operations is the **active parameter set**. The inactive parameter set is called the **passive parameter set**.
>
> The following sections describe how to change and enable the passive parameter set.

6.3.1 Device Configuration Procedure

If you have not changed the parameter set since the first start of the device (see chapter 6.2.1), use the default settings. To change the settings of the parameter set, proceed as follows:

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

The **Configure** tab opens.
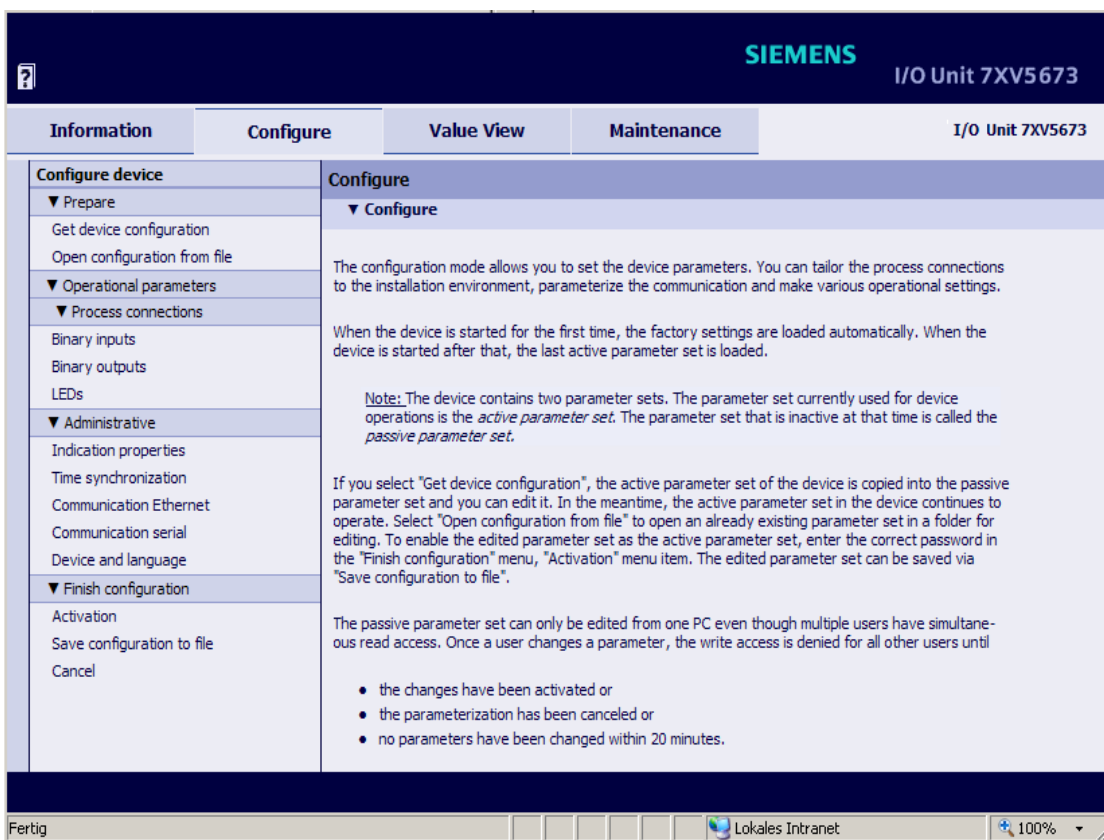
Figure 6-12   Configure Tab

✧ 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 <u>copy</u> of the active parameter set of the device is displayed on the screen. In the meantime, the active parameter set 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 parameter set that was already created and saved to a folder.

6.3.1.1 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:
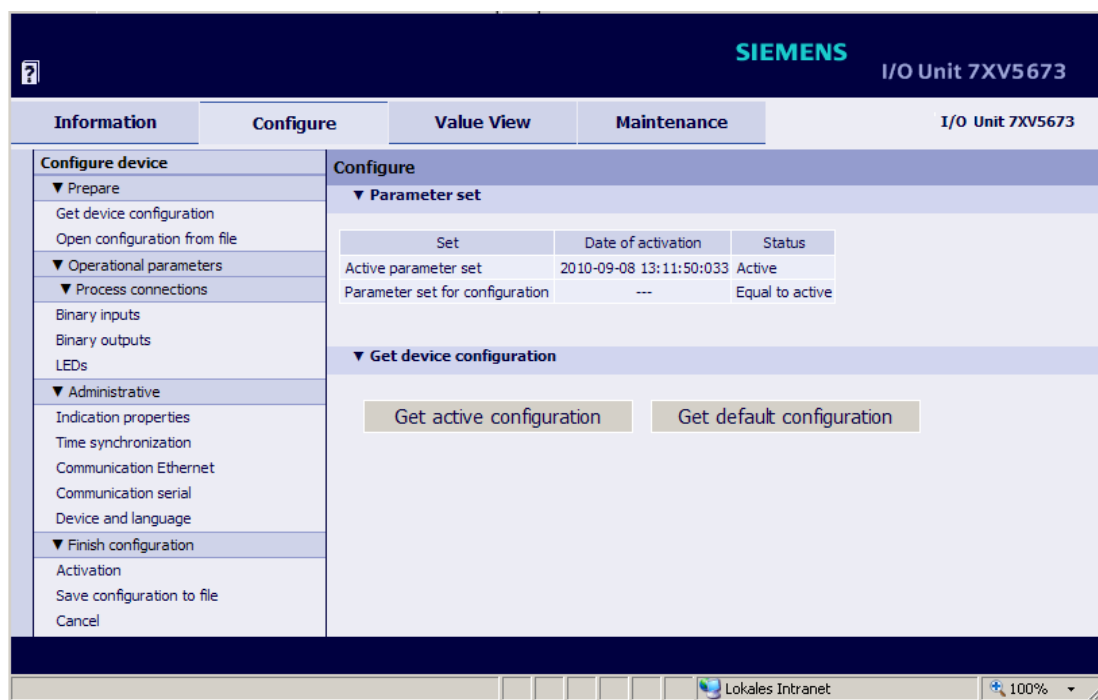
Figure 6-13   Configure Tab, Get Device Configuration

Get Active Configuration and Editing

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

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

✧ Check and if necessary change the set parameters by calling the desired **Operational parameters** and **Administrative** in the navigation window according to chapter 6.3.3.

✧ Activate the modified configuration as described in chapter 6.3.1.3.

Get Default Configuration and Editing

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

A <u>copy</u> of the factory settings (= passive parameter set) of the device is opened for editing.

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

✧ Activate the modified configuration as described in chapter 6.3.1.3.

6.3.1.2 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:
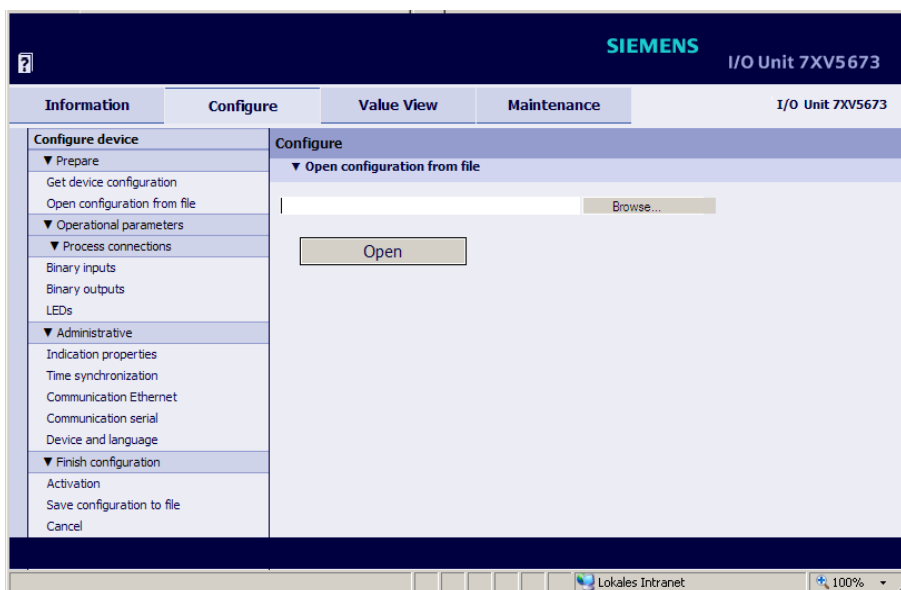
Figure 6-14   Configure Tab, Open Configuration from File

✧ Click the **Browse...** button.

The **Choose file** dialog opens.
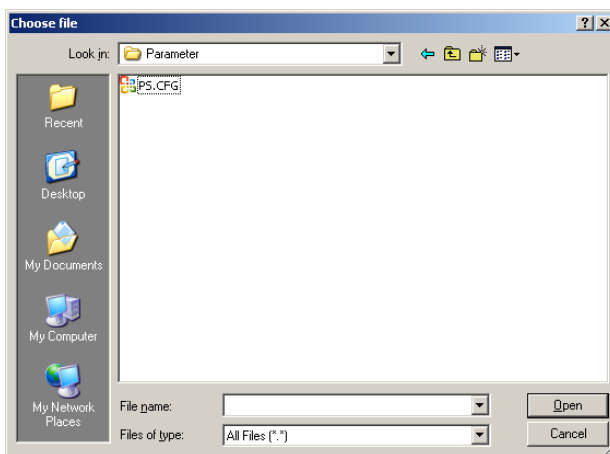
Figure 6-15   Choose File

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

✦ Click the **Open** button.

The selected path is inserted into the **Browse** field in the input/output window, see Figure 6-14.

✦ Click the **Open** button.

The device configuration from the CFG file is loaded.

6.3.1.3 Finish Configuration

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

Activating the Parameter Set

To activate the parameter set, proceed as follows:

✦ In the navigation window, click the **Finish configuration** menu and then the **Activation** item.

The **Activation** input/output window opens.
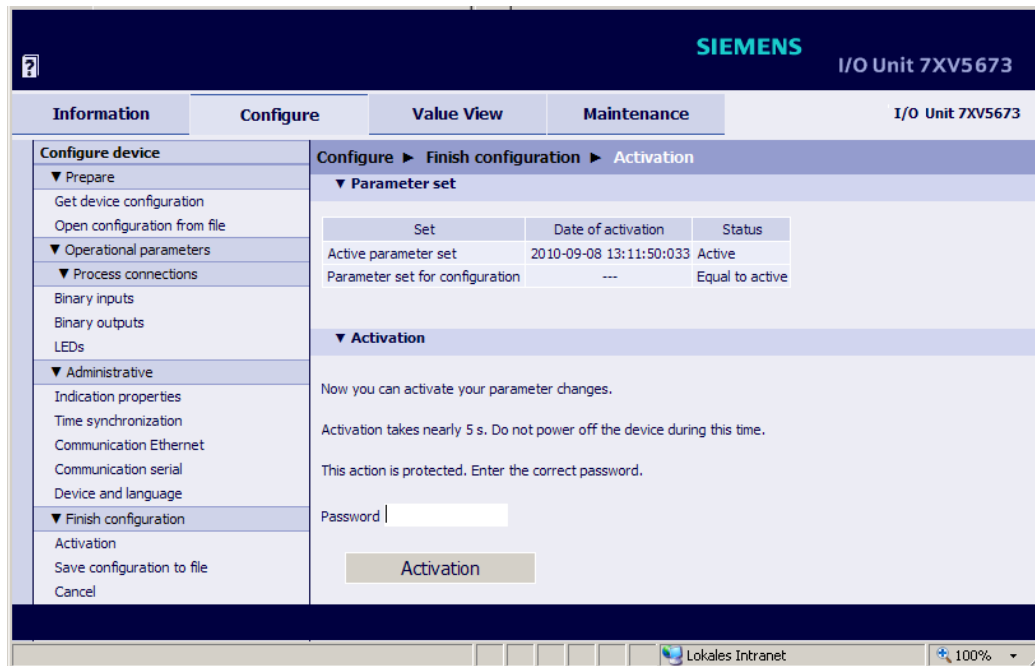
Figure 6-16   Configure Tab, Activation Input/Output Window

✦ In the **Activation** input/output window, enter the valid activation password into the password field; chapter 6.3.3.9 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 parameter set is loaded as the active parameter set 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 parameter set 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.
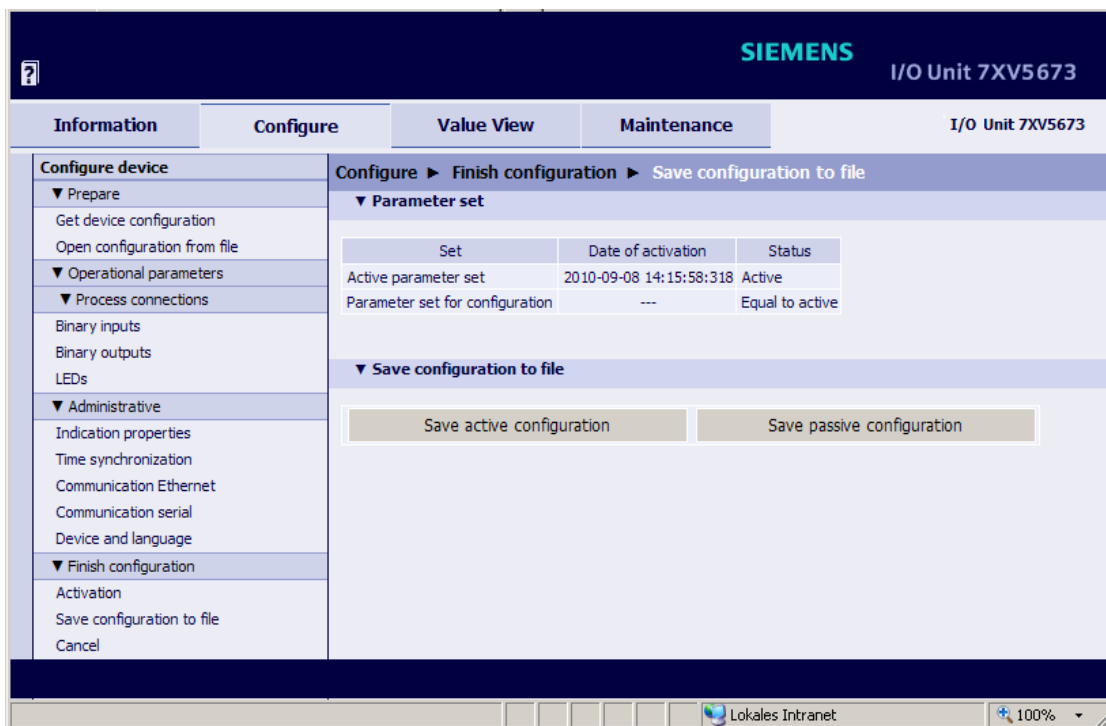
Figure 6-17   Configure Tab, Save Configuration to File Input/Output Window

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

The **File Download** dialog opens.
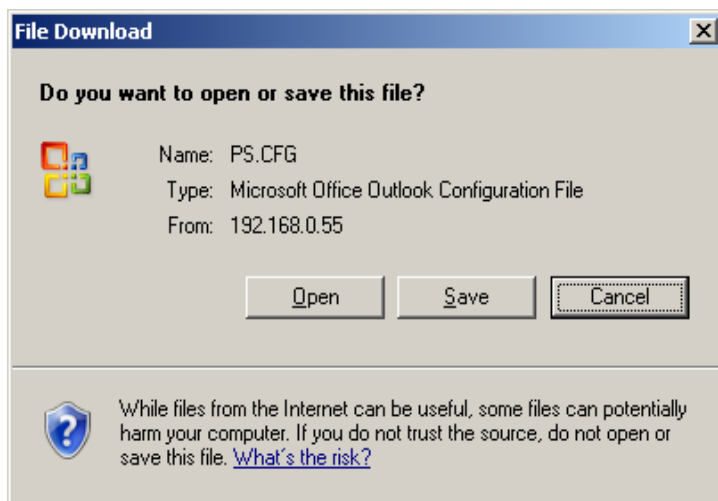
Figure 6-18   File Download Dialog

File Download → **Save**

✧   Click the **Save** button.
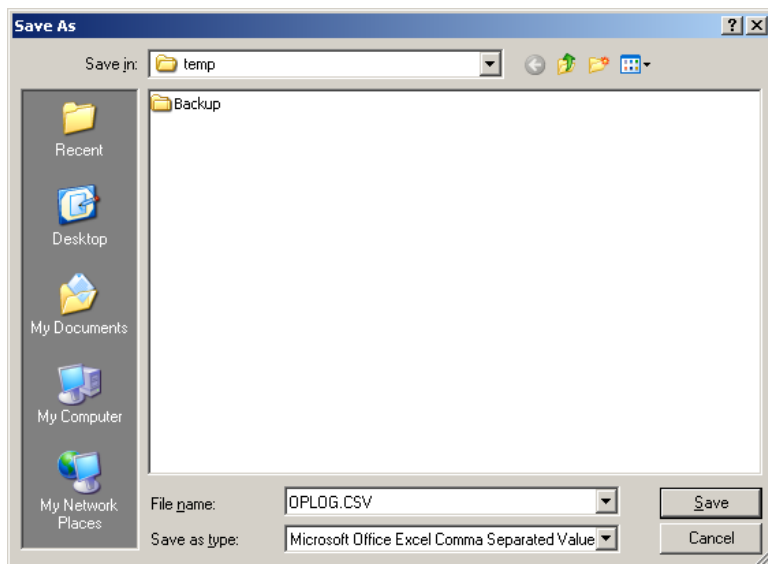
    The **Save As** dialog opens.
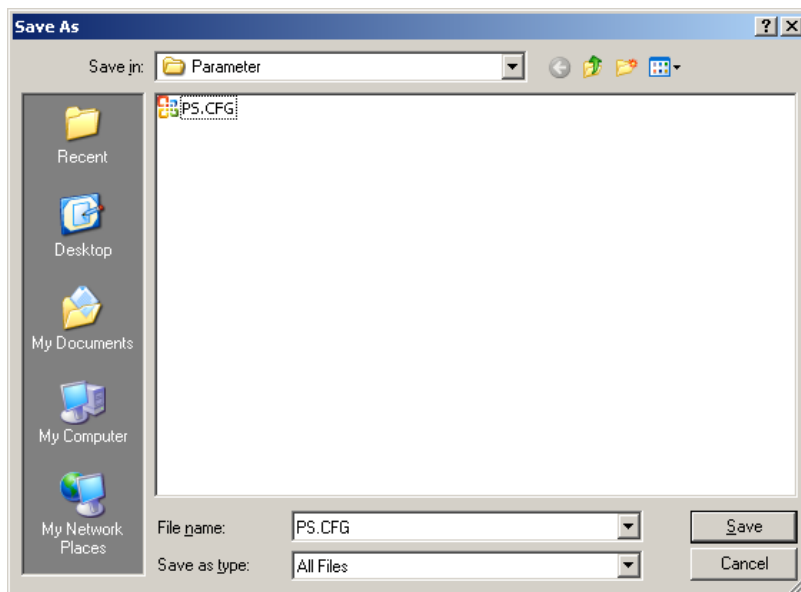
Figure 6-19   Save As Dialog

✧   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.

✧   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.
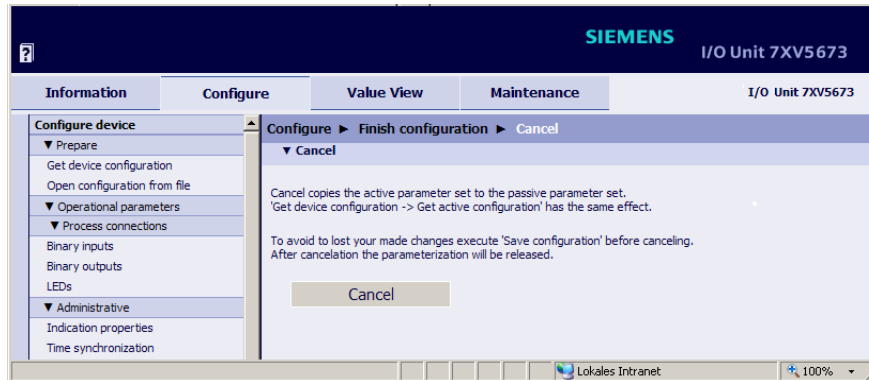
Figure 6-20   Configure Tab, Cancel Input/Output Window

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

NOTE

After clicking the **Cancel** button, the active parameter set is copied into the passive parameter set. This action is the same as **Get device configuration** → **Get active configuration** described in chapter 6.3.1.1.

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

6.3.2 Access to the Passive Parameter Set by Multiple Users

Reading the Passive Parameter Set

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

Editing the Passive Parameter Set

The passive parameter set 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, see Figure 6-21**.**
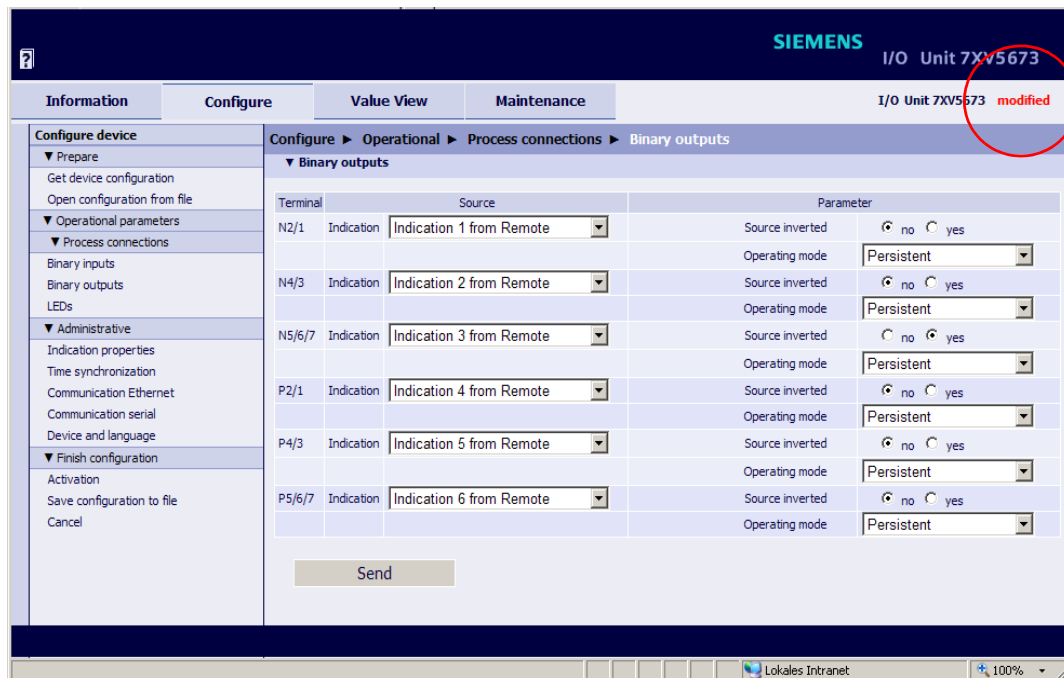
Figure 6-21   Configure Tab, Access Blocked

If a user makes a change, the server starts a 20-minute timer. If no further changes to the parameter set 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 parameter set is overwritten with the content of the active parameter set.

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

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

6.3.3 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. For the setting the submenus **Process connections** and **Administrative** are available. The submenus contain the following elements:

- Process connections
    - Binary inputs
    - Binary outputs
    - LEDs
- Administrative
    - Indication properties
    - Time synchronization
    - Communication Ethernet
    - Communication Serial
    - Device and Language

NOTE

Observe the procedure for the device configuration described in chapter 6.3.1 when you set the operational parameters.

6.3.3.1 Binary Inputs

Table 6-2   Settings for Binary Inputs

Parameter	Default Settings	Setting Range
Threshold voltage (can be set for all binary inputs individually)	19 V	19 V 88 V 176 V
Software filter time (can be set individually for each terminal block in 2-ms steps)	1 ms (* 2 ms)	2 ms to 120 000 ms
Binary input indication (can be set for all binary inputs individually)	For example for terminal P8/9: Binary input 1 - terminal block P	Arbitrary text; name of the indication

If you want to change the parameters for the binary inputs, please proceed as follows:

✧ In the navigation window, select the **Operational parameters** menu, then the **Process connection** submenu, and click the element **Binary inputs**.

The **Binary inputs** input/output window opens.
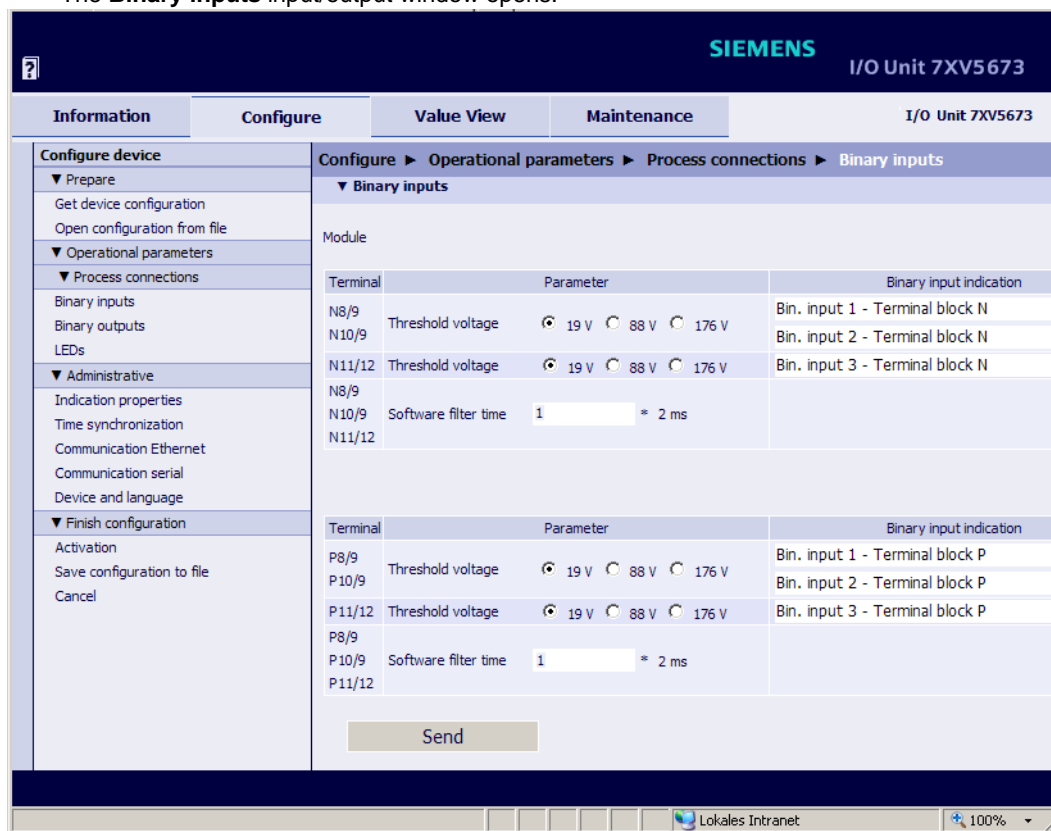
Figure 6-22   Configure Tab, Binary Inputs Input/Output Window

---

NOTE

The parameterization of the 6 binary inputs is identical.

✧ For each connected binary input in the **Parameter** column, select a voltage in the **Threshold voltage** option button.

✧ Enter the **Software filter time** (in x * 2 ms) for each terminal block (P, N) in the **Parameter** column.

✧ Accept the preassigned entry in the **Binary input indication** column or change it.

✧ 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 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

6.3.3.2 Binary Outputs (Relay Outputs)

Table 6-3   Binary Output Settings

Parameter	Default Setting	Settings
Indication (can be set individually for all relay outputs)	-none-	Acc. to list box ▾ (see chapter 13.1.2)
Source inverted (can be set individually for all relay outputs)	no	no yes
Operating mode (can be set individually for all relay outputs)	Persistent	Acc. to list box ▾ (see chapter 13.1.2)

To change the outputs of a binary output, proceed as follows:

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

The **Binary outputs** input/output window opens.
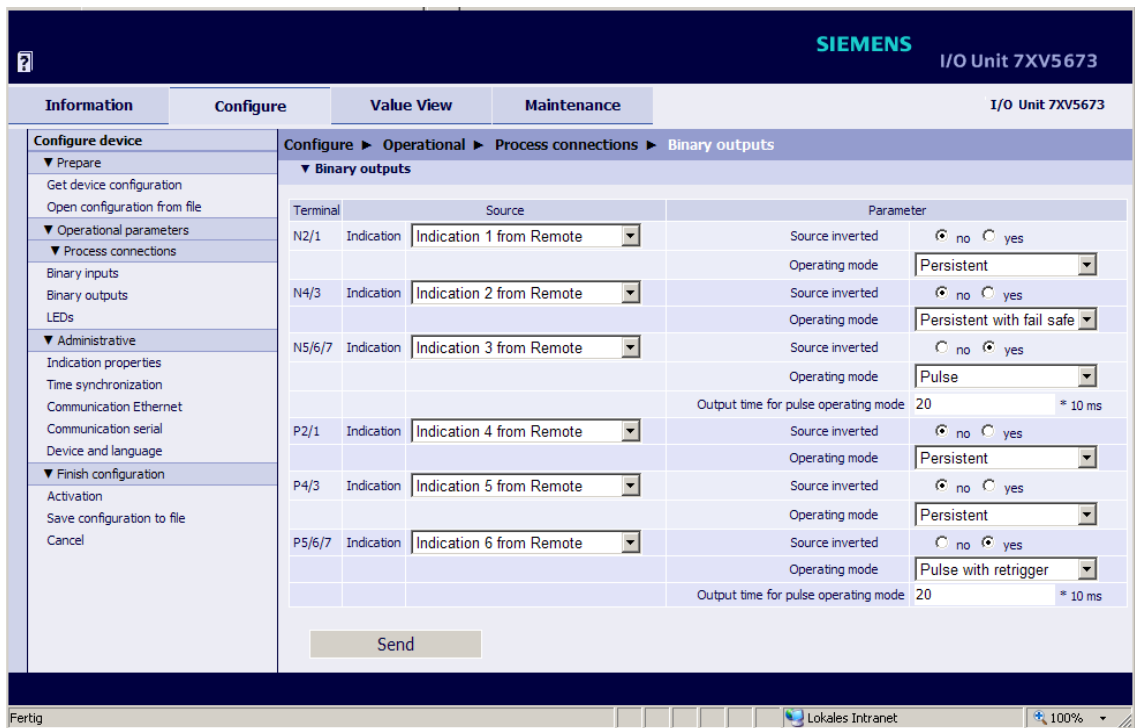
Figure 6-23   Configure Tab, Binary Outputs Input/Output Window

NOTE

The parameterization of both binary outputs is identical.

✧ Select the **Source** of the message from the **Indication** list box. You can select the following messages:
   - Ready and status indications, for example Device OK, Modbus TCP OK
   - Indications about present device activities, for example Settings load
   - Error indications, for example Battery Failure, Ethernet Link Error
   - Administrative indications, for example Daylight Saving Time
   - Communication indications, for example Indication 1 from Remote
   - Indications to the binary inputs, for example Binary input 1 - Terminal block 1

   Select **-none-** to disable the binary output.

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

✧ Select the output mode at the binary outputs in the **Operating mode** list box. The following output types are available:
   - **Persistent**: The binary output has the status ON or OFF. If the indication becomes invalid, the binary output continues to maintain its current status.
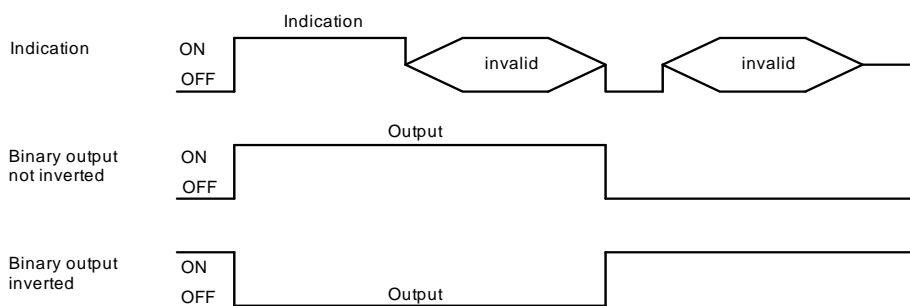
Figure 6-24   Persistent

   - **Fail-safe persistent output**: If the message becomes invalid and **Source inverted = no** has been parameterized, the binary output switches to OFF mode. If the message becomes invalid and **Source inverted = yes** has been parameterized, the binary output switches to ON mode.
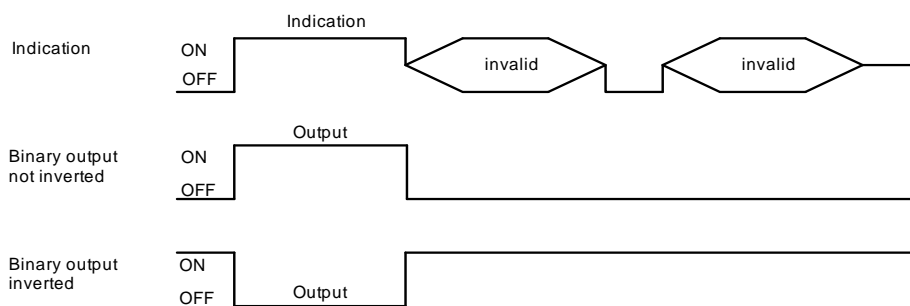
Figure 6-25   Persistent with Fail Save

- **Pulse** without retrigger: This indication is output as pulse. If the indication changes again while the output pulse is ON, the pulse output time is not restarted. This means that a change of the indication during the pulse output will be ignored.
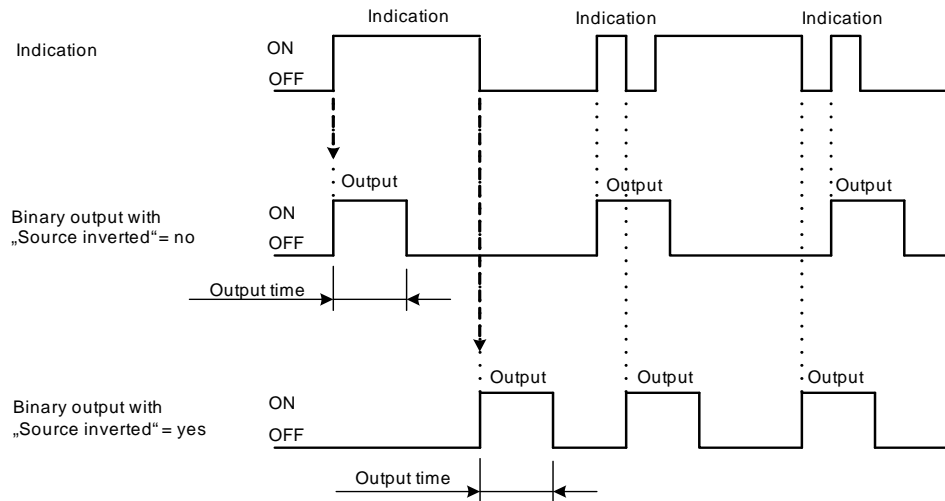
Figure 6-26   Pulse without Retrigger

- **Pulse with retrigger**: This indication is output as pulse. The output pulse is retriggered if the indication is changed during the pulse output. This means that the pulse output is extended
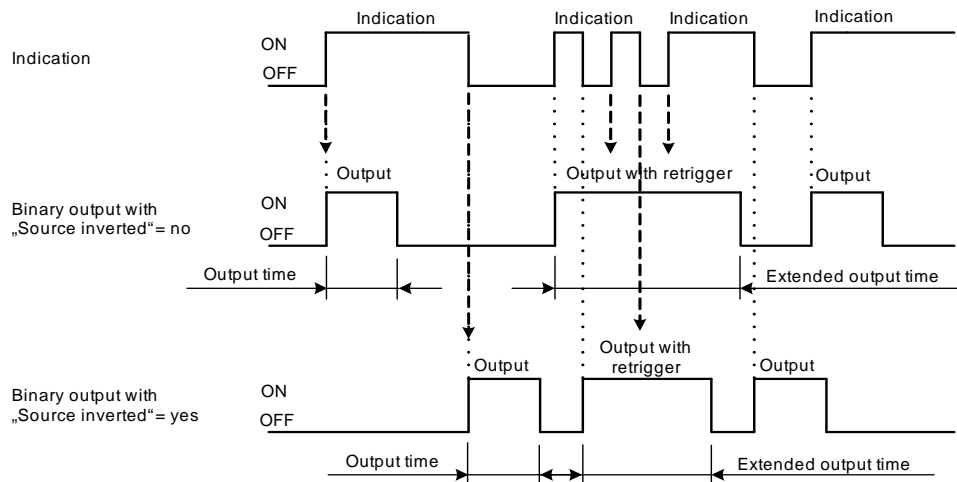
Figure 6-27   Pulse with Retrigger

- ✧ If you have selected one of the two **Pulse** types in the **Operating mode** list box, enter an output time x (in x *10 ms) into the **Output time for pulse operating mode** 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 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

Behavior when Activating the Parameter Set after the Parameter Set was Changed

Persistent:

The binary output is set to the new status (ON or OFF) as defined by the current indication.

Pulse:

If the binary output is ON in **pulse** mode while activating the parameter set, the binary output is immediately switched to the OFF status after the parameter set has been successfully activated. This happens even if the parameterized **Output time for pulse operating mode** has not yet elapsed.

6.3.3.3 LEDs

Table 6-4   LED Settings

LED	Default Setting	Settings
RUN	Device ready	Not settable
ERROR	-none-	Acc. to list box ▼ (see chapter 13.1.3)
H1	-none-	Acc. to list box ▼ (see chapter 13.1.3)
H2	-none-	Acc. to list box ▼ (see chapter 13.1.3)

To change the outputs of the LEDs H1, H2 and 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.
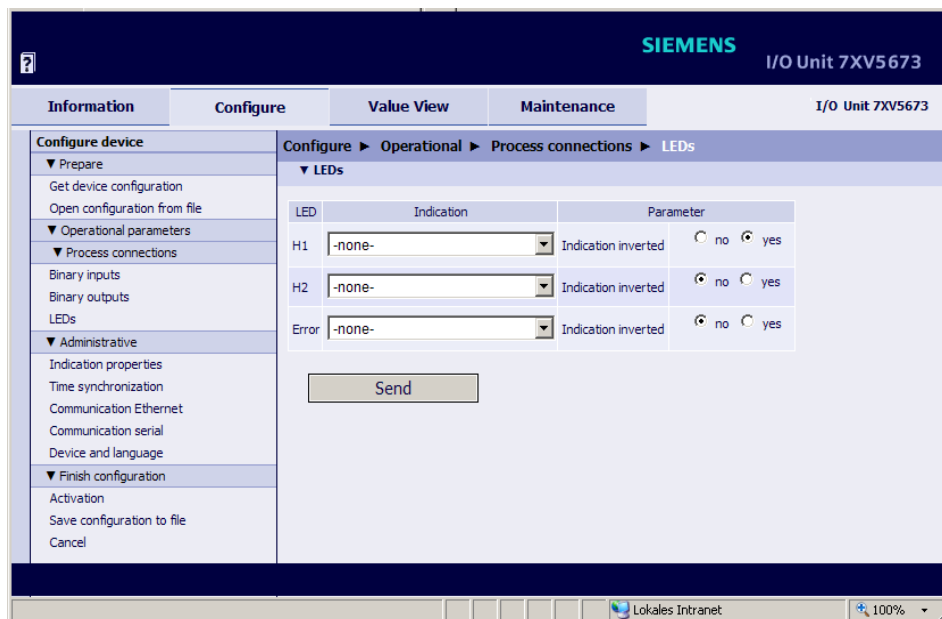
Figure 6-28   Configure Tab, LEDs Input/Output Window

✧ Select the indication to be assigned to the corresponding LED from the **H1**, **H2** and/or **Error** list boxes. You can select from the following indications:

- − Ready and status indications, for example Device OK, Modbus TCP OK
- − Indications about present device activities, for example Settings load
- − Error indications, for example Battery Failure, Ethernet Link Error
- − Administrative indications, for example Daylight Saving Time
- − Communication indications, for example Indication 1 from Remote
- − Indications to the binary inputs (for example Binary input 1 - Terminal block 1)

If you select **-none-**, the respective LED becomes inactive.

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

✧ 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 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

Behavior of the LEDs
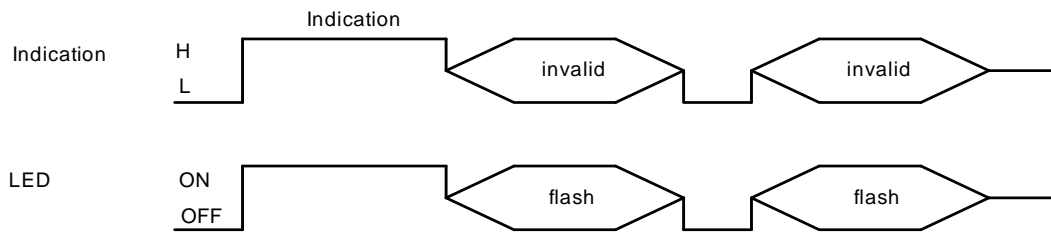
Figure 6-29   Behavior of the LEDs

6.3.3.4 Indication Properties

When setting up the indication properties, you will decide which entries are to appear in the operational log (indication logging).

Table 6-5　　Indication Properties Settings

Parameter	Default Setting	Settings
Indication x from Remote (x = 1 to 6)	Not configured	Not configured On Off On/Off
Binary Output y - Terminal Block z (y = 1 to 3, z = N or P)	Not configured	Not configured On Off On/Off
Binary Input y - Terminal Block z (y = 1 to 3, z = N or P)	Not configured	Not configured On Off On/Off

To change the indication properties, proceed as follows:

✧ In the navigation window, select the **Operational** menu, then the **Administrative** submenu and click **Indication properties**.
The **Indication properties** input/output window opens.
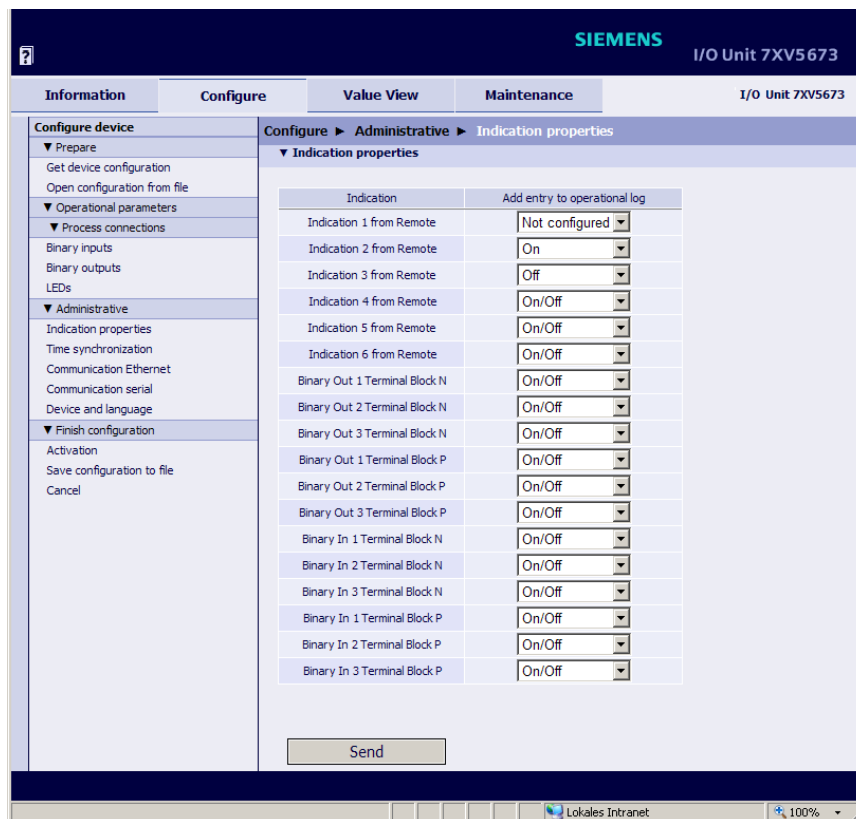
Figure 6-30　　Configure Tab, Indication Properties Input/Output Window

✧ In the list box, select the message which is to appear in the operational log.

✧ 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 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

6.3.3.5 Time Synchronization

Table 6-6   Time Synchronization Settings

Parameter	Default Setting	Settings
Source time synchronization	Internal	Internal Ethernet NTP Fieldbus
Time zone offset to UTC	+00:00	-12 to +13 (hours) (in increments of 0.5 h)
Daylight saving time switchover	yes	no yes
DST offset to UTC	+01:00	0 to + 2 (hours) (in increments of 0.5 h)
Start of DST	March Last week Sunday 02:00 AM	Acc. to list box (see chapter 13.2.2)
End of DST	October Last week Sunday 03:00 AM	Acc. to list box (see chapter 13.2.2)
Additional parameters if the source is Ethernet NTP		
Primary NTP server IP address	192.168.0.254	Any
Secondary NTP server IP address	192.168.0.253	Any
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, select the **Operational** menu, then the **Administrative** submenu and click **Time synchronization**.

The **Time synchronization** input/output window opens.
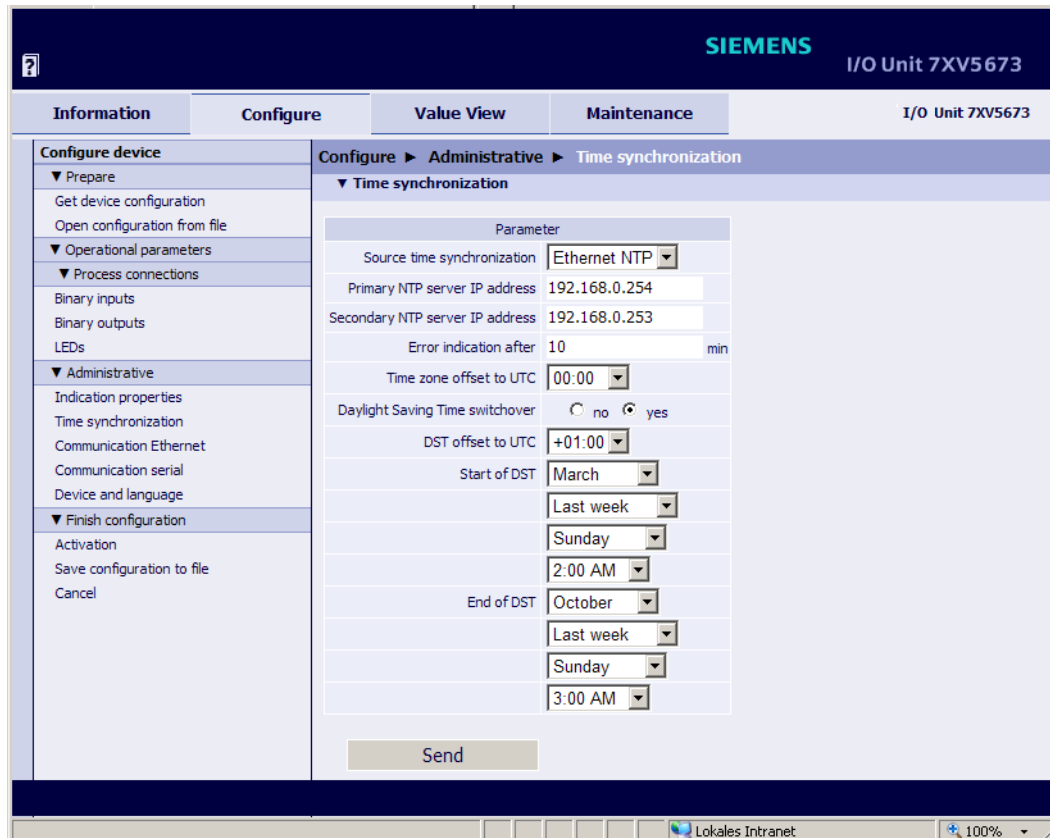
Figure 6-31   Configure Tab, Time Synchronization Input/Output Window, Ethernet NTP Selected

✧ 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.

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✧ 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 parameter set).

✧ If you do not want to change any other settings, continue with the **Activation** of the device configuration according to chapter 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

Time Synchronization via Ethernet NTP

> **NOTE**
>
> If the IEC 61850 protocol is used, NTP synchronization must be selected.

✧ 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 parameter set).

✧ If you do not want to change any other settings, continue with the **Activation** of the device configuration according to chapter 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

Time Synchronization via Fieldbus (Modbus)

✧ 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.

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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 parameter set).

✧ If you do not want to change any other settings, continue with the **Activation** of the device configuration according to chapter 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

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6.3.3.6 Ethernet Communication

Table 6-7   Ethernet Communication Settings

Parameter	Default Settings	Settings
IP Address [1]	192.168.0.55	Any, 0.0.0.0 at DHCP
Subnet mask [1]	255.255.255.0	Any
Default gateway [1]	192.168.0.1	Any
Ethernet switch on	no	no yes
Bus protocol/Operating mode	Modbus TCP	-None- Modbus TCP Modbus UDP I/O Mirror client I/O Mirror server IEC 61850
Modbus TCP		
Use a user-port number [2]	no	no yes
User-port number [2]	10000	10000 to 65535
Access rights for user port	Full	Full Read only
Access rights for user port 502	Full	Full Read only
Keep Alive time	10 s	0 s = switch off 1 s to 65 535 s
Communication supervision time	600 * 100 ms	0 ms = none 100 ms to 6 553 400 ms
Modbus UDP		
Port number	51000	10000 to 65535
Access rights	Full	Full, Read only
Communication supervision time	8 * 10 ms	0 ms = invalid 10 ms to 60 000 ms
I/O Mirror client **(can be parameterized, if no I/O mirror mode is selected under Communication Serial)**		
Server IP Address	192.168.0.56	Any
Server port	51000	10000 to 65535
Response timeout	3 * 10 ms	0 ms = invalid 10 ms to 60 000 ms
I/O Mirror server **(can be parameterized, if no I/O mirror mode is selected under Communication Serial)**		
Port number	51000	10000 to 65535
Communication supervision time	8 *10 ms	0 ms = invalid 10 ms to 60 000 ms

Table 6-7   Ethernet Communication Settings

Parameter	Default Settings	Settings
Bus Protocol IEC 61850 [3]		
IEC 61850 Edition	Edition 1	Edition 1 Edition 2
IED name number [4]	1	0 to 65534
Multicast MAC address [4]		[xx-xx-xx-xx-xx-xx] hexadecimal
App ID [4]		[xxxx] hexadecimal
VLAN ID [4]		[xxx] hexadecimal
VLAN priority [4]	4	0 to 7
Retransmit MIN [4]	5	1 ms to 500 ms
Retransmit MAX [4]	3000	500 ms to 65 534 ms

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

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

3) After having selected IEC 61850 or changed the IEC 61850 settings, the device must be restarted.

4) The parameters stated here are only used when **yes** is selected for "**Use settings in the table below**" (see Figure 6-36). This allows for a simple configuration of the GOOSE publishers without using DIGSI and the SICAM I/O Mapping Tool.

To change the Ethernet communication, proceed as follows:

✧ In the navigation window, select the **Operational** menu, then the **Administrative** submenu and click **Communication Ethernet**.

The **Communication Ethernet** input/output window opens.
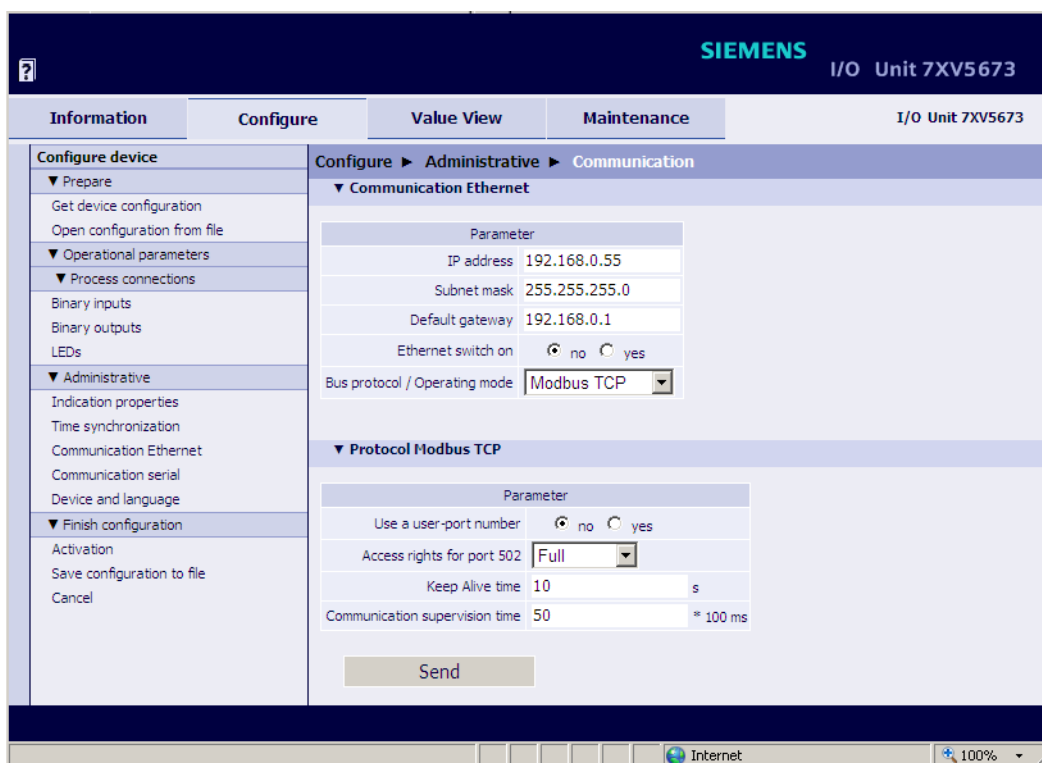
Figure 6-32   Configure Tab, Communication Ethernet via Modbus TCP Input/Output Window

✧ 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.

NOTE

When the network settings have been changed and the changed parameters have been activated (see description below), the device automatically perform a restart.

✧ If you want to switch on the Ethernet switch, select the option **yes** in the option field **Ethernet switch on**.

NOTE

The Ethernet switch is switched off at delivery to ensure a correct operation of the I/O mirror of 2 devices without Y-cable. Only switch on the Ethernet switch (option **yes**), if you connect a Y-cable at the Ethernet connector.

✧ Select the desired **Bus protocol,** the desired **Operating mode** or **-none-** from the **Bus protocol/ Operating mode** list box.

If you select **-none-**, there will be no log and no mode available. In this case, click the **Send** button. If you have selected a **Modbus** protocol or an **Operating mode**, parameterize as follows:

Protocol Modbus TCP (see Figure 6-32)

◇   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 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 (see Glossary; Monitoring of TCP connection).

◇   Enter the time in x * **100 ms** into the **Communication supervision time** field.

   (Monitoring of Modbus communication with setting/resetting of the "Modbus TCP OK" message, see chapter 12.)

◇   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 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

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Protocol Modbus UDP
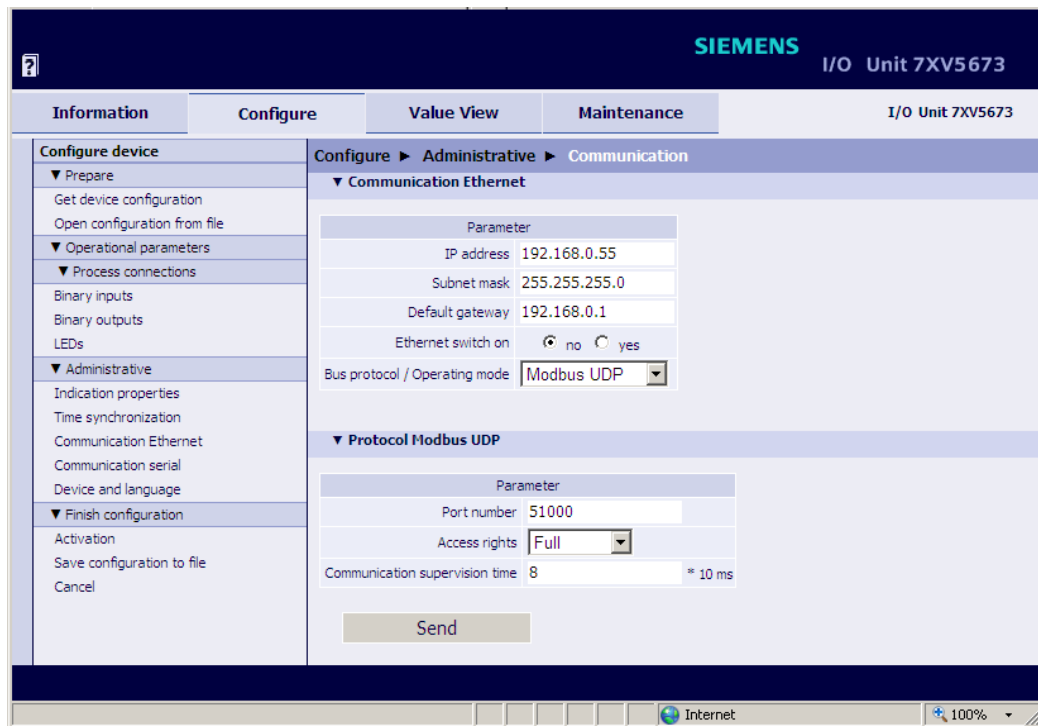
Figure 6-33   Configure Tab, Communication Ethernet via Modbus UDP Input/Output Window

✧ Enter the port number ($\geq$ 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 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

I/O Mirror Client

NOTE

Can only be parameterized, if no **I/O mirror mode** is selected under **Communication Serial**.

Figure 6-34   Configure Tab, Communication Ethernet via I/O mirror Client Input/Output Window

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

   ✧   Enter the port number ($\geq$ 10000) into the **Server port** field.

   ✧   Enter the response time under **Response timeout**.

       Siemens recommends the factory setting.

   ✧   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 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

I/O Mirror Server

NOTE

Can only be parameterized, if no **I/O Mirror mode** is selected under **Communication Serial**.
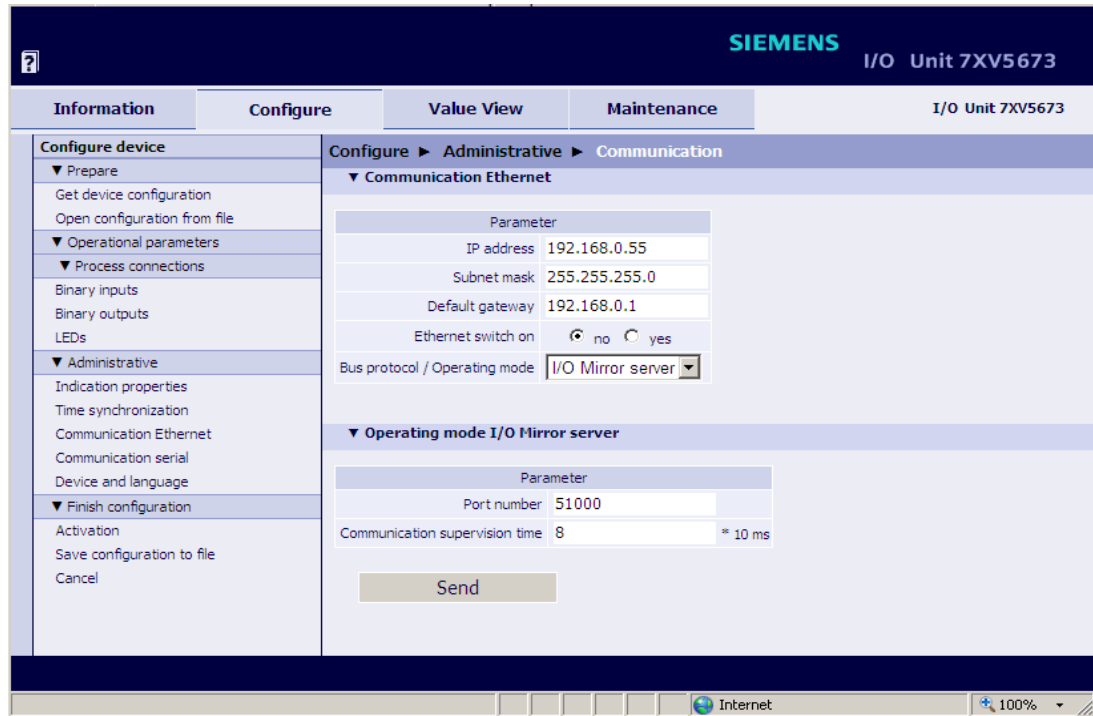
Figure 6-35   Configure Tab, Communication Ethernet via I/O Mirror Server Input/Output Window

✧ Enter the port number (≥ 10000) into the **Port number** field.

✧ Enter the time in x * **10 ms** into the **Communication supervision time** field.
   Siemens recommends the factory setting.

✧ 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 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

Ethernet Communication Using the IEC 61850 Bus Protocol

✦   Select the **IEC 61850** entry from the **Bus protocol** list box.

NOTE

When selecting IEC 61850 (and restarting the device), the IEC 61850 server and GOOSE are started.

After having selected IEC 61850, the device must be restarted.

✦   The **Communication Ethernet** input/output window with **Bus protocol IEC 61850** opens.

Figure 6-36   Configure Tab, Ethernet Communication 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.

After having clicked the **Download ICD file** button, the ICD file that corresponds to the selected edition is down-loaded.

NOTE

Before uploading the Subscriber configuration, please make sure that the **IEC 61850 GOOSE Subscriber Configuration** has been executed. For uploading the Subscriber configuration, the MAP file (file extension .MAP) is required.

✧ Click the **Upload Subscriber configuration** button. The following steps are executed:

— The **Upload Subscriber configuration** dialog opens.
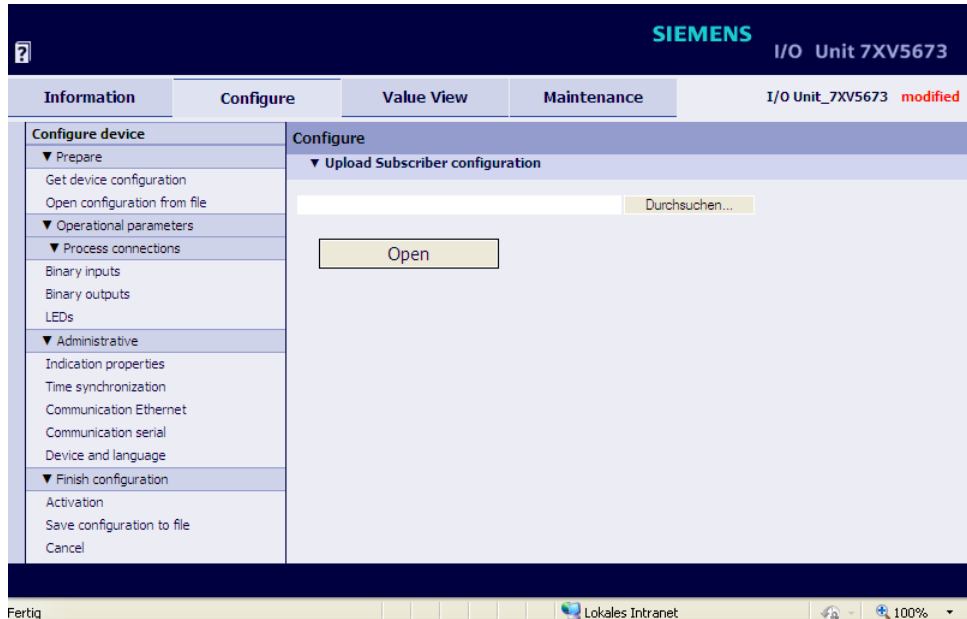
Figure 6-37   Upload Subscriber Configuration Dialog

— Click the **Browse...** button.
— The **Choose file** dialog opens.
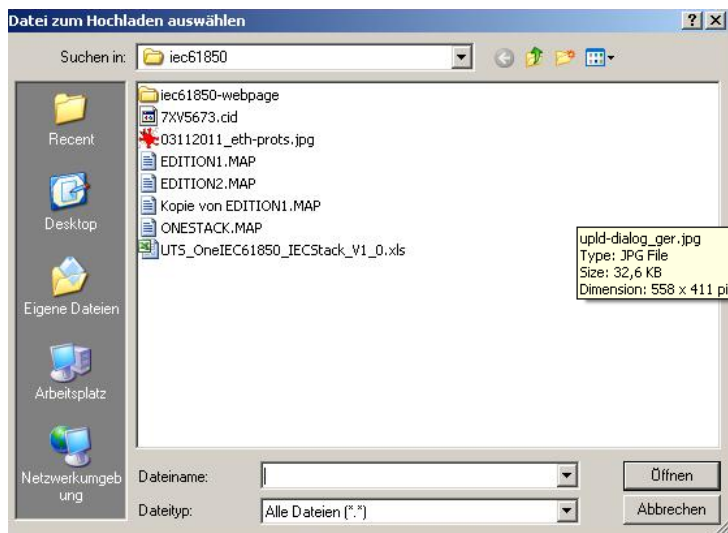
Figure 6-38   Choose File Dialog

— Select the desired file (file extension .MAP) in the folder.
— Click the **Open** button.

The selected path is inserted into the **Browse...** field in the input/output window (see Figure 6-37).

— Click the **Open** button (see Figure 6-37).

The device configuration is loaded from the MAP file.

Then, the software of the device checks which edition is configured by the file. The configuration

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belonging to this edition is overwritten by the current configuration. The current configuration will only become effective once the edition has been selected and the device restarted.

While uploading the Subscriber configuration, the following status indications may appear in the status bar:

Case 1: File opened successfully

The Edition 2 configuration is uploaded. Edition 2 is selected in the **IEC 61850 Edition** list box; the configuration becomes effective immediately after having restarted the device.
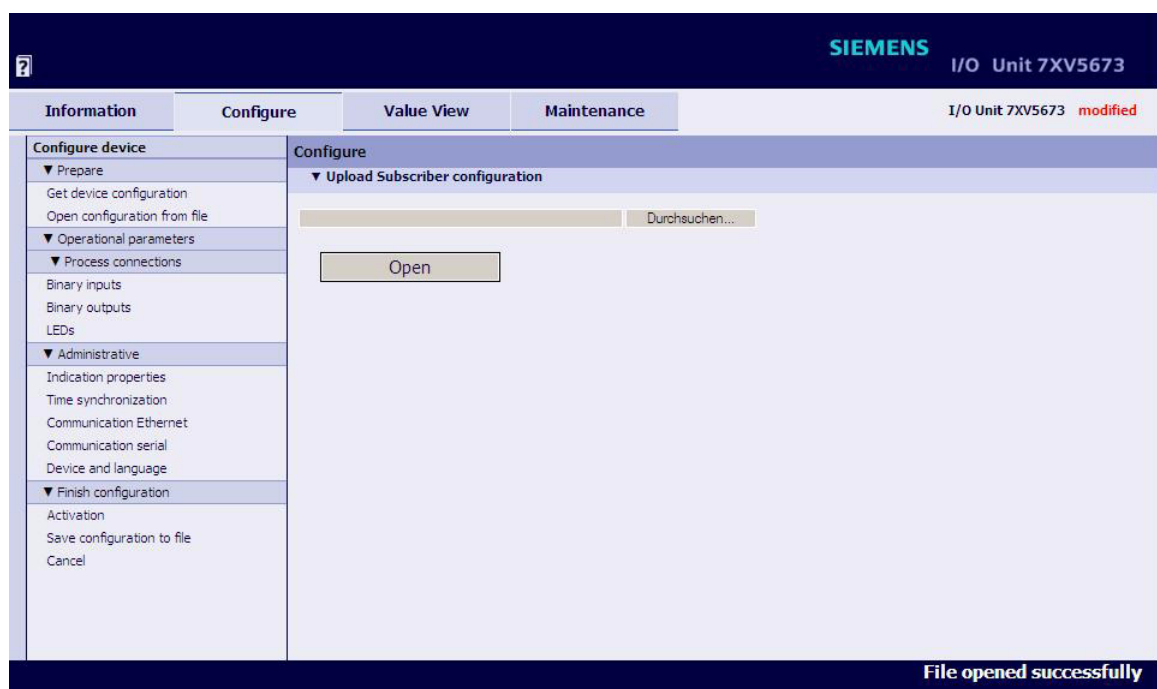
Figure 6-39   File Opened Successfully

Case 2: File failed to open

A wrong file is selected, which has the same file extension .MAP or a different file extension.
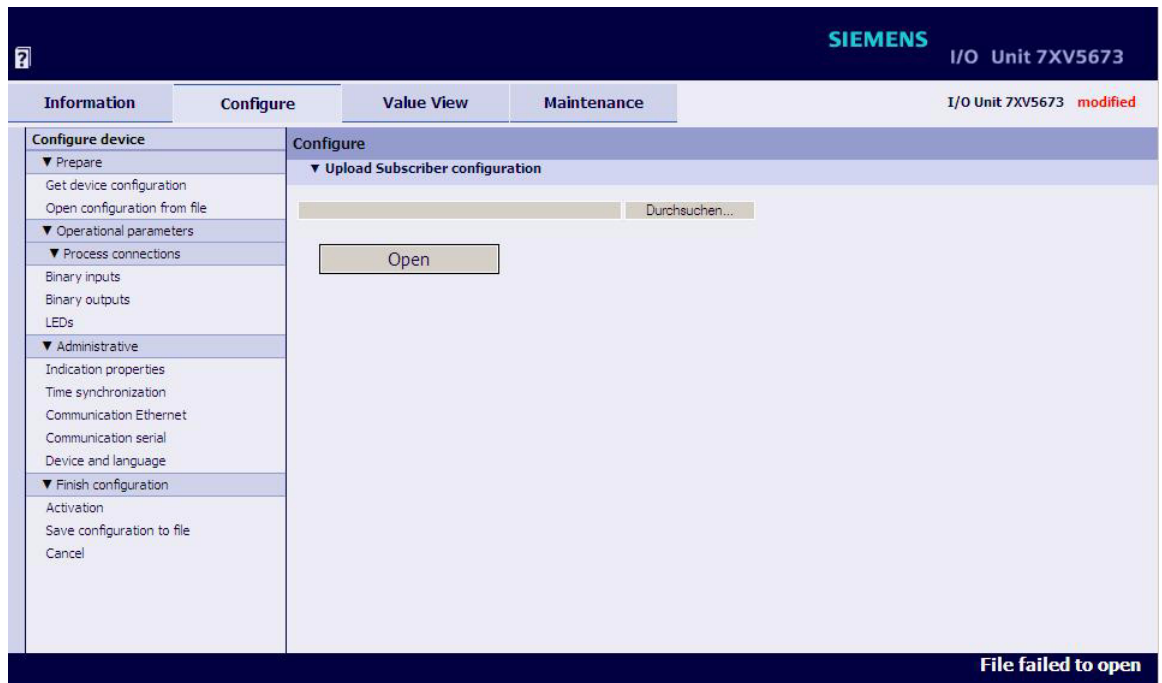
Figure 6-40   File Failed to Open

Case 3: File upload successful: Active Edition does not match file Edition

The Edition 1 configuration is uploaded. Edition 2 is selected in the **IEC 61850 Edition** list box; the configuration is stored but does not become effective. The configuration will only become effective after having selected Edition 1 from the **IEC 61850 Edition** list box and restarted the device.
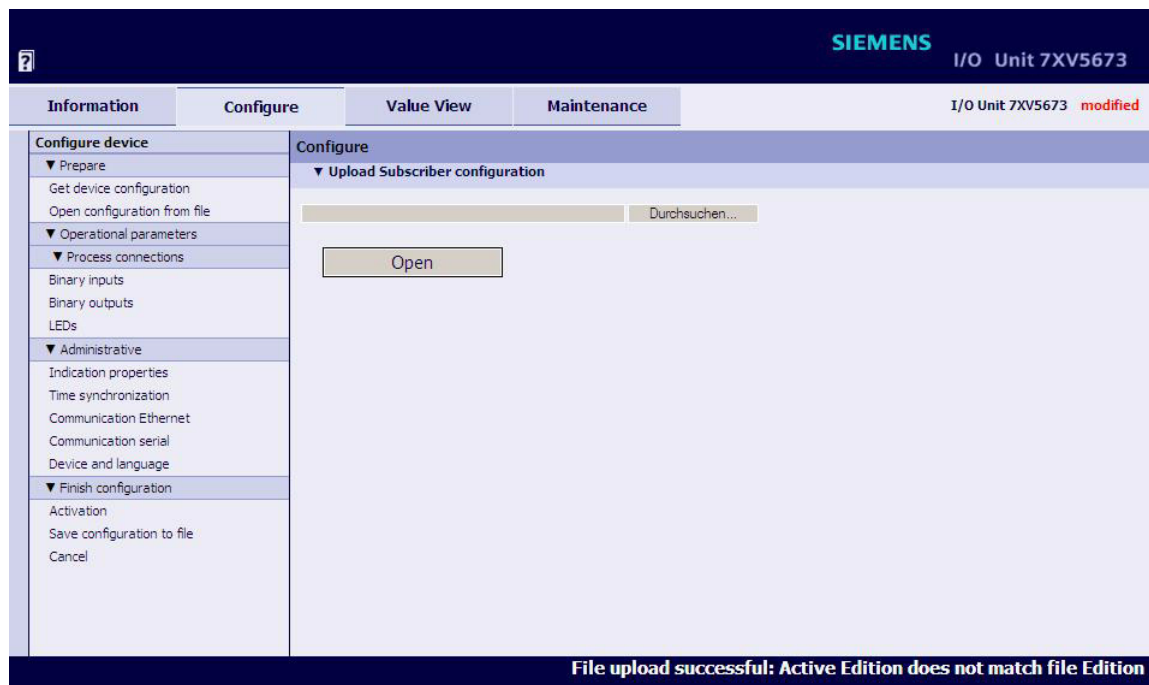
Figure 6-41   File Upload Successful: Active Edition Does Not Match File Edition

◇   In the **Use settings in the table below** option field (see Figure 6-36), select the option:

  —   **yes** if you want to manually set the GOOSE publisher parameters. The settings from the pre-installed or uploaded configuration are then overwritten. In this way, the device can be configured as publisher with simple means without using the SICAM I/O Mapping Tool and without DIGSI.

  —   **no** if:

    1. You want to take over the parameters generated in DIGSI and edited with the SICAM I/O Mapping Tool (see section **Configuration Using DIGSI 4**).

    2. You want to take over the configuration already pre-installed in the device upon delivery.

◇   Change the serial number of the SICAM I/O Unit in the **IED name number** (factory setting 1) if several SICAM I/O Units are used in the substation. The number must be identical with the number parameterized for this SICAM I/O Unit in the configurator of the substation.

NOTE

By stating the **IED name number** , the SICAM I/O Unit is uniquely identified in the network.

The following parameters describe the configuration of the GOOSE publishers (inputs/outputs):

◇   Enter the hexadecimal multicast address [xx-xx-xx-xx-xx-xx] in the **Multicast MAC address** field.

◇   Enter the hexadecimal App ID [xxxx] in the **App ID** field.

◇   Enter the hexadecimal VLAN ID [xxx] in the **VLAN ID** field.

✧ 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.

✧ If you do not want to change any further settings, continue with the **activation** of the device configuration as described in "Activating the Parameter Set". If you want to change further settings, enter these changes and then enable the device configuration as described in "Activating the Parameter Set".

> **NOTE**
>
> After having selected the GOOSE publisher parameters, the device must be restarted.

Download ICD File

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

The ICD file of the SICAM I/O Unit corresponding to the currently selected edition is downloaded.

No Ethernet Communication

✧ Select the **-none-** entry from the **Bus protocol** list box.

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

After having clicked 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 further settings, continue with the **activation** of the device configuration as described in "Activating the Parameter Set". If you want to change further settings, enter these changes and then enable the device configuration as described in "Activating the Parameter Set".

> **NOTE**
>
> After having selected IEC 61850, the device must be restarted.

6.3.3.7 IEC 61850 GOOSE Subscriber Configuration

The IEC 61850 IED configuration philosophy of the SICAM I/O Unit is to have one separate static ICD file each for Edition 1 and Edition 2 of IEC 61850. For the substation configuration, these ICD files are imported into the IEC 61850 system configurator (e.g. DIGSI 4).

When the configuration has been completed, the thus generated SCD file can be loaded into the SICAM I/O Mapping Tool, and a binary IEC 61850 parameter set can be created (proprietary format).

The result can then be uploaded via the HTML page.

> **NOTE**
>
> The configuration requires the installation of the SICAM I/O Mapping Tool program (see chapter 4.8).

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Configuration Using DIGSI 4

> **NOTE**
>
> Using DIGSI 4 is the easiest way to perform the GOOSE Subscriber configuration.
>
> IEC 61850 Edition 2 requires DIGSI 4.86 or higher.
>
> The handling of DIGSI 4 is assumed and not described in this manual.
>
> If you do not have DIGSI 4.86 or higher at your disposal, perform the installation as described in **Manual Configuration Without DIGSI 4**.

The following steps must be executed for configuring the IEC 61850 GOOSE Subscribers:

✧ Download the ICD file from the device.

✧ Import the ICD file into DIGSI 4 (as other IEC 61850 communicator).

✧ Change the IED name via the object properties (IED name S_IO_xxxxx, the name must conform to this pattern).

✧ Open the station for interconnecting GOOSE (see DIGSI 4 manual).

> **NOTE**
>
> DIGSI 4 allows the interconnection of binary signals to the DOs (data objects) SPCSO1 to SPCSO6 in LN ProxyGGIO1.
>
> It is not possible to interconnect external GOOSE messages to other objects in the SICAM I/O Unit. SPCSO1 to SPCSO6 correspond to the indications **Indication 1 from Remote** to **Indication 6 from Remote** in the SICAM I/O Unit (see chapter 6.3.3.2).

✧ After having exported the SCD file, open the SICAM I/O Mapping Tool program.

✧ Enter the same IED name as in DIGSI 4 in the SICAM I/O Mapping Tool (e.g. IED name S_IO_00002, see Figure 6-42).
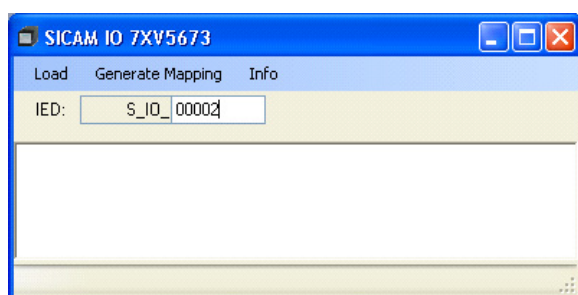
Figure 6-42   SICAM I/O Mapping Tool

✧ Click Load in the menu bar and load the SCD file into the SICAM I/O Mapping Tool. A validation is performed.

✧ Click **Generate Mapping** in the menu bar and select a folder for storing the file. In this folder, the file 7XV5673.MAP is generated.

NOTE

The MAP file (7XV5673.MAP) can be uploaded to the device (see section Ethernet Communication Using the IEC 61850 Bus Protocol).

NOTE

If there are several I/O units in the station, this process must be performed for each device.

Manual Configuration Without DIGSI 4

The manual Subscriber configuration is done according to the description of the ExtRef element in the SCD file.

NOTE

The ExtRef element describes where the GOOSE message object comes from and where the GOOSE message object is going.

The description of the ExtRef element is located below the IED node of the receiving device in the SCD file (LN → Inputs → Extref). The following example (Figure 6-43) shows a section of an SCD file with an ExtRef-element.

```xml
- <LN desc="Routable reciever objects" prefix="Proxy" inst="1" lnClass="GGIO" lnType="GGIO_BINSPC">
  - <DOI name="SPCSO1" desc="Proxy">
      <Private type="Siemens-Dir">Rx</Private>
    - <DAI name="ctlModel">
        <Val>status-only</Val>
      </DAI>
    - <DAI name="cdcNs">
        <Val>Siemens Proxy Object as defined in PIXIT</Val>
      </DAI>
    </DOI>
  - <Inputs>
      <Private type="Siemens-ExtRef-
        Application">IED_00000002a/CTRL/QUELLEGGIO1/SPCSO1/q/CTRL/ProxyGGIO1/ST/SPCSO1/q|GOOSE-
        Anwendung1|Subnet1|GooseSiemensApplication</Private>
      <Private type="Siemens-ExtRef-
        Application">IED_00000002a/CTRL/QUELLEGGIO1/SPCSO1/stVal/CTRL/ProxyGGIO1/CO/SPCSO1/ctlVal|GOOSE-
        Anwendung1|Subnet1|GooseSiemensApplication</Private>
      <ExtRef doName="SPCSO1" intAddr="CTRL/ProxyGGIO1/ST/SPCSO1/q" daName="q" iedName="IED_00000002a" ldInst="CTRL"
        prefix="QUELLE" lnClass="GGIO" lnInst="1" />
      <ExtRef doName="SPCSO1" intAddr="CTRL/ProxyGGIO1/CO/SPCSO1/ctlVal" daName="stVal" iedName="IED_00000002a"
        ldInst="CTRL" prefix="QUELLE" lnClass="GGIO" lnInst="1" />
    </Inputs>
  </LN>
```

Figure 6-43   Logical Node "**ProxyGGIO1**" of the **GGIO_BINSPC** Type (From the IED Node of the Receiving Device)

✧ Receiver's address (points to the IED node of the **receiving** device of the SCD file):

   — **intAddr**: Attribute containing the address to which the received indication is to be written. According to IEC 61850, this section is manufacturer-dependent and must have the following content for the SICAM I/O Unit (see Bild 6-44):

$$\text{intAddr="CTRL/ProxyGGIO1/CO/SPCSO3/ctlVal"}$$

Figure 6-44   "**intAddr**" Attribute

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1. In the third position in the **intAddr** line, one of the functional constraints (FCs) **CO** or **ST** is stated (see Table 6-8, first column).

2. The part marked in red is followed by a serial number (from 1 to 6) and one of the following data attributes:

Table 6-8   Data Attributes

FC	Data Attribute	Explanation
CO	ctlVal (Edition 1)	Control value
ST	stVal (Edition 2)	Status value
	q	Quality

  − **CTRL**: Instance name of the logical device (LDevice)
  − **ProxyGGIO1**: Instance name of the logical node (LN) GGIO

Table 6-9   ProxyGGIO1

	Explanation
Proxy	Prefix for the subsequent logical node
GGIO	Class of the logical node (LN)
1	Instance number of the GGIO object

  − **CO**: Functional Constraint (FC) control, see Table 6-8
    For more detailed information on the functional constraints, please refer to the International Standard IEC 61850-7-2.
  − **SPCS03**: Instance name of the data object (DO)
  − **ctlVal**: Name of the data attribute (DA)

NOTE

The other attributes describe the source of the received indication. In the example shown in Figure 6-43 , the source is another SICAM I/O Unit.

✧ Transmitter's address (points to the IED node of the **transmitting** device of the SCD file):

iedName="S_IO_00001" ldInst="CTRL" prefix="In" lnClass="GGIO" lnInst="1" doName="Ind3" daName="stVal"

  − iedName: Name of the IED
  − ldInst: Instance name of the logical device (LDevice)
  − prefix: Can be used for describing instances of the respective class of the logical node
  − lnClass: Class of the logical node (LN)
  − lnInst: Instance number of the logical node object
  − doName: Instance name of the data object (DO)
  − daName: Name of the data attribute (DA)

From these explanation results: **S_IO_00001/CTRL/InGGIO1/Ind3/stVal**

6.3.3.8 Serial Communication

Table 6-10 Serial Communication Settings

Parameter	Default Settings	Settings
Bus protocol/Operating mode	Modbus RTU	-None- Modbus RTU I/O Mirror client I/O Mirror server
Modbus RTU		
Device address	1	1 to 247
Baud rate	19 200 bit/s	Acc. to list box (see chapter 13.2.4)
Parity	Even	Acc. to list box (see chapter 13.2.4)
Access rights	Full	Full Read only
Communication supervision time	600 * 100 ms	0 s = none 100 ms to 6 553 400 ms
If there is an FO interface: Fiber optical idle state	Light OFF	Light OFF Light ON
I/O Mirror Client *(can be parameterized, if no I/O mirror mode is selected under Communication Ethernet)*		
Communication mode	Bidirectional	Bidirectional Unidirectional
Baud rate	115 200 bit/s	Acc. to list box (see chapter 13.2.4)
Response timeout (only in communication mode bidi-rectional)	3 * 10 ms	10 ms bis 60 000 ms (Siemens recommendation, see chapter 8.3.2.1)
Send time synchronization	no	yes no
If there is an FO interface: Fiber optical idle state	Light OFF	Light OFF Light ON
I/O Mirror Server **(can be parameterized, if no I/O mirror mode is selected under Communication Ethernet)**		
Baud rate	115 200 bit/s	Acc. to list box (see chapter 13.2.4)
Communication supervision time	8 * 10 ms	0 s = invalid 10 ms to 60 000 ms (Siemens recommendation, see chapter 8.3.2.2)
If there is an FO interface: Fiber optical idle state	Light OFF	Light OFF Light ON

To change the serial communication settings, proceed as follows:

✧ In the navigation window, select the **Operational** menu, then the **Administrative** submenu and click **Communication Serial**.

The **Communication Serial** input/output window opens.
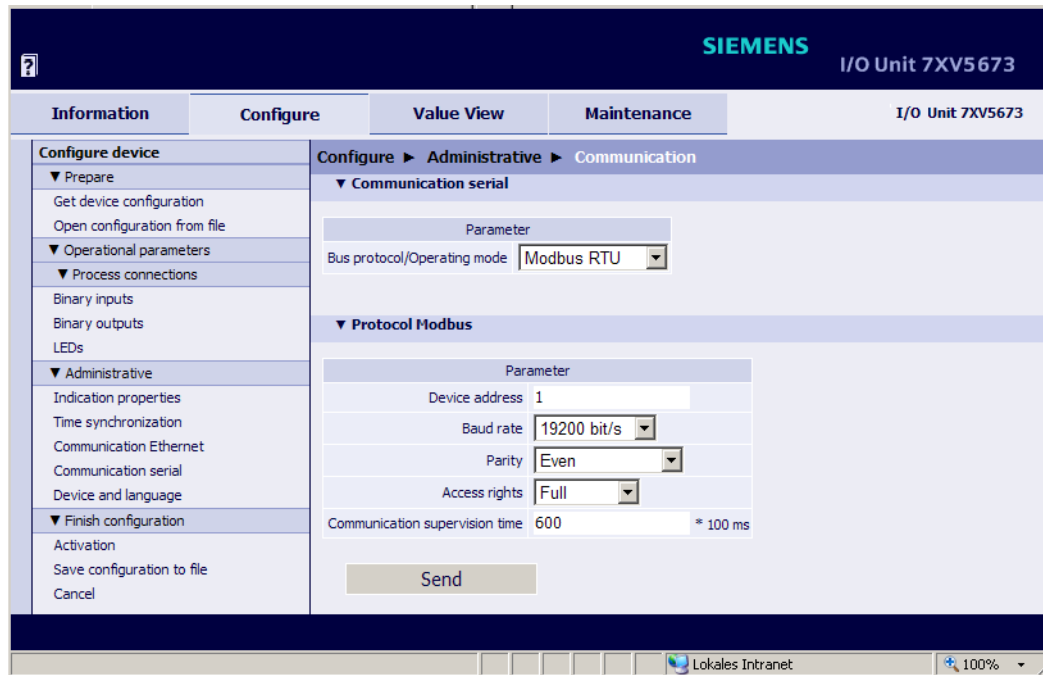
Figure 6-45   Configure Tab, Communication Serial via Modbus RTU Input/Output Window

---

NOTE

If the device has a serial FO interface instead of a RS485 interface, the input/output window additionally contains the **Fiber optical idle state** option button with the settings **Light OFF** and **Light ON**.

✧ In the **Bus protocol/Operating mode** list box, select the entry **Modbus RTU**, **I/O Mirror client**, **I/O Mirror server** or **-none-**.

I/O Mirror client or **I/O Mirror server** can only be parameterized, if no I/O mirror mode has been selected under Ethernet communication.

If you select **-none-**, there will be no protocol available. In this case, click the **Send** button.

Protocol Modbus RTU (see Figure 6-45)

✧ 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.

✧ 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 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

Operating Mode I/O Mirror Client

> **NOTE**
>
> Can only be parameterized, if no **I/O Mirror mode** is selected under **Communication Ethernet**.

Figure 6-46   Configure Tab, Communication Serial via I/O Mirror Client Input/Output Window

> **NOTE**
>
> If the device has a serial FO interface instead of a RS485 interface, the input/output window additionally contains the **Fiber optical idle state** option button with the settings **Light OFF** and **Light ON**.

✧ Select the **Bidirectional** or **Unidirectional** option in the **Communication Mode** option button.

✧ Select the baud rate in the **Baud rate** list box.

✧ Enter the response time under **Response timeout** (only in Communication mode Bidirectional).

✧ Select the **Yes** option in the **Send time synchronization** option button, if you do not want to send telegram or **no**, if you do not want to send telegrams.

✧ 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 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

Operating Mode I/O Mirror Server

> **NOTE**
>
> Can only be parameterized, if no **I/O Mirror mode** is selected under **Communication Ethernet**.
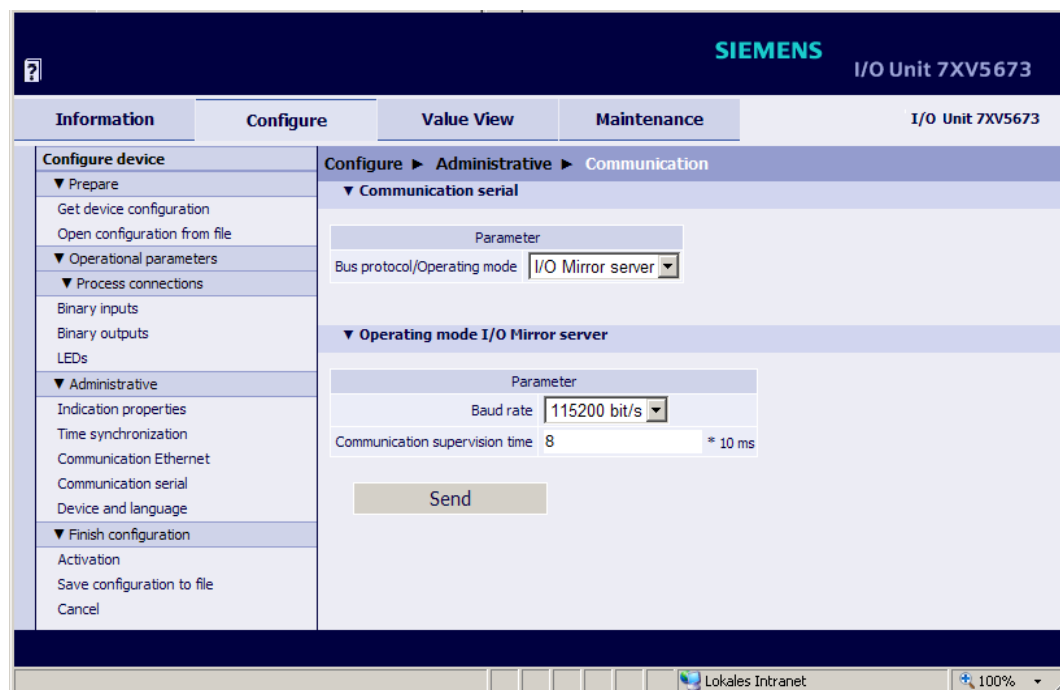
Figure 6-47   Configure Tab, Communication Serial via I/O Mirror Server Input/Output Window

> **NOTE**
>
> If the device has a serial FO interface instead of a RS485 interface, the input/output window additionally
> contains the **Fiber optical idle state** option button with the settings **Light OFF** and **Light ON**.

◇ Select the baud rate in the **Baud rate** list box.

◇ 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 6.3.1.3. If you want to change other settings, enter the changes and then enable the device configuration.

6.3.3.9 Device and Language

Table 6-11   Device and Language Settings

Parameter	Default Setting	Settings
Device name	IO-Unit 7XV5673	Any, max. 32 characters
Language	ENGLISH (US)	ENGLISH (US) DEUTSCH (DE)
Date/time format	YYYY-MM-DD, Time with 24 hours	Acc. to list box (see chapter 13.2.5)
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, select the **Operational** menu, then the **Administrative** submenu and click **Device and language**.

The **Device and language** input/output window opens.
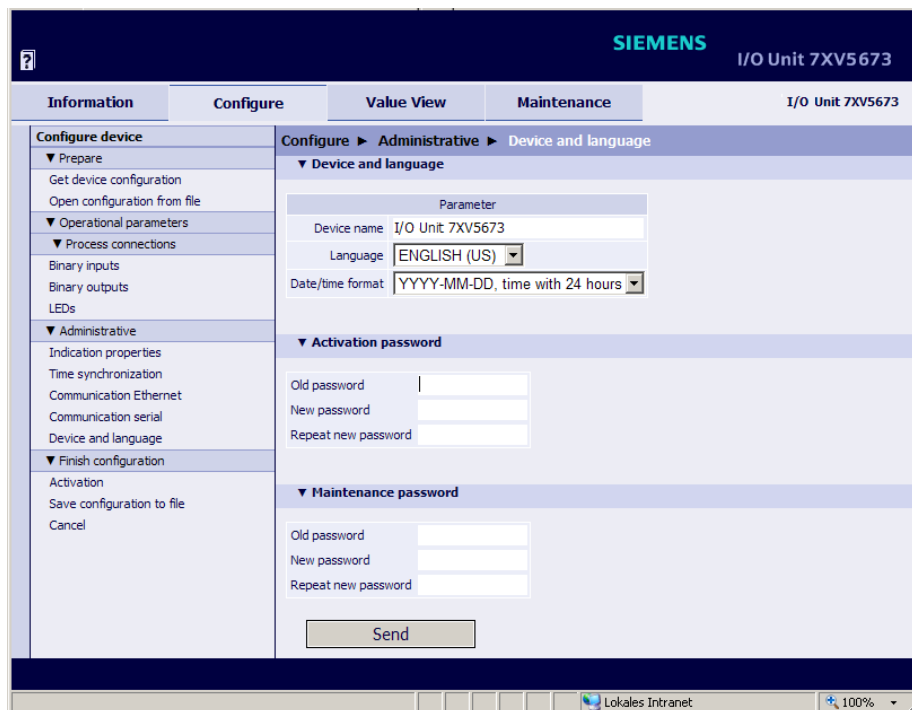
Figure 6-48   Configure Tab, Device and Language Input/Output Window

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

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

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

Changing the Activation Password

✧ Enter the old activation password in the **Old password** field.

✧ Enter the new activation password (any 6 to 14 characters) 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) 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..

6.3.3.10 Finish Configuration

The items in the **Finish configuration** menu in the navigation window are described in chapter 6.3.1, in these subsections:

• Activating the Parameter Set

• Save Configuration to File

• Cancel

6.4 Value View

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

✧ Click the **Value View** tab.

The **Value View** tab, **Binary outputs** input/output window opens.

Indication		Output	
Identifier	Value	Terminal	Value
Indication 1 from Remote	Invalid	N2/1	Off
Indication 2 from Remote	Invalid	N4/3	Off
Indication 3 from Remote	Invalid	N5/6/7	Off
Indication 4 from Remote	Invalid	P2/1	Off
Indication 5 from Remote	Invalid	P4/3	Off
Indication 6 from Remote	Invalid	P5/6/7	Off
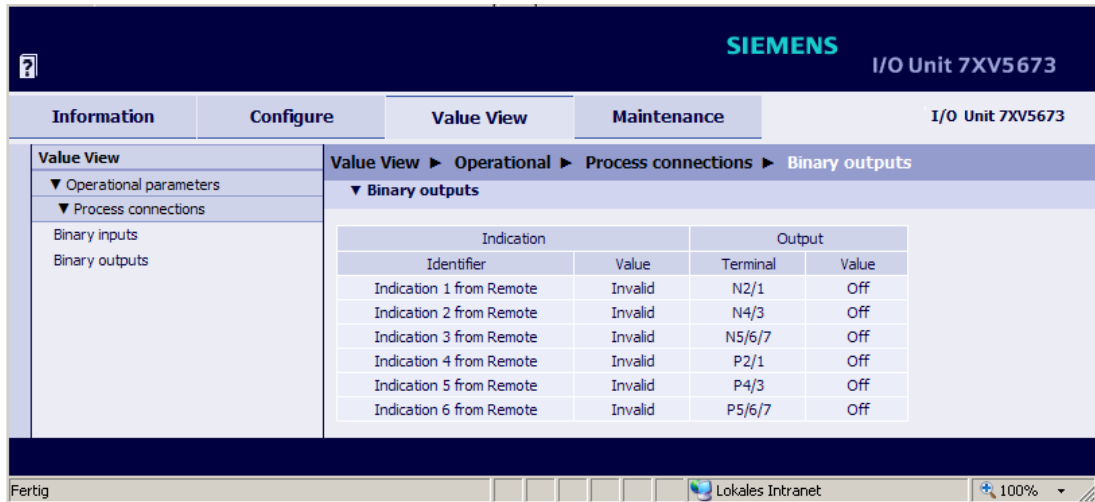
Figure 6-49   Value View Tab, Binary Outputs

✧ If you want to display the values of the binary inputs, click the **Binary inputs** element in the navigation window of the **Operating parameters** menu, submenu **Process connections**.

The **Binary inputs** input/output window opens.

Terminal	Information	Value
N8/9	Bin. input 1 - Terminal block N	On
N10/9	Bin. input 2 - Terminal block N	On
N11/12	Bin. input 3 - Terminal block N	On
P8/9	Bin. input 1 - Terminal block P	On
P10/9	Bin. input 2 - Terminal block P	On
P11/12	Bin. input 3 - Terminal block P	On
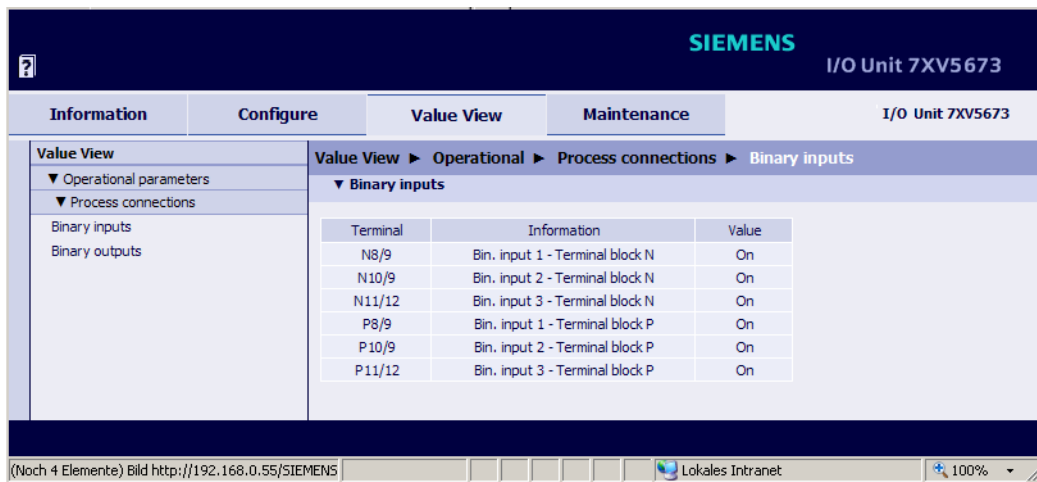
Figure 6-50   Value View Tab, Binary Inputs

Depending on the selection, the values of the binary inputs or outputs are displayed in a table in the input/output window and they are each updated after 5 s.

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

6.5 Maintenance

You can update the firmware in the maintenance tab and perform default settings of date and time. You can also view and delete indication lists and analyze protocol-specific communication data.

When the firmware is updated, newly implemented parameters become factory settings; deleted parameters are no longer analyzed.

If you want to edit this tab, you need the Maintenance password (see chapter 4.5).

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

✧ Click the **Maintenance** tab.

The **Maintenance** tab opens.
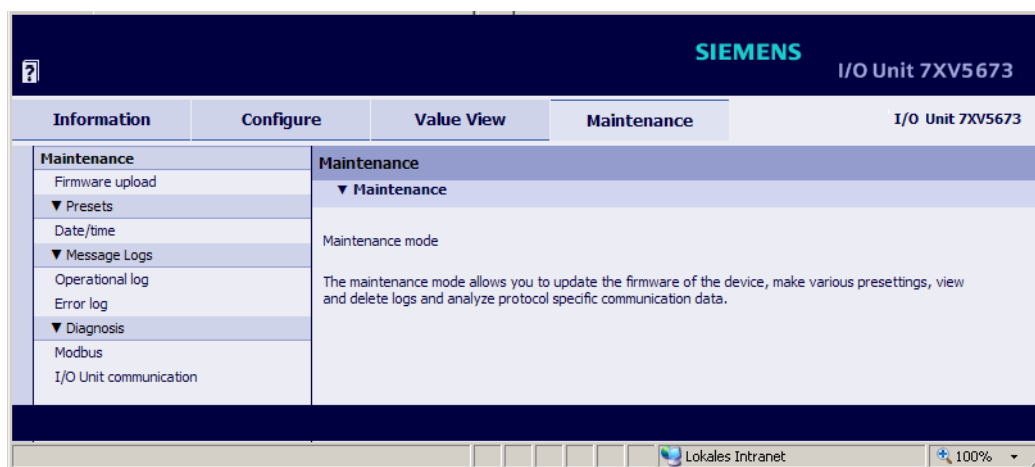
Figure 6-51   Maintenance Tab

6.5.1 Firmware Upload

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

> **NOTE**
>
> Before updating the firmware, Siemens recommends saving the current parameters set as described in chapter 6.3.1.3.

To update the firmware proceed as follows:

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

The **Firmware upload** input/output window opens.
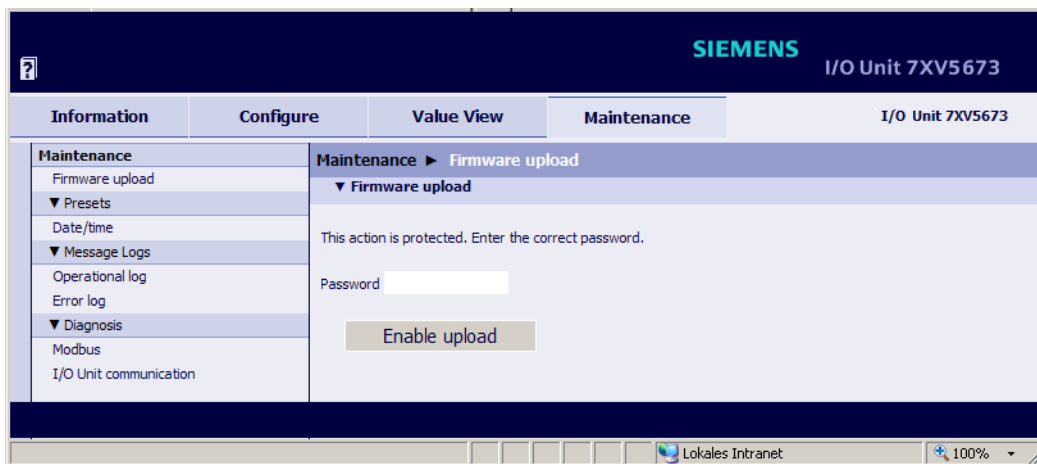
Figure 6-52   Maintenance Tab, Firmware Upload - Enable Upload Input/Output Window

✧ Enter the maintenance password

✧ Click the **Enable upload** button.

The following window opens:
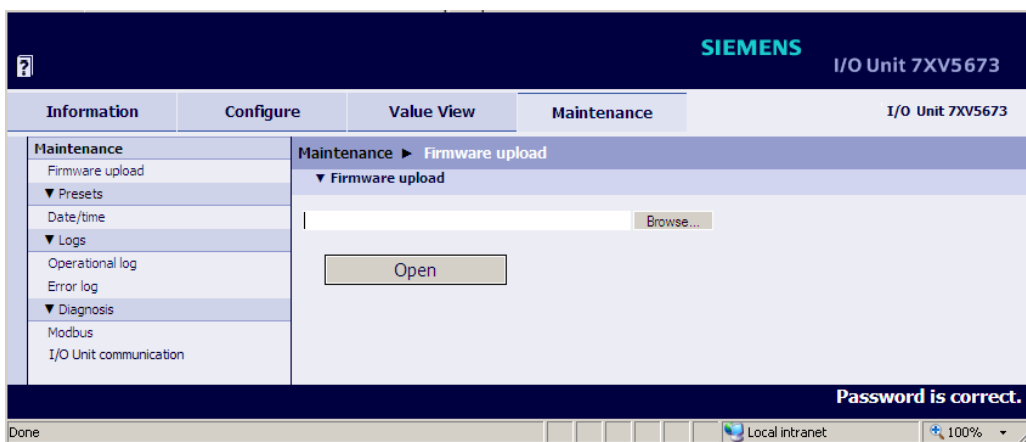
Figure 6-53   Maintenance Tab, Firmware Upload - Open Input/Output Window

✧ Click the **Browse...** button.

  The **Choose file** dialog opens.
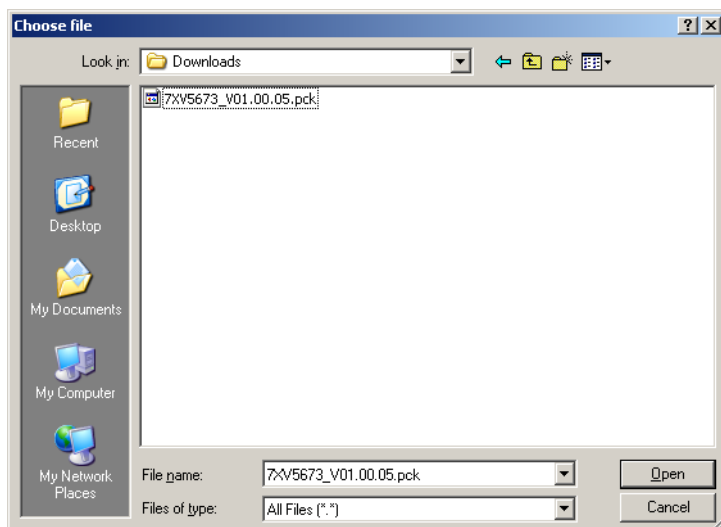
Figure 6-54   Choose File Dialog

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

✧ Click the **Open** button.

✧ The selected path is inserted in the input/output window, Figure 6-53, 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 parameter set, 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 update process as this can lead to data loss.

6.5.2   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.
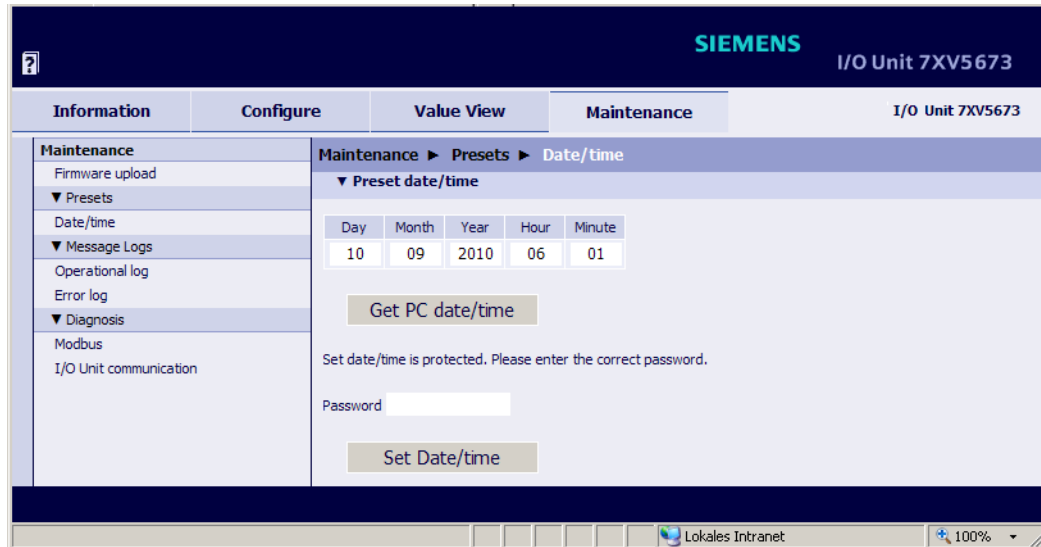
Figure 6-55   Maintenance Tab, Preset Date/Time

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.

6.5.3 Message Logs

In the navigation window open the **Message Logs** menu and then the input/output windows for **Operational log** and **Error log**.

6.5.3.1 Operational Logs

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.

✧ Click the **Operational log** element in the navigation window of the **Message Logs** menu.

The **Operational log** input/output window opens.
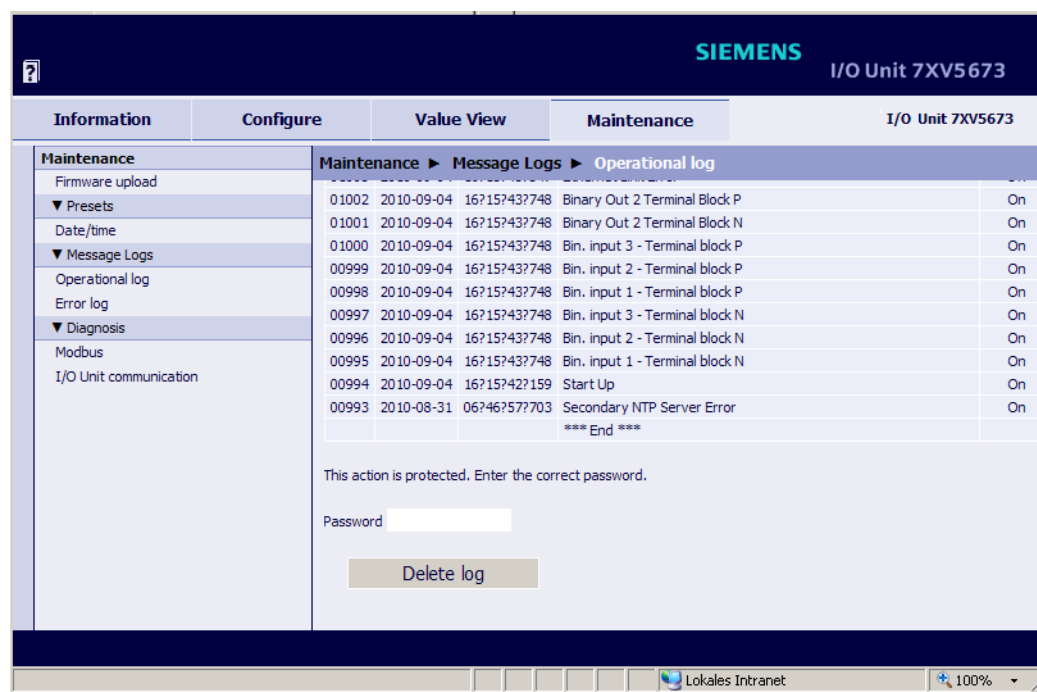
Figure 6-56   Maintenance Tab, Delete Log

✧ 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. 00001 appears in the column **Information**: "Clear Operational Log".

NOTE

If you need the operational indications, for example for subsequent analysis, save or print them out as described in chapter 6.2.5.2.

6.5.3.2 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:

✧ Click the **Error log** element in the navigation window of the **Message Logs** menu.

The **Error log** input/output window opens.
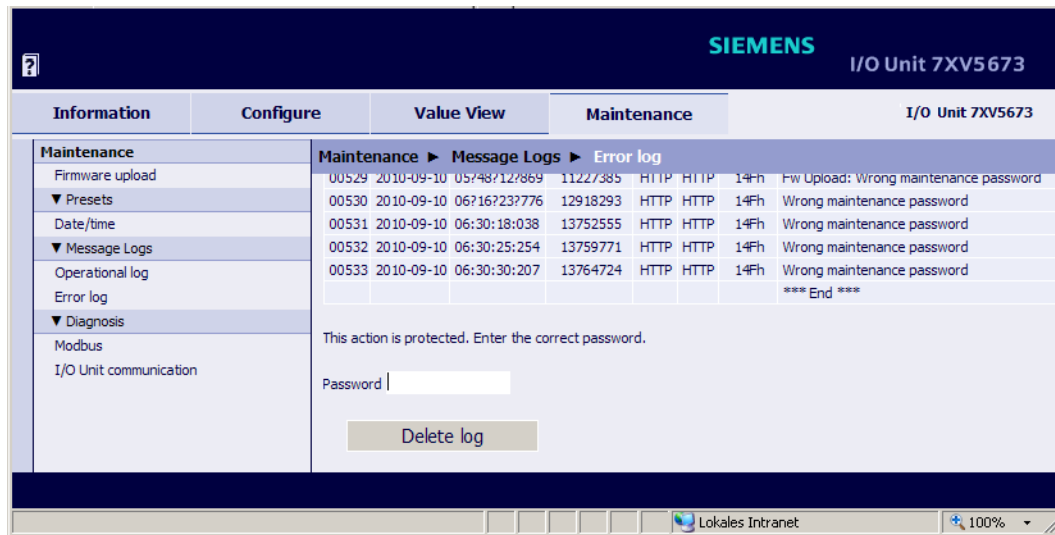
Figure 6-57   Maintenance Tab, Delete Error log

✧ 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. 00001 appears in the column **Description**: ***Error Log Cleared***.

> **NOTE**
>
> If you need the error messages, for example for subsequent analysis, save or print them out as described in chapter 6.2.5.2.

6.5.4 Diagnosis

6.5.4.1 Diagnosis Modbus TCP

> **NOTE**
>
> The data for diagnosing Modbus TCP are only displayed if you have selected these bus protocol on the **Con-figure** tab → **Operational** menu → **Administrative** submenu → **Communication Ethernet** item.
>
> For protocols that are not selected, the **Diagnosis Modbus** input/output window shows the entry **-none-**.

✧ Click the **Modbus** element in the navigation window of the **Diagnosis** menu.

The **Modbus TCP** input/output window opens up. An analysis of the **Standard server**, the **User port server** and of the **Connection Parameters** is displayed for Modbus TCP.

Figure 6-58   Maintenance Tab, Diagnosis Modbus Input/Output Window, Protocol Modbus TCP

✧ 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.

> **NOTE**
>
> The chapter 8.2.9.1 gives more details about diagnosing Modbus.

6.5.4.2 Diagnosis Modbus UDP

> **NOTE**
>
> The data for diagnosing Modbus UDP are only displayed if you have selected these bus protocol on the **Configure** tab → **Operational** menu → **Administrative** submenu → **Communication Ethernet** item.
>
> For protocols that are not selected, the **Diagnosis Modbus** input/output window shows the entry **-none-**..

✧ Click the **SICAM I/O Unit communication** element in the navigation window of the **Diagnosis** menu.

The **SICAM I/O Unit communication** input/output window opens and the **Modbus UDP** protocol is displayed under **Communication Ethernet**. An analysis of the **Parameter**, **Counter**, **Transmission and error rate** and of the **Server** is performed for **Modbus UDP**.
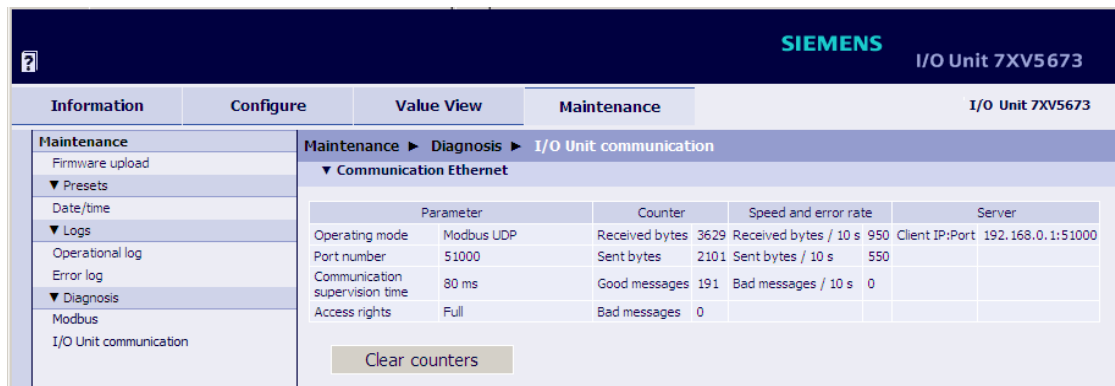
Figure 6-59   Maintenance Tab, Diagnosis SICAM I/O Unit Communication Input/Output Window, Protocol Modbus UDP

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

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

> **NOTE**
>
> The chapter 8.2.9.2 gives more details about diagnosing Modbus.

6.5.4.3 Diagnosis Modbus RTU

NOTE

The data for diagnosing **Modbus RTU** are only displayed if you have selected these bus protocol on the **Configure** tab → **Operational** menu → **Administrative** submenu → **Communication Serial** item.

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

✧ Click the **Modbus** element in the navigation window of the **Diagnosis** menu.

The **Modbus** input/output window opens and the **Modbus RTU** protocol is displayed. An analysis of the **Parameter, Serial interface** and of the **Serial server** is performed for **Modbus RTU**.
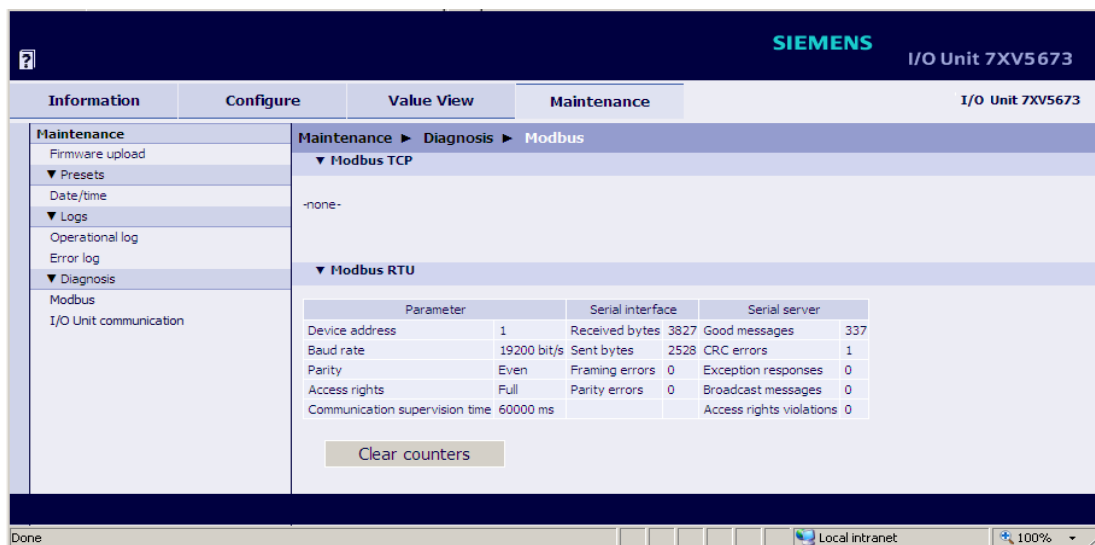
Figure 6-60   Maintenance Tab, Diagnosis Modbus Input/Output Window, Protocol Modbus RTU

✧ 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 8.2.9.3 gives more details about diagnosing Modbus.

6.5.4.4 Diagnosis I/O Mirror

> **NOTE**
>
> The diagnostic data in **I/O Mirror server** or **I/O Mirror client** mode are only displayed if the parameterized mode was selected in the **Configure** tab → **Operational parameters** menu → **Administrative** submenu → **Communication Ethernet** or **Communication Serial** element.
>
> For protocols that were not selected, the entry **-none-** appears in the **Diagnosis SICAM I/O Unit communication** input/output window.

Ethernet Communication

Prerequisite for diagnosis: The **I/O Mirror client** or **I/O Mirror server** mode was selected in the **Configure** tab, under **Communication Ethernet** (see chapter 6.3.3.6).

✧ Click the **SICAM I/O Unit communication** element in the navigation window of the **Diagnosis** menu.

The **SICAM I/O Unit communication** input/output window opens and displays an analysis of the **Communication Ethernet** in the parameterized mode.

Figure 6-61 Maintenance Tab, Diagnosis SICAM I/O Unit Communication, Communication Ethernet

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

All counters in the **Communication Ethernet** section are reset to zero.

> **NOTE**
>
> For further information regarding the diagnosis of I/O Mirror via Ethernet, refer to chapter 8.3.3.1 (Communication Ethernet, I/O Mirror Client) and in chapter 8.3.3.2 (Communication Ethernet, I/O Mirror Server).

Serial Communication

Prerequisite for diagnosis: The **I/O Mirror client** or **I/O Mirror server** mode was selected in the **Configure** tab, under **Communication Serial** (see chapter 6.3.3.8).

✧ Click the **I/O Communication** element in the navigation window of the **Diagnosis** menu.

The **I/O communication** input/output window opens and displays an analysis of **Communication Serial** in parameterized mode.

Figure 6-62   Maintenance Tab, Diagnosis Communication SICAM I/O Unit Input/Output Window, Serial Communication

✧ To clear the counters for **Communication Serial**, click **Clear counters** in the **Communication Serial** section of the input/output window.

All counters in the **Communication Serial** section are reset to zero.

NOTE

For further information regarding the diagnosis of the serial I/O mirror, refer to chapter 8.3.3.3 (Communication Serial, I/O Mirror Client) and in chapter 8.3.3.4 (Communication Serial, I/O Mirror Server).

6.5.4.5 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.
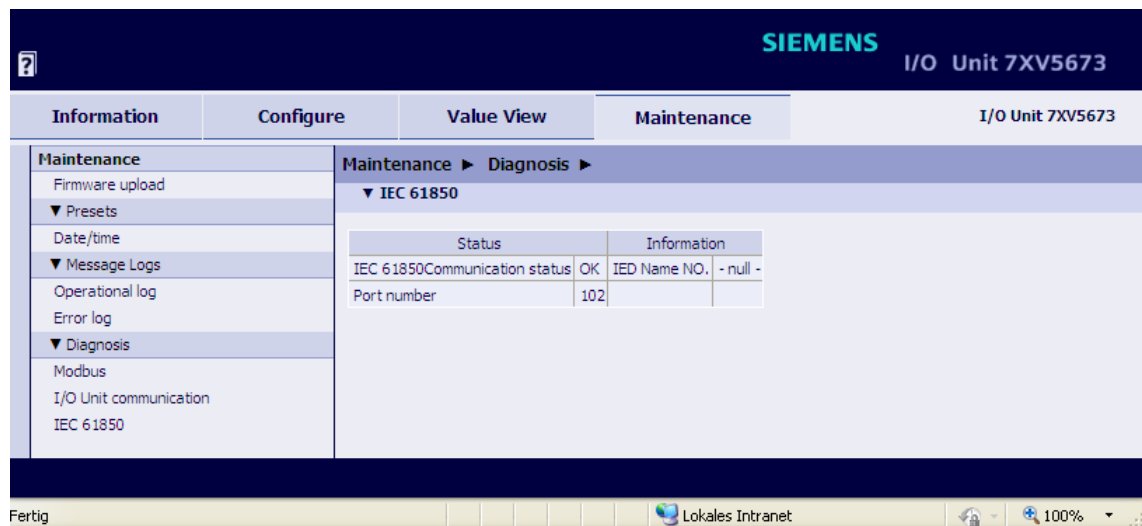
Fig. 6-63   Maintenance Tab, Diagnosis IEC 61850 Input/output Window

> **NOTE**
>
> The chapter 8.4.4 provides more details on diagnosing IEC 61850.

6.6 Examples for Parameterization

NOTE

In the following examples, only the typical settings for the respective parameterization are described. General settings, such as time synchronization, language, or the activation of the set of parameters, are described in chapter 6.

The following default settings are assumed in the parameter examples:

- Cabling of the device or of the devices according to the respective application (see chapter 4.3 and chapter 4.7.1)
- Set IP address for communication via Ethernet (see chapter 4.7.2 and chapter 6.3.3.6)

  When assigning the IP address make sure that this address is only assigned once in the communication network (see chapter 6.2.1).

Parameterization is always via the Ethernet interface – locally or via communication.

Binary inputs and outputs that are not connected are insignificant for the parameterization.

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6.6.1 Application as Modbus Server via the Ethernet Connection

Conceptual Formulation

- ✧ Carry out parameterization, using the factory settings.

- ✧ Parameterize the threshold voltages of the 6 binary inputs.

- ✧ Parameterize the messages and modes of the 6 binary outputs (relay outputs).

- ✧ Use the hardware configuration according to Figure 5-3 without I/O expansion.

Factory Setting of the Ethernet Communication via Modbus TCP

NOTE

Please note the Modbus data mapping in chapter 8.2.8.
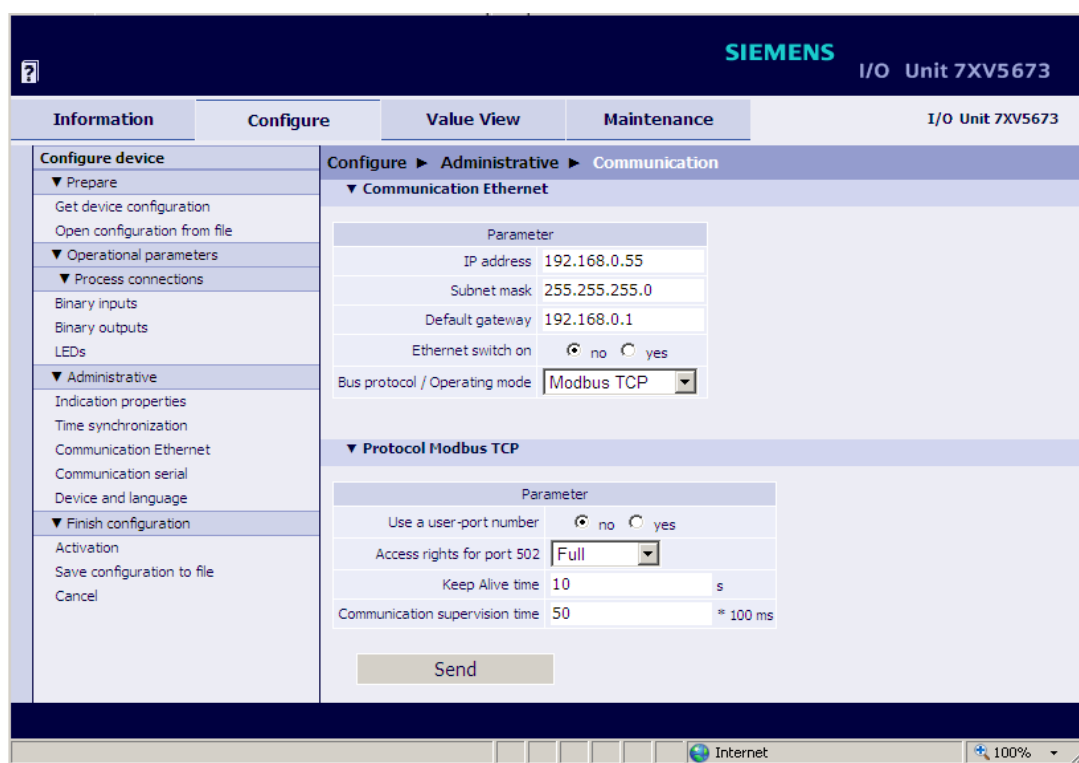
Figure 6-64   Default Setting Ethernet Communication

Setting of the 6 Binary Inputs with Different Threshold Value Voltages
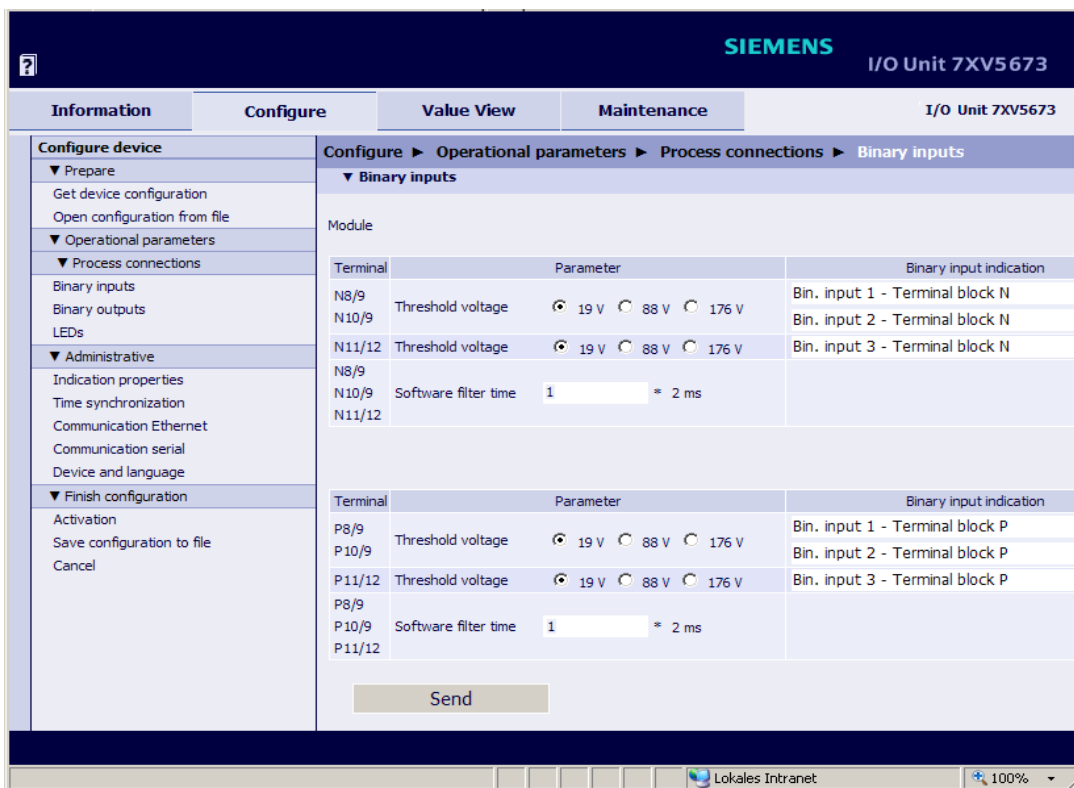
Figure 6-65   Settings of the 6 Binary Inputs

Routing of Indications from Remote to the 6 Binary Outputs with Various Modes
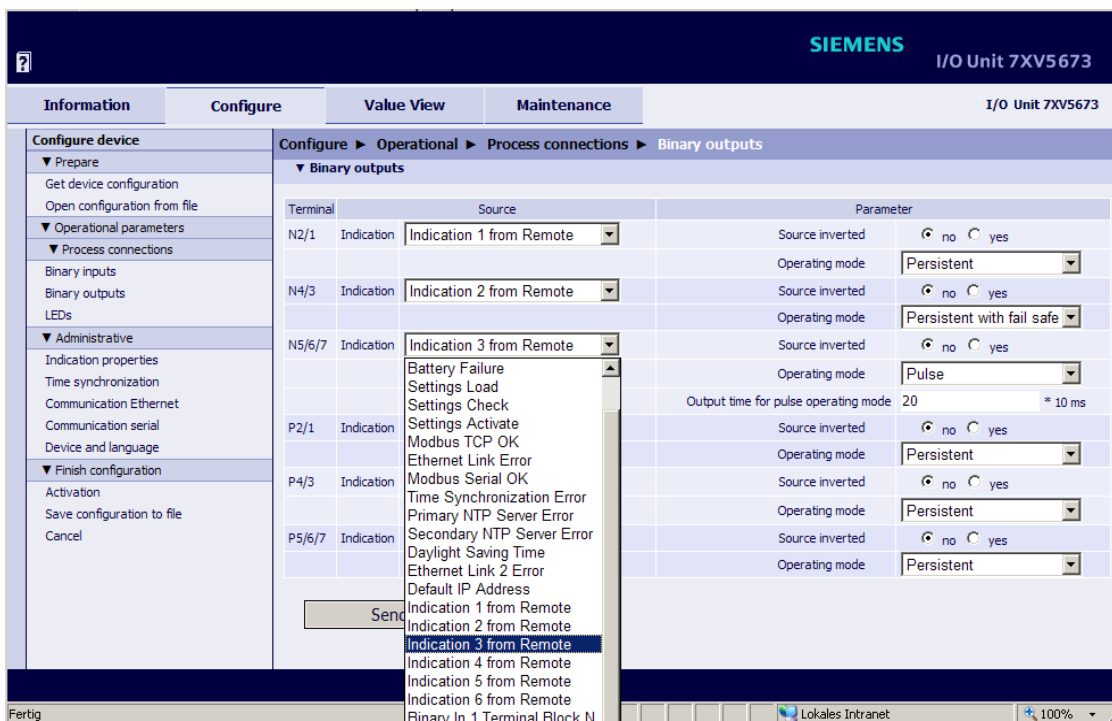
Figure 6-66   Settings of the 6 Binary Outputs

6.6.2   Application as Modbus Server via Serial RS485 Connection

Conceptual Formulation

✧ Carry out parameterization, using the factory settings.

✧ Parameterize the threshold voltages of the 6 binary inputs.

✧ Parameterize the messages and modes of the 6 binary outputs (relay outputs).

✧ Use the hardware configuration according to Figure 5-3 without I/O expansion, without Ethernet communication, and with serial communication via RS485 interface.

Factory Setting of the Serial Communication via RS485 Interface via Modbus RTU

> **NOTE**
>
> Please note the Modbus data mapping in chapter 8.2.8.
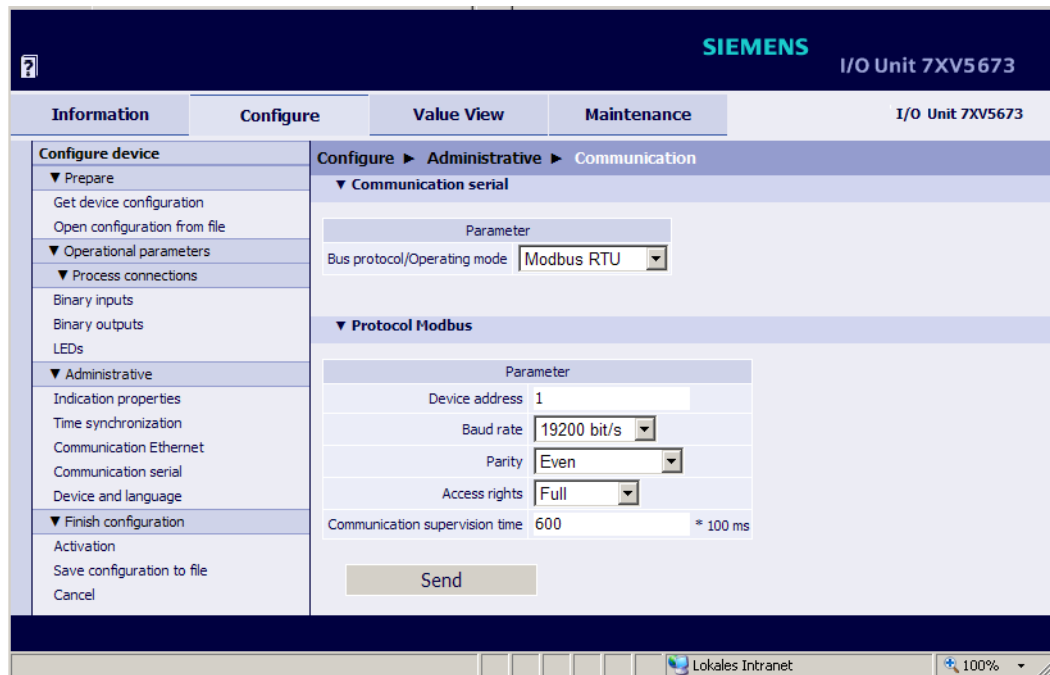
Figure 6-67   Default Setting Serial Communication (RS485 Interface)

Setting of the 6 Binary Inputs

✧ Parameterize the threshold value voltages of the binary inputs according to Figure 6-65.

Routing of Indications from Remote to the 6 Binary Outputs

✧ Parameterize the indications and modes of the binary outputs according to Figure 6-66.

6.6.3 Application as I/O Mirror via Ethernet Connection

Conceptual Formulation

✧ Parameterize 2 SICAM I/O Units using the factory settings; one SICAM I/O Unit acts as I/O mirror server and one SICAM I/O Unit as I/O mirror client.

✧ Parameterize the threshold voltages of the 6 binary inputs.

✧ Parameterize the indications and modes of the 6 binary outputs (relay outputs).

✧ If the port numbers set by default in the SICAM I/O Units in the network are blocked, change them. The port numbers of the SICAM I/O Unit – server and of the SICAM I/O Unit – client have to be identical.

✧ Enter the server IP address in the I/O mirror client.

✧ Use the hardware configuration according to Figure 5-1 with Ethernet connection.

Setting of the SICAM I/O Unit – Server with Ethernet Communication in I/O Mirror Server Mode
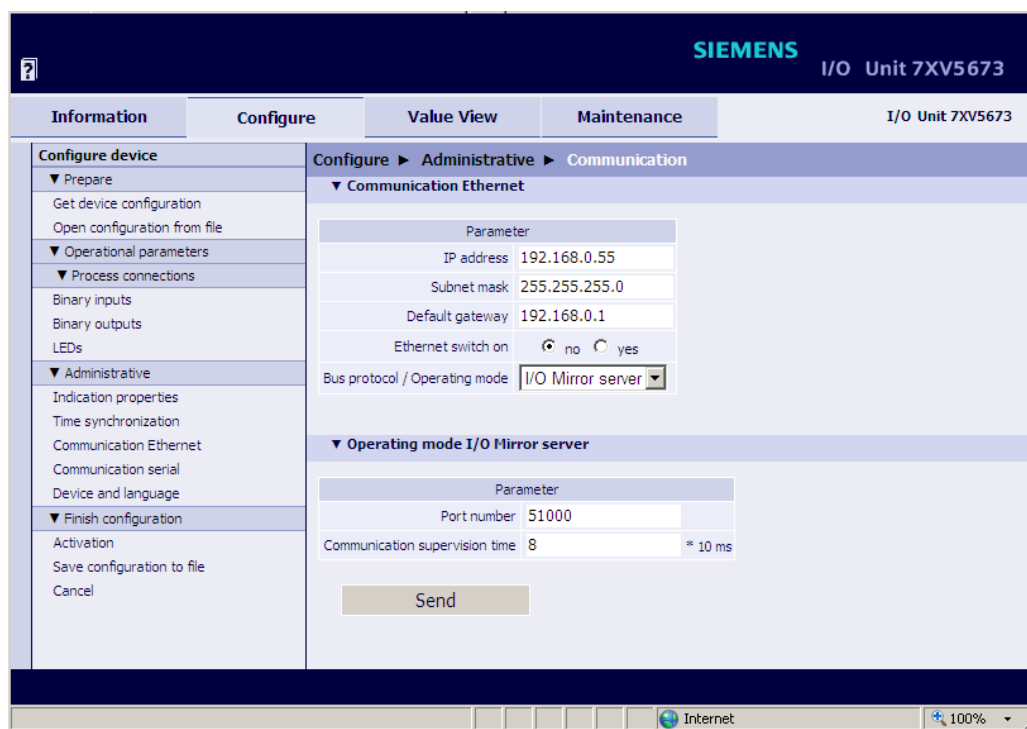
Figure 6-68   Setting of the Ethernet Communication for I/O Mirror Server

Setting of 6 Binary Inputs of the SICAM I/O Unit – Server

✧ Parameterize the threshold value voltages of the binary inputs according to Figure 6-65.

Route the Indications from Remote to the 6 Binary Outputs of the SICAM I/O Unit – Server

✧ Parameterize the indications and modes of the binary outputs according to Figure 6-66.

Setting of the SICAM I/O Unit – Client with Ethernet Communication in I/O Mirror Client Mode
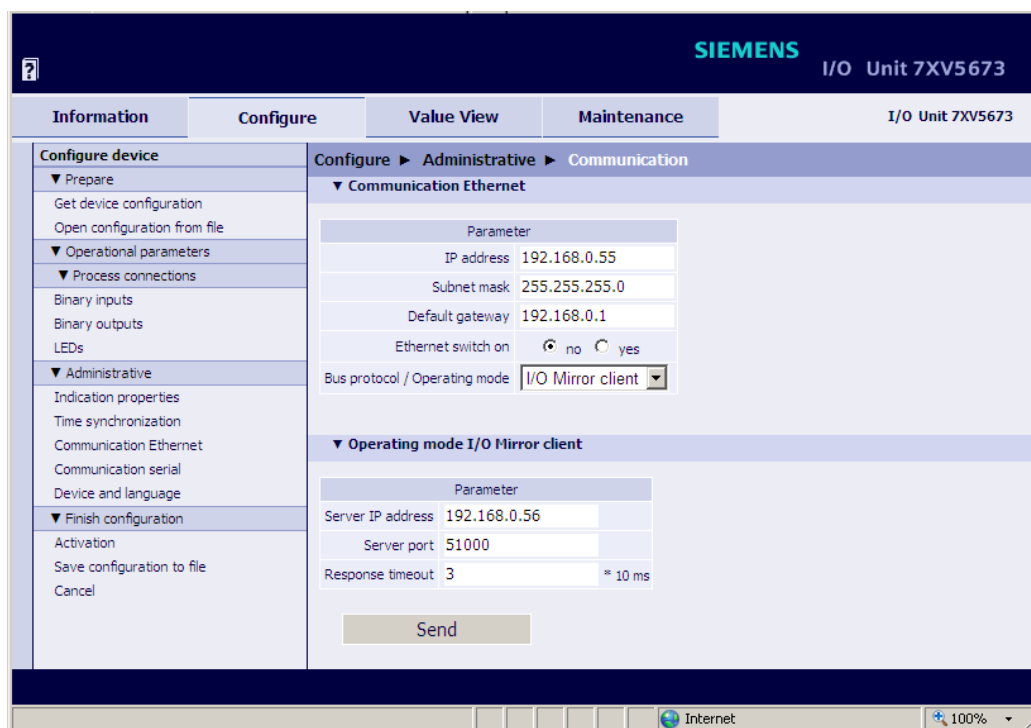
Figure 6-69   Setting of the Ethernet Communication for I/O Mirror Client

Setting of 6 Binary Inputs of the SICAM I/O Unit – Client

✦   Parameterize the threshold value voltages of the binary inputs according to Figure 6-65.

Route the Indications from Remote to the 6 Binary Outputs of the SICAM I/O Unit – Client

✦   Parameterize the messages and modes of the binary outputs according to Figure 6-66.

NOTE

Please note, that when parameterizing the SICAM I/O Unit – client, its **IP address** has to differ from the **Server IP address** of the SICAM I/O Unit – server. If necessary, change the **IP address** of the SICAM I/O Unit – client.

6.6.4 Application as I/O Mirror via the Optical Fiber Connection, Bidirectional

Conceptual Formulation

- ✧ Parameterize 2 SICAM I/O Units using the factory settings; one SICAM I/O Unit acts as I/O mirror server and one SICAM I/O Unit as I/O mirror client.

- ✧ Parameterize the threshold voltages of the 6 binary inputs.

- ✧ Parameterize the indications and modes of the 6 binary outputs (relay outputs).

- ✧ Parameterize whether you want to send time synchronization telegrams or not.

- ✧ Use the hardware configuration according to Figure 5-1 with FO connection.

Setting of the SICAM I/O Unit – Server with Serial Optical Communication, I/O Mirror Server Mode
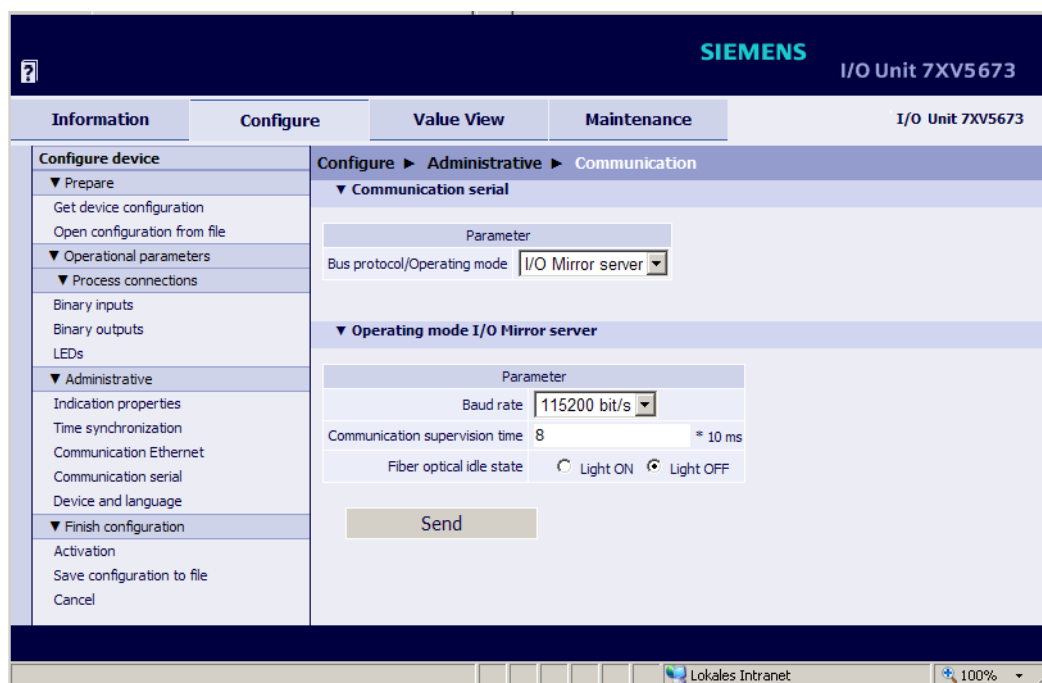
Figure 6-70   Setting of the Serial Optical Communication for I/O Mirror Server

NOTE

Please note, that the **Communication supervision time** has to be set depending on the **Baud rate**, see chapter 8.3.2.2, Table 8-10.

Setting of 6 Binary Inputs of the SICAM I/O Unit – Server

- ✧ Parameterize the threshold value voltages of the binary inputs according to Figure 6-65.

Route the Indications from Remote to the 6 Binary Outputs of the SICAM I/O Unit – Server

- ✧ Parameterize the indications and modes of the binary outputs according to Figure 6-66.

Setting of the SICAM I/O Unit – Client with Serial Optical Communication, I/O Mirror Client Mode
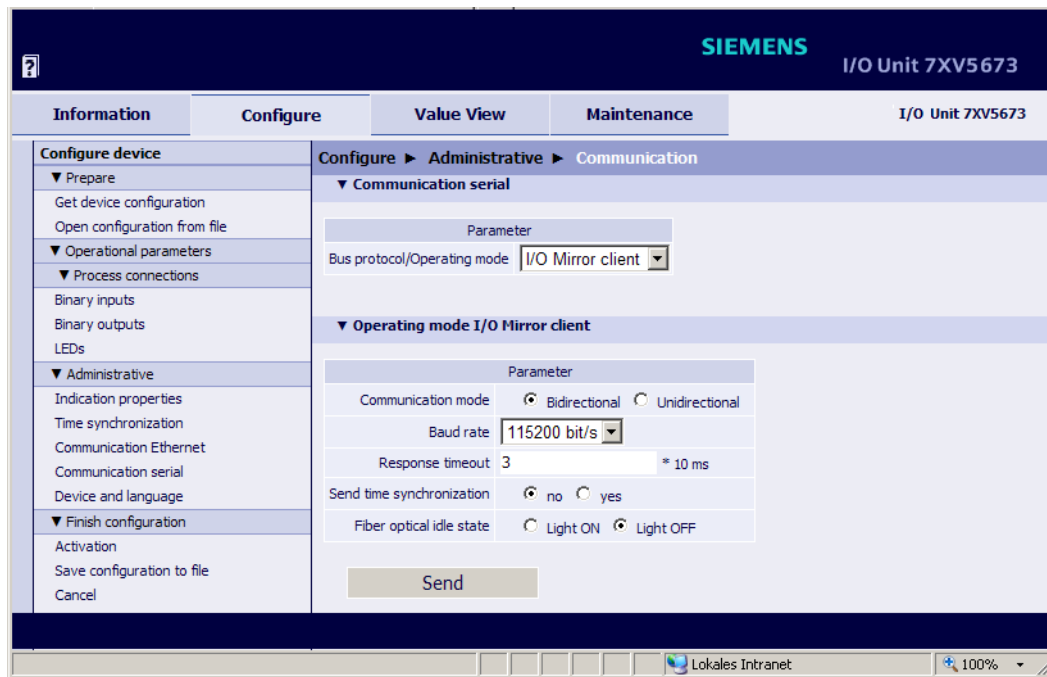
Figure 6-71   Setting of the Serial Optical Communication for I/O Mirror Client

---

NOTE

Please note, that the **Response timeout** in the **Communication mode Bidirectional** has to be set depending on the **Baud rate**, see chapter 8.3.2.1, Table 8-8.

Setting of 6 Binary Inputs of the SICAM I/O Unit – Client

✦   Parameterize the threshold value voltages of the binary inputs according to Figure 6-65.

Route the Indications from Remote to the 6 Binary Outputs of the SICAM I/O Unit – Client

✦   Parameterize the indications and modes of the binary outputs according to Figure 6-66.

6.6.5 Application as I/O Mirror via Serial RS485 Connection, Unidirectional

Conceptual Formulation

 ✧ Parameterize 2 SICAM I/O Units using the factory settings; one SICAM I/O Unit acts as I/O mirror server and one SICAM I/O Unit as I/O mirror client.

 ✧ Parameterize the threshold voltages of the 6 binary inputs.

 ✧ Parameterize the indications and modes of the 6 binary outputs (relay outputs).

 ✧ Parameterize the SICAM I/O Unit – client for unidirectional transmission.

 ✧ Use the hardware configuration according to Figure 5-2 with RS485 interface and with only one server.

Setting of the SICAM I/O Unit – Server with Serial Communication (RS485), I/O Mirror Server Mode
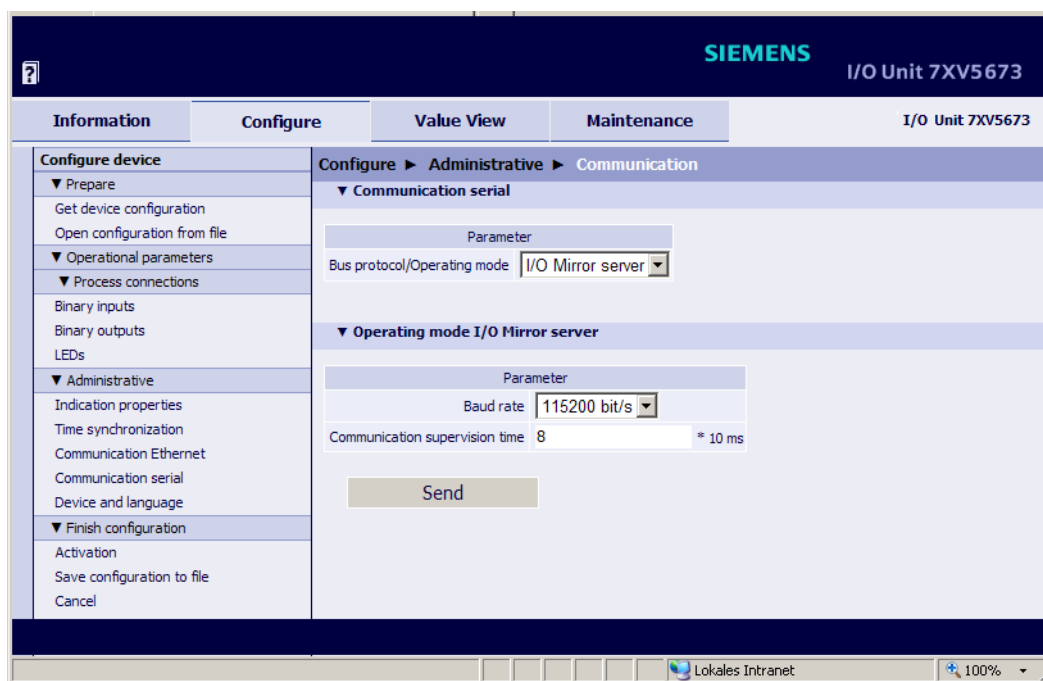
Figure 6-72   Setting of the Serial Communication (RS485) for I/O Mirror Server

NOTE

Please note, that the **Communication supervision time** has to be set depending on the **Baud rate**, see chapter 8.3.2.2, Table 8-10.

Setting of 6 Binary Inputs of the SICAM I/O Unit – Server

 ✧ Parameterize the threshold value voltages of the binary inputs according to Figure 6-65.

Route the Indications from Remote to the 6 Binary Outputs of the SICAM I/O Unit – Server

 ✧ Parameterize the indications and modes of the binary outputs according to Figure 6-66.

Setting of the SICAM I/O Unit – Client with Serial Communication (RS485), I/O Mirror Client Mode
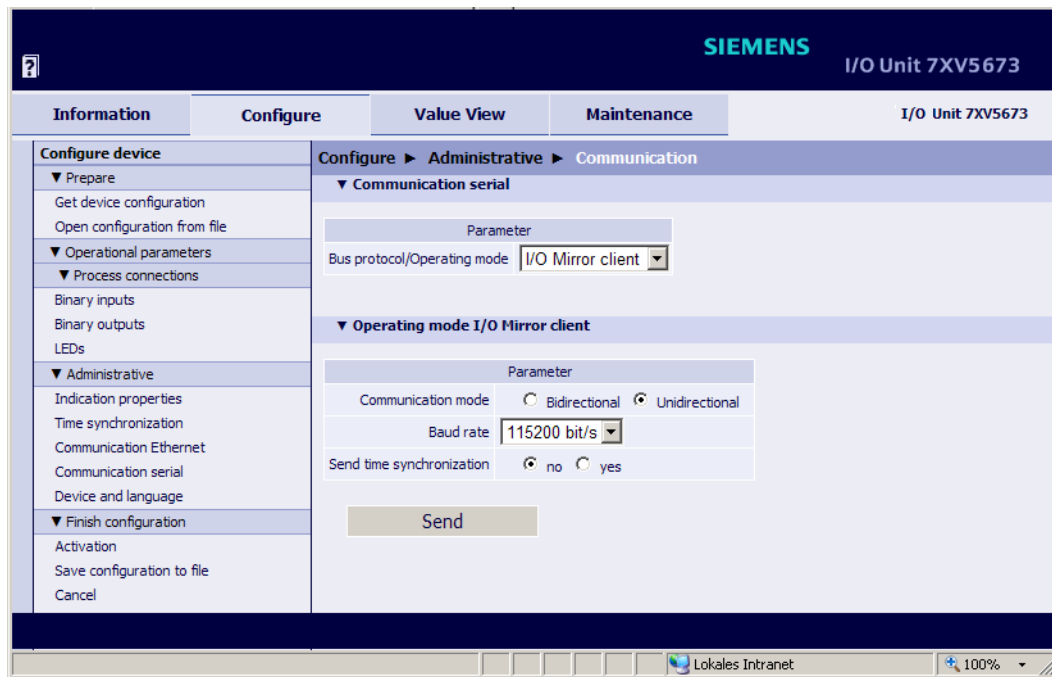
Figure 6-73   Setting of the Serial Communication (RS485) for I/O Mirror Client

Setting of 6 Binary Inputs of the SICAM I/O Unit – Client

✧   Parameterize the threshold value voltages of the binary inputs according to Figure 6-65.

Route the Indications from Remote to the 6 Binary Outputs of the SICAM I/O Unit – Client

Parameterize the messages and modes of the binary outputs according to Figure 6-66.

NOTE

If you operate several servers in parallel on one client, as shown in Figure 5-2, all servers have to be parameterized with the same settings.

6.6.6 Application as Contact Multiplier

Conceptual Formulation

◇ Parameterize the threshold value voltage of the binary input terminals N8/9 and change the name for the binary input indication.

◇ Route the binary input terminals N8/9 to the 2 binary outputs (relay outputs) terminals N2/1 and N4/3 with various modes.

◇ Parameterize the threshold value voltage of the binary input terminals P10/9 and change the name for the binary input indication.

◇ Route the binary input terminals P10/9 to the 4 binary outputs (relay outputs) terminals N5/6/7, P2/1, P4/3, and P5/6/7 with various modes.

◇ Use the hardware configuration according to Figure 5-5.

NOTE

In order to be able to better identify the substation-specific identification of the messages, Siemens recommends assigning individual names for the binary input indications. The default names set by the factory can also be kept.

Setting of Binary Inputs

Figure 6-74   Binary Input Settings

Route 2 Binary Inputs to the 6 Binary Outputs
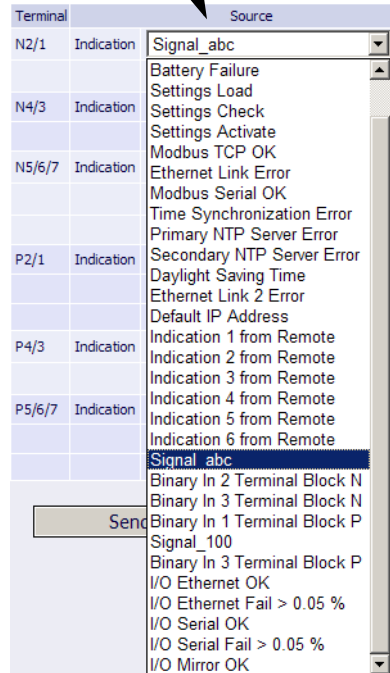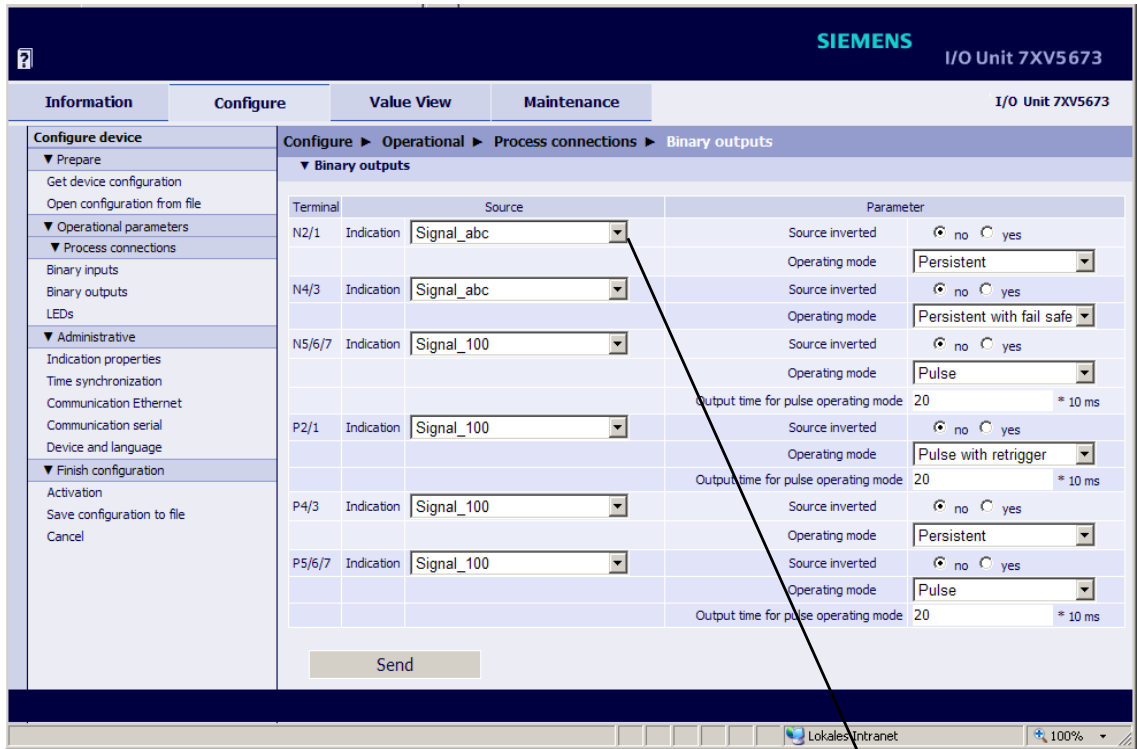
Figure 6-75   Binary Output Settings and Listbox

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E50417-H1040-C484-A3, Edition 05.2012

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7 Time Synchronization

7.1 General

During operation, SICAM I/O 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 I/O Unit is necessary to guarantee a common time basis for the communication with peripheral devices and time stamping of the process data.

SICAM I/O Unit supports both external and internal time synchronization. The type of time synchronization is specified during the parameterization (see chapter 6.3.3.5).

7.2 Internal Time Keeping

7.2.1 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 for example 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 6.3.3.5).

7.2.2 Status Bits

FAIL Status Bit

The **FAIL** status bit implemented in the SICAM I/O 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 12.

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 2007-09-26, time 13:49.35246*:

Table 7-1   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

NOTE

When time output contains "?", there will be no time synchronization. In this case, first of all, parameterize the **Source of the time synchronization** "**Internal**" and afterwards the desired time synchronization source again.

DST Status Bit

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

7.3 External Time Synchronization via Ethernet NTP

General

To synchronize the time via an external source, SICAM I/O 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 6.3.3.5 describes how to set the parameters of the two 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 (Real-Time Clock) 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 12.

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 6-31) 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 6.3.3.5.

SICAM I/O 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 I/O 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 12.

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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 parameterization of time is described in detail in chapter 6.3.3.5, section Time Synchronization via Ethernet NTP. For information regarding the data format, refer to chapter 8.2.7.1 and chapter 8.2.8.4.

7.4 External Time Synchronization via Fieldbus

If the device is connected with systems control via the serial FO or the RS485 interface through the **Modbus RTU** protocol, then the external time synchronization is used via fieldbus.

The time information can also be transmitted from the systems control via **Modbus TCP** or **Modbus UDP** using Ethernet. When using the Ethernet connection, we recommend, however, to synchronize the device from an NTP server, see chapter 7.3.

For external time synchronization via fieldbus, a telegram is sent cyclically from the client to the device every minute, together with the time information.

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

> **NOTE**
>
> The parameterization of time is described in detail in chapter 6.3.3.5, section Time Synchronization via Fieldbus (Modbus). For information regarding the data format, refer to chapter 8.2.7.1 and chapter 8.2.8.4.

7.5 Internal Time Synchronization via RTC

Besides external time synchronization, the internal time synchronization is also possible using the battery-buffered RTC. The SICAM I/O 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 parameterization of time is described in detail in chapter 6.3.3.5, section Internal Time Synchronization. For information regarding the data format, refer to chapter 8.2.7.1 and chapter 8.2.8.4.

8 Communication

8.1 Communication Features

The SICAM I/O Unit supports communication via Ethernet and, depending on version, via the serial FO or the RS485 interface.

If parameterized accordingly, communication can be performed in parallel via the Ethernet interface and <u>simultaneously</u> via the serial interface. In doing so, it is for example possible to parameterize via Ethernet interface and to read out data, whilst the protocol traffic with a client is running via the serial interface or while the I/O mirror is active.

8.1.1 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 (Modbus TCP server is implemented in the SICAM I/O Unit)
- Data exchange with connected devices via Modbus UDP (Modbus UDP server and Modbus UDP client is implemented in the SICAM I/O Unit)
- Data exchange between 2 SICAM I/O Units via Modbus UDP as point-to-point I/O mirror
- Data exchange with connected devices via IEC 61850 (GOOSE, MMS, Reporting)

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

8.1.1.1 TCP/IP Protokol Stack

SICAM I/O Unit supports the following TCP/IP services:

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

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8.1.1.2 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 gateway.

The device comes delivered with a default IP address that can be restored at any time by pressing the IP-Addr. 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 8-1:

Default IP Address : 192.168.0.55
Default Subnet Mask : 255.255.255.0
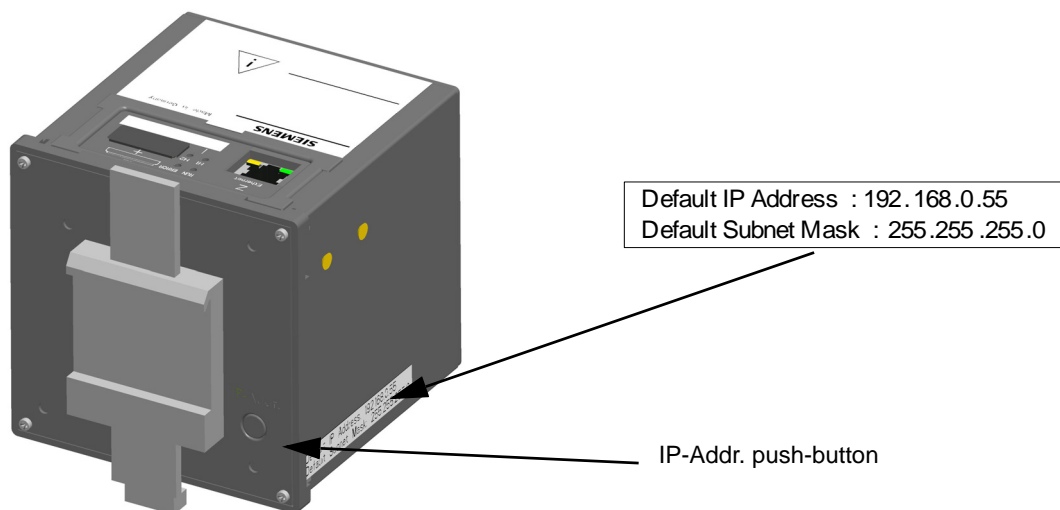
IP-Addr. push-button

Figure 8-1   With IP-Addr. Push-Button on the Side of the DIN Rail

Default IP Address and IP-Addr. Push-button

To set the default IP address assigned as factory setting, there is the IP-Addr. push-button on the bottom right of the case on the side of the DIN rail (see Figure 8-1). When pressed (> 3 s), this button activates the factory-set default IP address. After pressing the IP-Addr. 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 6.3.3.6). After a renewed restart the parameterized network configuration is used again.

Check for Twice Assigned IP Address

An IP address assigned twice, leads to serious malfunction in the 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 10.3) 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 needs 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.

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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 6.3.3.6), 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 4.7.2) and assign a permanent IP address.

8.1.1.3 Ethernet Interface with internal Ethernet Switch

SICAM I/O 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.
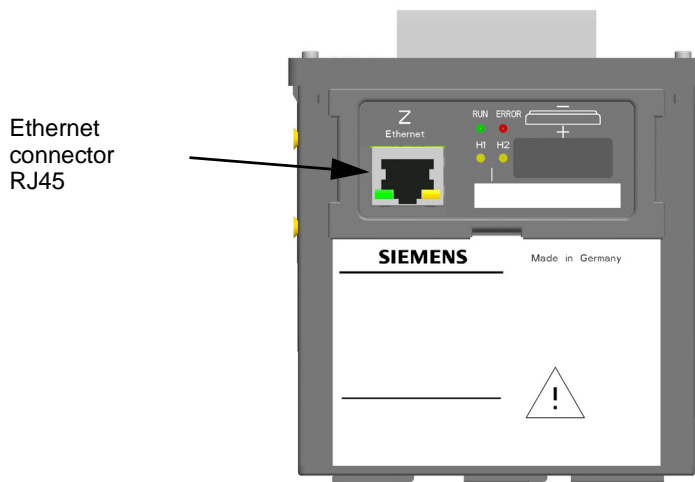
Figure 8-2   RJ45 Ethernet Plug Connector

Since the SICAM I/O 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: 100BaseT (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

8.1.2　Serial Communication

As per order reference, the SICAM I/O Unit has a serial FO or RS485 interface and can therefore communicate in series with peripheral devices via Modbus RTU. The serial interface supports:

- Transfer of messages
- Time Synchronization
- Data exchange between 2 SICAM I/O Units via Modbus RTU as point-to-point I/O mirror

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: 1 min

You can modify these parameters during the parameterization, see chapter 6.3.3.8.

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

Data of the FO Interface when Using the Modbus RTU Protocol

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

- Bus protocol: Modbus RTU
- Device address: 1
- Baud rate: 19 200 bit/s
- Parity: Even
- Access rights: Full
- Communication supervision time: 1 min
- Fiber optical idle state: Light off

You can modify these parameters during the parameterization, see chapter 6.3.3.8.

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

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Location of the RS485 Interface on the Device
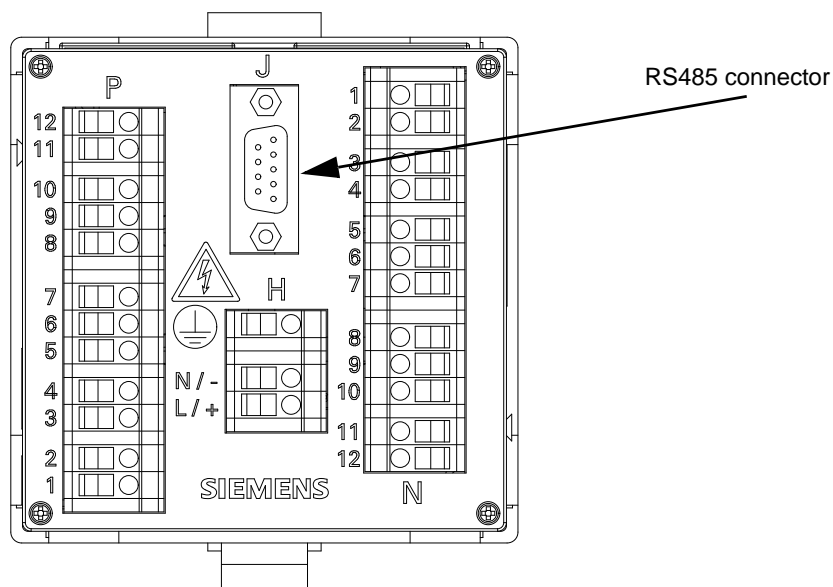
Figure 8-3   RS485 Interface of I/O Unit 7XV5673-0JJ10-1AA1
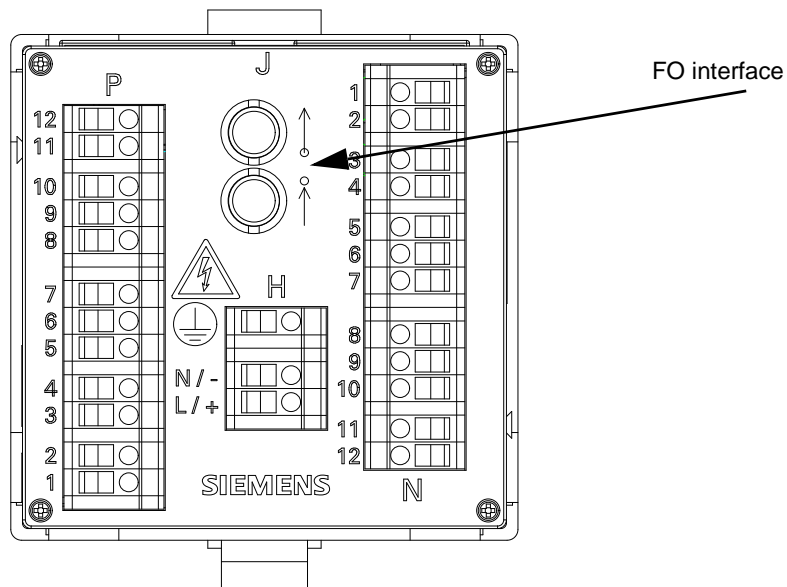
Figure 8-4   FO Interface of I/O Unit 7XV5673-0JJ20-1AA1

NOTE

The pin assignment of the RS485 plug connector is described in chapter 11.1.3.

8.2 Modbus

For the communication via the Ethernet interface, the Modbus TCP protocol or Modbus UDP protocol is used. For serial FO and RS485 interface, the Modbus RTU protocol is used. 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

The following features are implemented in the SICAM I/O Unit:

- Modbus TCP server
- Modbus UDP server
- Modbus UDP client (only I/O mirror function)
- Modbus RTU master (only I/O mirror function)
- Modbus RTU slave
- Support of the Modbus function codes 3, 6, 16, and 23
- Support of the data types: ASCII strings, date/time, indications, controllable indications, and command

8.2.1 Modbus Functions

NOTE

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

The Modbus server of SICAM I/O Unit supports the following Modbus functions:

Table 8-1 Supported Modbus Functions

Function Number	Function Name	Description
03 (03H)	Read Holding Registers	Reading one or more holding registers from the Modbus server Up to 125 registers can be read with one message.
06 (06H)	Preset Single Register	Writing of value in a single holding register Function 16 is used for writing several holding registers via a Modbus telegram.
16 (10H)	Preset Multiple Registers	Writing of values in several holding register (sequential) A maximum of 123 registers can be written with a telegram.
23 (17H)	Read/Write 4x Registers	Combination of writing (request indication) and reading (answer indication) in one or more holding registers; writing and reading do not have to take place in the same register.

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8.2.2 Exception Responses

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

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

The messages contain the following codes:

Exception-Code 01   ILLEGAL_FUNCTION

- The Modbus client uses a function that is not supported by the Modbus server of the SICAM I/O Unit (the supported Modbus functions are listed in chapter 8.2.1).

Exception-Code 02   ILLEGAL_DATA_ADDRESS

- An attempt is made to read out or write to a nonexistent Modbus register (see chapter 8.2.8, 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 8.2.8).

Exception-Code 03   ILLEGAL_DATA_VALUE

- The Modbus client addresses a register, for which the access to partial data was not released.
- The Modbus client attempts to write to the Modbus server for which the access rights are set to "read only".
- The Modbus client, the I/O mirror server, or the I/O mirror client (Ethernet or serial) tries to control the writing of the **Indication from Remote** indication into the register of the SICAM I/O Unit. If the SICAM I/O Unit is configured as I/O mirror server or I/O mirror client (apart from I/O mirror server, serial, unidirectional), the **Indication from Remote** indication is only controlled via the I/O mirror.

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).

8.2.3 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 (see Table 8-2).
- 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.
- 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 TCP data packet has a maximum size of 260 bytes:
  - 253 bytes max. for data
  - 7 bytes for the Modbus TCP header

Parameterization

The following parameters can be set for the Modbus see also chapter 6.3.3.6:

Table 8-2   Modbus TCP Settings

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

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Number of Connections

Up to 4 TCP connections are possible:

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

8.2.4   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 8-3)
- 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 8-3   Modbus UDP Settings

Parameter	Default Setting	Settings
IP address	192.168.0.55	Any, 0.0.0.0 for DHCP
Subnet mask	255.255.255.0	Any
Default gateway	192.168.0.1	Any
Bus protocol	Modbus UDP	-
Port number	51000	10000 to 65535
Access rights	Full	Full Read only
Communication supervision time	8 * 10 ms	0 s = invalid 10 ms to 60 000 ms

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8.2.5 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 or FO 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:

Table 8-4   Modbus RTU Settings

Parameter	Default Setting	Settings
Device address	1	1 to 247
Baud rate	19 200 bit/s	1200 bit/s 2400 bit/s 4800 bit/s 9600 bit/s 19 200 bit/s 38 400 bit/s 57 600 bit/s 115 200 bit/s
Parity	Even	Even Odd None, 1 stop bit None, 2 stop bits
Access rights	Full	Full Read only
Communication supervision time	600 * 100 ms	0 s = none 100 ms to 6 553 400 ms

8.2.6 Register Assignment

The SICAM I/O Unit uses only holding registers. This is where all messages and commands are stored.

Each Modbus register set has an individual 6-digit identification number.

The holding register set has the identification number 4xxxxx and begins with the register number "1" (400001).

NOTE

The following descriptions only quote the last 4 digits of the holding register numbers, for example **0052** for 400052.

8.2.7 Data Types

NOTE

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

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

- ASCII string
- Date/time
- Indication (read only)
- Controllable indications (read and write)
- Commands

NOTE

The storage of variables of more complex data types in the Modbus holding register (that is, variables that are larger than a holding register) is performed according to the following arrangement:

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

8.2.7.1 Data Type - Date/Time

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

Milliseconds (0 to 59 999)	
Byte 1 (MSB)	Byte 0 (LSB)

Holding register 0065

Hours (0 to 23)	Minutes (0 to 59)
Byte 3	Byte 2

Holding register 0066

Month (1 = Jan. to 12 = Dec.)	Day (1 to 31)
Byte 5	Byte 4

Holding register 0067

Data/time status	Year (0 = 1900)
Byte 7	Byte 6

Holding register 0068
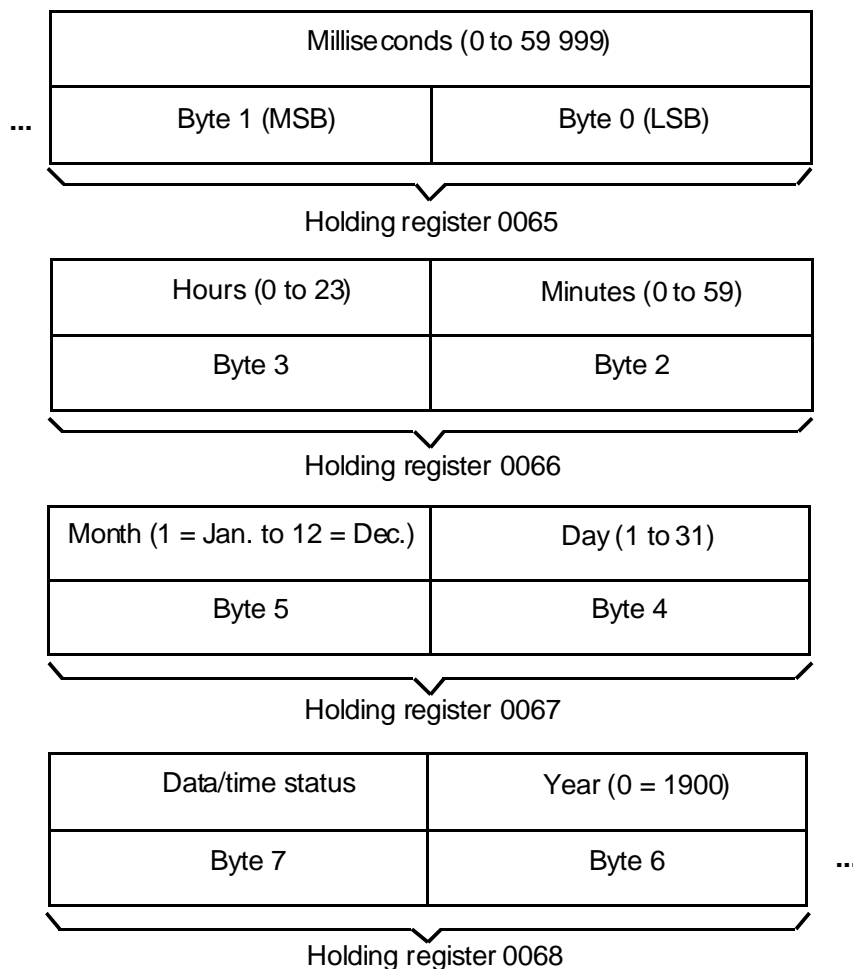
Date/Time Status

- 10H set: Daylight saving time active
- 20H set: Date/time error (equivalent to FAIL bit in Table 7-1)

NOTE

For the time synchronization via Ethernet, Siemens recommends the use of NTP, see chapter 7.

8.2.7.2 Data Type - Indications (Read Only)

The *Indications* data type is represented by 2 bits in holding registers

Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
Indication 8		Indication 7		Indication 6		Indication 5		Indication 4		Indication 3		Indication 2		Indication 1	
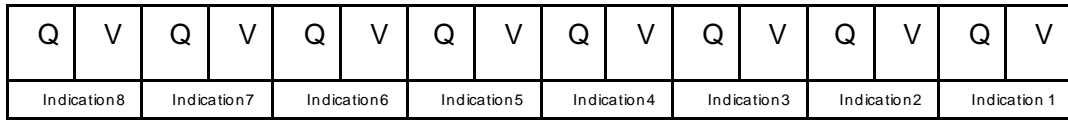
e.g. Holding register 0101

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 value. In the case of an invalid indication, the quality bit is set to "1". The value bit can be ignored in this case.

Example: "Indications from remote" are invalid until they are set via communication. In the case of communication failure, they automatically become invalid again.

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).

8.2.7.3 Data Type - Controllable Indications/Commands (Read/Write)

The *Controllable Indications* data type is needed for:

- The binary outputs of the SICAM I/O Unit (Indications from Remote)
- Execution of device internal commands (for example resetting of counter)

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

Use as Read Register

Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
Indication 8		Indication 7		Indication 6		Indication 5		Indication 4		Indication 3		Indication 2		Indication 1	
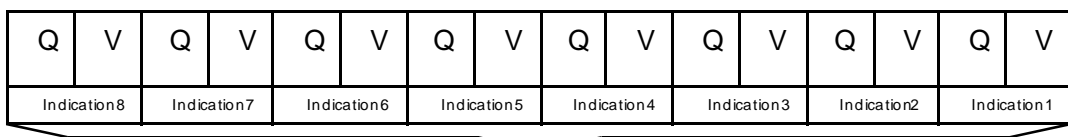
Holding register 0141

Where:

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

See also chapter 8.2.7.2.

Use as Write Register

ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
Indication 8		Indication 7		Indication 6		Indication 5		Indication 4		Indication 3		Indication 2		Indication 1	

Holding register 0141
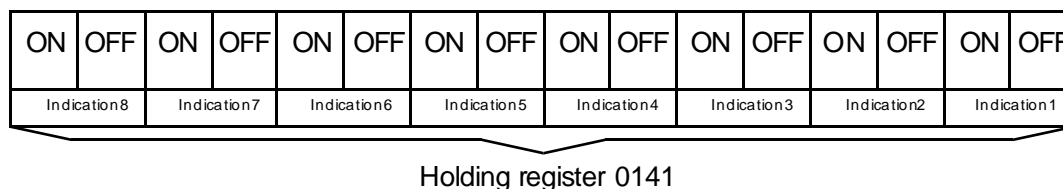
This data format enables up to 8 commands to be transmitted via the holding register for which the ON/OFF bits are set to either 0/1 or to 1/0. If these bits are set to 0/0 or 1/1, no evaluation will be performed.

8.2.8   Data in the Modbus Registers (Data Mapping)

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

The indications, values etc.are stored in holding registers. The existing register groups are described in the following chapters:

- Register 0001 to 0049: Device identification, for example device type and name, serial number (read only)
- Register 0050: Information on device configuration (read only)
- Register 0051: Information on inputs/outputs, for example number of binary inputs/outputs (read only)
- Register 0065 to 0068: Date and time (reading and writing)
- Register 0071 to 0089: Version information, for example boot firmware (read only)
- Register 0101: Indications regarding device status, for example battery fault (read only)
- Register 0131: Indications regarding status of relay outputs (read only)
- Register 0131: Indications regarding status of relay outputs (read only)
- Register 0141: Controllable messages *Indication from Remote* (read and write)

8.2.8.1   Register 0001 to 0049: Device Identification

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

Register	Type of information	Remark
0001 to 0008	Device type (string, max. 16 characters)	"IO_UNIT"
0009 to 0024	Device ordering code (string, max. 32 characters)	Example: "7XV56730JJ101AA1"
0025 to 0040	Device name from the configuration (string, max. 32 characters)	Example: "IO_UNIT #1"
0041 to 0049	Device serial number (string, max. 16 characters)	Example: "BF0904075879"

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8.2.8.2 Register 0050: Device Configuration

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

Register	Type of information	Remark
0050	Device configuration	1 = Modbus TCP/UDP or Modbus RTU 2 = I/O mirror

8.2.8.3 Register 0051 and 0052: Information to Inputs and Outputs

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

Register	Type of information	Remark
0051	Number of relay outputs	6 (for 7XV56730JJx01AA1)
0052	Number of binary inputs	6 (for 7XV56730JJx01AA1)

8.2.8.4 Register 0065 to 0068: Data 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 through 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

Register	Type of information	Remark
0065	Milliseconds	See chapter 8.2.7.1
0066	Hours/minutes	
0067	Month/day	
0068	Time status/year	

8.2.8.5 Register 0071 to 0089: Version Information

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

Register	Type of information	Remark
0071 to 0076	Boot version	For example „V01.10.01"
0077 to 0082	Firmware version	For example „V02.10.02"
0083 to 0089	Parameter set version	For example „V01.10.01"

8.2.8.6 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

Register	Type of information	Remark
$0101/2^0$	Device ready	1 = Device ready
$0101/2^2$	Battery failure	0 = Battery OK, 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 0101 and 0141 that are not shown can be read too during requests and return the value 0.

8.2.8.7 Register 0131: Status of Relay Outputs

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

Data type: Indication

Register	Type of information	Remark
$0131/2^0$	Relay output 1, terminal block N	Relay output 1 at the terminal block N, terminals N1/2
$0131/2^2$	Relay output 2, terminal block N	Relay output 2 at the terminal block N, terminals N3/4
$0131/2^4$	Relay output 3, terminal block N	Relay output 3 at the terminal block N, terminals N5/6/7
$0131/2^6$	Relay output 1, terminal block P	Relay output 1 at the terminal block P, terminals P1/2
$0131/2^8$	Relay output 2, terminal block P	Relay output 2 at the terminal block P, terminals P3/4
$0131/2^{10}$	Relay output 3, terminal block P	Relay output 3 at the terminal block P, terminals P5/6/7
$0131/2^{12}$	Reserved	= 0
$0131/2^{14}$	Reserved	= 0

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8.2.8.8 Register 0135: Status of Binary Inputs

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

Data type: Command

Register	Type of information	Remark
$0135/2^0$	Binary input 1, terminal block N	Binary input 1 at the terminal block N, terminals N8/9
$0135/2^2$	Binary input 2, terminal block N	Binary input 2 at the terminal block N, terminals N9/10
$0135/2^4$	Binary input 3, terminal block N	Binary input 3 at the terminal block N, terminals N11/12
$0135/2^6$	Binary input 1, terminal block P	Binary input 1 at the terminal block P, terminals P8/9
$0135/2^8$	Binary input 2, terminal block P	Binary input 2 at the terminal block P, terminals P9/10
$0135/2^{10}$	Binary input 3, terminal block P	Binary input 3 at the terminal block P, terminals P11/12
$0135/2^{12}$	Reserved	= 0
$0135/2^{14}$	Reserved	= 0

8.2.8.9 Register 0141: Indications of the Communication

Data type: controllable indications

Register	Type of information	Remark
$0141/2^0$	Indication 1 from Remote	For controlling the relay outputs via the communication
$0141/2^2$	Indication 2 from Remote	
$0141/2^4$	Indication 3 from Remote	
$0141/2^6$	Indication 4 from Remote	
$0141/2^8$	Indication 5 from Remote	
$0141/2^{10}$	Indication 6 from Remote	
$0141/2^{12}$	Reserved	= 0
$0141/2^{14}$	Reserved	= 0

8.2.9 Modbus Diagnosis

The diagnostics function for Modbus TCP, Modbus UDP and Modbus RTU, see chapter 6.5.4, enables analyzing the parameters and the communication and resetting diagnostics counters.

8.2.9.1 Modbus TCP Diagnosis

Figure 8-5 Modbus TCP Diagnosis

Parameters for Standard Server and User-port Server

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

    For other user port numbers: 2 connections via standard port 502 and 2 connections via the user port

- Used connections: Number of connections that are actually used
- Connection overflows: Counter of the attempts to establish more connections than allowed;

    Number of allowed connection attempts:

    For user port number 502: $\geq$ 5 connection attempts via standard port 502,

    For other user port numbers: $\geq$ 3 connection attempts via standard port 502 and/or $\geq$ 3 connection attempts via user port

- Access rights: Default: Full
- Communication supervision time: Default: 60 000 ms

Parameter for 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

- Bytes received:

  Total number of bytes received by the TCP port

- Bytes sent:

  Total number of bytes sent to the TCP port

- Correct 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 8.2.2)

- Number of 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 chapter 6.3.3.6)

8.2.9.2 Modbus UDP Diagnosis

Figure 8-6   Modbus UDP Diagnosis

Parameter

- Operating mode   Modbus UDP
- Port number: 51000
- Communication supervision time: Default: 80 ms
- Access rights: Default: full

Counter

- Received bytes:

  Total number of received bytes from UDP port

- Sent bytes:

  Total number of sent bytes to UDP port

- Good messages:

  Total number of received telegrams that were detected as valid Modbus telegrams

- Bad messages:

  Total number of telegram errors

Transmission and Error Rate

- Received bytes/10 s: Received bytes from UDP port per 10 s
- Sent bytes/10 s: Bytes sent to UDP port per 10 s
- Bad messages/10 s: Number of telegram errors per 10 s

Server

- Client IP:Port: Last or current IP address and port number of client

8.2.9.3 Modbus RTU Diagnosis
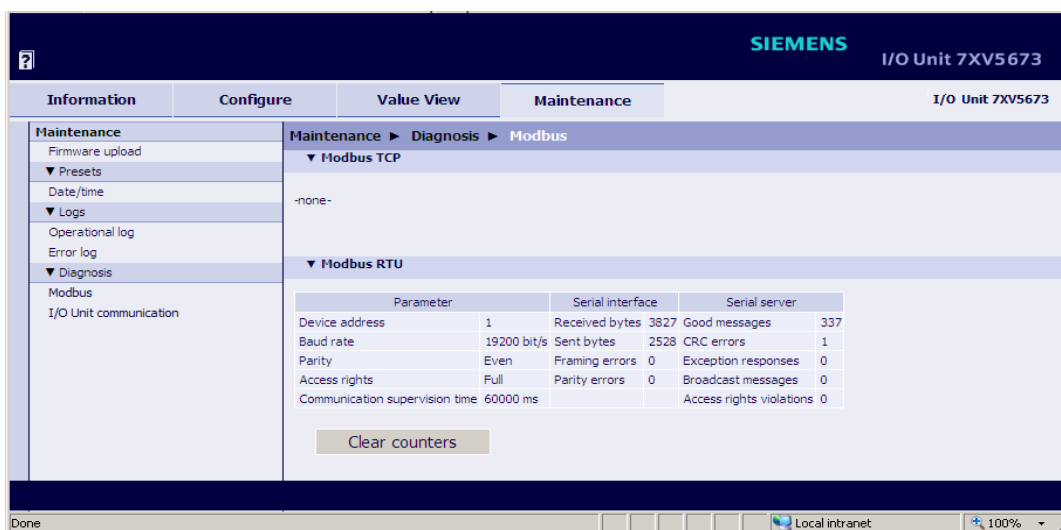
Figure 8-7   Modbus RTU Diagnosis

Parameter

- 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
- Fiber optical idle state (at FO interface): Default: Light OFF

Serial Interface

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

Serial Server

- Good messages: Total number of messages received that were detected as valid Modbus messages

- CRC errors: Total number of messages received in which CRC errors were detected

- Exception responses: Counters of the transmitted exception response messages (see chapter 8.2.2)

- 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 chapter 6.3.3.8)

8.3 I/O Mirror

> **NOTE**
>
> The operational indications output by the SICAM I/O Unit are described in detail in chapter 12.

8.3.1 Ethernet Communication

8.3.1.1 I/O Mirror Client

Prerequisite

Under serial communication, no I/O mirror mode must be parameterized.

Parameterization

The following parameters can be parameterized for Ethernet communication for the I/O mirror client mode, see also chapter 6.3.3.6:

Table 8-5   I/O Mirror Client Settings at Ethernet Communication

Parameter	Default Settings	Settings
IP address	192.168.0.55	Any
Subnet mask	255.255.255.0	Any
Default gateway	192.168.0.1	Any
Operating mode	I/O mirror client	-
Server IP address	192.168.0.56	Any
Server port	51000	10000 to 65535
Response timeout	3 * 10 ms	0 ms = invalid 10 ms to 60 000 ms

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8.3.1.2 I/O Mirror Server

Prerequisite

Under serial communication, no I/O mirror mode must be parameterized.

Parameters

The following parameters can be parameterized for Ethernet communication for the I/O mirror server mode, see also chapter 6.3.3.6:

Table 8-6   I/O Mirror Server Settings at Ethernet Communication

Parameter	Default Settings	Settings
IP address	192.168.0.55	Any
Subnet mask	255.255.255.0	Any
Default gateway	192.168.0.1	Any
Operating mode	I/O mirror server	-
Port number	51000	10000 to 65535
Communication supervision time	8 *10 ms	0 ms = invalid 10 ms to 60 000 ms

SICAM I/O Unit, 7XV5673, Device Manual

8.3.2 Serial Communication

8.3.2.1 I/O Mirror Client

Prerequisite

Under Ethernet communication, no I/O mirror mode must be parameterized.

Parameterization

The following parameters can be parameterized for serial communication (FO or RS485) for the I/O mirror client mode, see also chapter 6.3.3.8:

Table 8-7   I/O Mirror Client Settings at Serial Communication

Parameter	Default Settings	Settings
Operating mode	I/O mirror client	-
Communication mode	Bidirectional	Bidirectional Unidirectional
Baud rate	115 200 bit/s	Acc. to list box ▾ (see chapter 13.2.4)
Response timeout (only communications mode bidi-rectional)	3 * 10 ms	10 ms to 60 000 ms
Send time synchronization	No	Yes (every minute) No
If there is an FO interface: Fiber optical idle state	Light OFF	Light OFF Light ON

Response Timeout Setting

Siemens recommends the response timeout settings indicated in the following table for the respectively parameterized baud rate in the communication mode bidirectional:

Table 8-8   Response Timeout Settings Depending on the Set Baud Rate

Baud Rate (bit/s)	Response Timeout (ms)
187 500	30
115 200	30
57 600	30
38 400	40
19 200	50
9600	60
4800	90
2400	160
1200	300

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8.3.2.2 I/O Mirror Server

Prerequisite

No I/O mirror mode must be parameterized under Ethernet communication.

Parameterization

The following parameters can be parameterized for serial communication (FO or RS485) for the I/O mirror server mode, see also chapter 6.3.3.8:

Table 8-9   I/O Mirror Server Settings at Serial Communication

Parameter	Default Settings	Settings
Operating mode	I/O mirror server	-
Baud rate	115 200 bit/s	Acc. to list box ▼ (see chapter 13.2.4)
Communication supervision time	8 * 10 ms	0 s = invalid 10 ms to 60 000 ms
If there is an FO interface: Fiber optical idle state	Light OFF	Light OFF Light ON

Communication Supervision Time

Siemens recommends the monitoring time communication settings indicated in the following table for the respectively parameterized baud rate:

Table 8-10   Monitoring Time Communication Settings Depending on the Set Baud Rate

Baud Rate (bit/s)	Communication Supervision Time (ms)
187 500	80
115 200	80
57 600	80
38 400	100
19 200	120
9600	150
4800	220
2400	390
1200	720

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8.3.3 I/O Mirror Diagnosis

8.3.3.1 Ethernet Communication - I/O Mirror Client
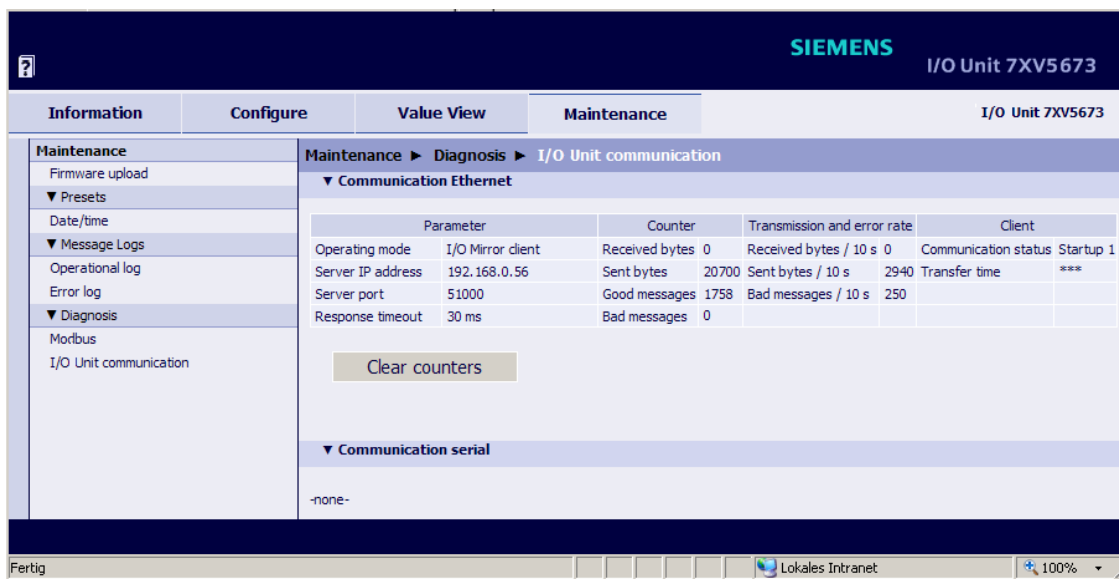
Figure 8-8   Diagnosis Ethernet Communication - I/O Mirror Client

Parameter

• Operating mode:	I/O mirror client
• Server IP address:	192.168.0.56
• Server port:	51000
• Response timeout:	Default: 30 ms

Counter

• Received bytes:	Total number of received bytes via communication since the last start of the device or since last deleting the counter
• Sent bytes:	Total number of sent bytes via communication since the last start of the device or since last deleting the counter
• Good messages:	Total number of received frames, which were detected as valid telegrams since the last start of the device or since last deleting the counter
• Bad messages:	Total number of telegram errors since the start of the device or since last deleting the counter

Transmission and Error Rate

• Received bytes/10 s:	Received bytes in the last 10 s
• Sent bytes/10 s:	Sent bytes in the last 10 s
• Bad messages/10 s:	Number of frame errors in the last 10 s

Client

- Communication status:

  Startup 1: Start phase 1 has started

  Startup 1 fail: Incorrect MLFB number

  Startup 2: Start phase 2 has started

  Startup 2 fail: Incorrect device configuration values

  Data Exchange: Normal data exchange between client and server

- Transfer time:

  Transfer time of a telegram cycle from client to server and back

8.3.3.2 Ethernet Communication - I/O Server

Figure 8-9   Diagnosis Ethernet Communication - I/O Mirror Server

Parameter

- Operating mode: I/O mirror server
- Port number: 51000
- Communication supervision time: Default: 80 ms

Counter

- Received bytes:

  Total number of received bytes via communication since the last start of the device or since last deleting the counter

- Sent bytes:

  Total number of sent bytes via communication since the last start of the device or since last deleting the counter

- Good messages:

  Total number of received frames, which were detected as valid telegrams since the last start of the device or since last deleting the counter

- Bad messages:

  Total number of telegram errors since the start of the device or since last deleting the counter

Transmission and Error Rate

- Received bytes/10 s: Received bytes in the last 10 s
- Sent bytes/10 s: Sent bytes in the last 10 s
- Bad messages/10 s: Number of telegram errors in the last 10 s

Server

- Communication status: Startup 1: Start phase 1 has started

    Startup 1 fail: Incorrect MLFB number

    Startup 2: Start phase 2 has started

    Startup 2 fail: Incorrect device configuration values

    Startup 3: Waiting for "Data Exchange"

    Data Exchange: Normal data exchange between client and server

- Client IP:Port: Last or current IP address and port number of client

8.3.3.3 Serial Communication - I/O Mirror Client

Figure 8-10   Diagnosis Serial Communication - I/O Mirror Client

Parameter

- Operating mode: I/O mirror client
- Communication mode: Bidirectional
- Baud rate: Default: 115 200 bit/s
- Response timeout: Default: 30 ms
- Send time synchronization: No

Counter

- Receive bytes: Total number of received bytes via communication since the last start of the device or since last deleting the counter

- Sent bytes: Total number of sent bytes via communication since the last start of the device or since last deleting the counter

- Good messages: Total number of received frames, which were detected as valid telegrams since the last start of the device or since last deleting the counter

- Bad messages: Total number of telegram errors since the start of the device or since last deleting the counter

- Parity errors: Total number of parity errors since the start of the device or since last deleting the counter

- Framing errors: Total number of frame errors since the start of the device or since last deleting the counter

Transmission and Error Rate

- Received bytes/10 s: Received bytes in the last 10 s
- Sent bytes/10 s: Sent bytes in the last 10 s
- Bad messages/10 s: Number of telegram errors in the last 10 s

Client

- Communication status: Startup 1: Start phase 1 has started

  Startup 1 fail: Incorrect MLFB number

  Startup 2: Start phase 1 has started

  Startup 2 fail: Incorrect device configuration values

  Data Exchange: Normal data exchange between client and server

  Communication mode unidirectional: Always data exchange

- Transfer time: Transfer time of a telegram cycle from client to server and back.

  Communication mode unidirectional: Time between 2 sent broadcast telegrams to server

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8.3.3.4 Serial Communication - I/O Mirror Server

Figure 8-11   Diagnosis Serial Communication - I/O Mirror Server

Parameter

- Operating mode: I/O mirror server
- Baud rate: Default: 115 200 bit/s
- Communication supervision time: Default: 80 ms

Counter

- Received bytes: Total number of received bytes via communication since the last start of the device or since last deleting the counter
- Sent bytes: Total number of sent bytes via communication since the last start of the device or since last deleting the counter
- Good messages: Total number of received frames, which were detected as valid telegrams since the last start of the device or since last deleting the counter
- Bad messages: Total number of telegram errors since the start of the device or since last deleting the counter
- Parity errors: Total number of parity errors since the start of the device or since last deleting the counter
- Framing errors: Total number of frame errors since the start of the device or since last deleting the counter

Transmission and Error Rate

- Received bytes/10 s: Received bytes in the last 10 s
- Sent bytes/10 s: Sent bytes in the last 10 s
- Bad messages/10 s: Number of telegram errors in the last 10 s

Server

- Communication status: Startup 1: Start phase 1 has started

    Startup 1 fail: Incorrect MLFB number

    Startup 2: Start phase 2 has started

    Startup 2 fail: Incorrect device configuration values

    Startup 3: Waiting for "Data Exchange"

    Data Exchange: Normal data exchange between client and server

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8.4 IEC 61850

8.4.1 General I/O Processes

Table 8-11   Binary Inputs

inst		1
desc		**Binary inputs**
InClass		**GGIO**
InName		**CTRL/InGGIO1**
Data Objects	**CDC**	
Status information		
IntIn1~6	SPS	Binary inputs 1 to 6

Table 8-12   Indications from Remote

inst		2
desc		**Indications from remote[*] 1 to 6**
InClass		**GGIO**
InName		**CTRL/ProxyGGIO1**
Data Objects	**CDC**	
Status information		
SPCSO1~6	SPC	Indications from remote 1 to 6

*) Indications from remote will be routed to binary outputs, refer to chapter 6.3.3.2

Table 8-13   Binary Outputs

inst		3
desc		Binary outputs
InClass		GGIO
InName		CTRL/OutGGIO1
Data Objects	CDC	
Status information		
Ind1~6	SPS	Status of the binary outputs 1 to 6

Table 8-14   Battery

inst		1
desc		Battery status
InClass		ZBAT
InName		CTRL/ZBAT1
Data objekts	CDC	
Status information		
Vol	MV	Battery voltage (not available, invalid)
BatLo	SPS	Battery failure (undervoltage or battery is missing)

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8.4.2 PICS

(PICS = Protocol Implementation Conformance Statement)

ACSI Basic Conformance Statement

Table 8-15   Basic Conformance Statement

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

Y = supported; N or empty: not supported

ACSI Models Conformance Statement

Table 8-16   ACSI Models Conformance Statement

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

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Table 8-16   ACSI Models Conformance Statement (cont.)

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

Y = supported; N or empty: not supported

ACSI Service Conformance Statement

Table 8-17   ACSI Service Conformance Statement

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

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Table 8-17   ACSI Service Conformance Statement (cont.)

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

Table 8-17   ACSI Service Conformance Statement (cont.)

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

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Table 8-17   ACSI Service Conformance Statement (cont.)

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Transmission of sampled value model (SVC)					
Multicast SVC					
S45	SendMSVMessage	MC	N	N	
S46	GetMSVCBValues	TP	N	N	
S47	SetMSVCBValues	TP	N	N	
Unicast SVC					
S48	SendUSVMessage	TP	N	N	
S49	GetUSVCBValues	TP	N	N	
S50	SetUSVCBValues	TP	N	N	
Control					
S51	Select		N	N	
S52	SelectWithValue	TP	N	N	
S53	Cancel	TP	N	N	
S54	Operate	TP	N	N	
S55	Command-Termination	TP	N	N	
S56	TimeActivated-Operate	TP	N	N	
File transfer					
S57	GetFile	TP	N	N	
S58	SetFile	TP	N	N	
S59	DeleteFile	TP	N	N	
S60	GetFileAttributeValues	TP	N	N	
Time					
T1	Time resolution of internal clock			10 (1 ms)	nearest negative power of 2 in seconds

Table 8-17   ACSI Service Conformance Statement (cont.)

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

Y = supported; N or empty: not supported

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8.4.3 PIXIT

(PIXIT = Protocol Implementation Extra Information for Testing)

PIXIT for Association Model

Table 8-18   PIXIT for Association Model

Description	Value/Clarification		Example
Maximum number of clients that can set-up an association simultaneously	5		
TCP_KEEPALIVE value	10 seconds Adjustable under "Configuration Modbus TCP"		
Lost connection detection time	10 seconds Adjustable under "Configuration Modbus TCP"		
Is authentication supported	No		
What association parameters are necessary for successful association	Transport selector	Yes	0001
	Session selector	Yes	0001
	Presentation selector	Yes	00000001
	AP Title	No	Any
	AP Qualifier	No	Any
What is the maximum and minimum MMS PDU size	Max MMS PDU size	20 000	
	Min MMS PDU size		
What is the maximum startup time after a power supply interrupt	45 seconds		

PIXIT for Server Model

Table 8-19   PIXIT for Server Model

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

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PIXIT for Data Set Model

Table 8-20   PIXIT for Data Set Model

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

PIXIT for Reporting Model

Table 8-21   PIXIT for Reporting Model

Description	Value/Clarification	
The supported trigger conditions are (compare PICS)	integrity	Yes
	data change	Yes
	quality change	Yes
	data update	No
	general interrogation	Yes
The supported optional fields are	sequence-number	Yes
	report-time-stamp	Yes
	reason-for-inclusion	Yes
	data-set-name	Yes
	data-reference	Yes
	buffer-overflow	Yes
	entryID	Yes
	conf-rev	Yes
	segmentation	Yes
Can the server send segmented reports	Yes	

Table 8-21 PIXIT for Reporting Model (cont.)

Description	Value/Clarification	
Mechanism on second internal data change notification of the same analogue data value within buffer period (Compare IEC 61850-7-2 §14.2.2.9)	Send report immediately	
Multi client URCB approach (compare IEC 61850-7-2 §14.2.1)	Each URCB is visible to all clients	
What is the format of EntryID	First 2 Byte : Integer Last 6 Bytes: BTime6 time stamp	
What is the buffer size for each BRCB or how many reports can be buffered	No fixed size, depends on total number of BRCBs	
Pre-configured RCB attributes that cannot be changed online when RptEna = FALSE (see also the ICD report settings)		
May the reported data set contain: - structured data objects? - data attributes? - timestamp data attributes?	Yes Yes Yes, will not be included in a dchg report	
What is the scan cycle for binary events? Is this fixed, configurable	60 ms Fixed	
additional items:		
Dynamic BRCB reservation after an abort of the client/server association	Reservation of the BRCB has been fixed with TISSUE 453. A Value of -1 for ResTms is not supported	

PIXIT for Time and Time Sychronization Model

Table 8-22 PIXIT for Time and Time Syncronization Model

Description	Value/Clarification	
What quality bits are supported	LeapSecondsKnown	No
	ClockFailure	Yes
	ClockNotSynchronized	Yes
Describe the behavior when the time synchro-nization signal/messages are lost	After a waiting period, time quality is set to ClockNotSynchronized and ClockFailure	

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Table 8-22   PIXIT for Time and Time Syncronization Model (cont.)

Description	Value/Clarification	
When is the time quality bit "Clock failure" set?	At faulty internal clock or failure of the synchronization source (SNTP, field bus) or RTC failure	
When is the time quality bit "Clock not syn-chronised" set?	After a waiting period, time quality is set to ClockNotSynchronized and ClockFailure	
Is the timestamp of a binary event adjusted to the configured scan cycle?	No	
Does the device support time zone and day-light saving?	Yes	
Which attibutes of the NTP response packet are validated?	Leap indicator not equal to 3?	Yes
	Mode is equal to SERVER	No
	OriginateTimestamp is equal to value sent by the SNTP client as TransmitTimestamp	No
	RX/TX timestamp fields are checked for reasonableness	Yes
	SNTP version 3 and/or 4	No
	Other (describe)	No

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TICS

TICS = Technical Issues Conformance Statement

Table 8-23   TICS

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

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Table 8-23   TICS (cont.)

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

Services Which are Not Supported

- Substitution model
- Setting group control model
- Logging model
- Generic substation event model
- Control model
- File transfer model

8.4.4 Diagnosis IEC 61850

The diagnosis for IEC 61850, see chapter 6.5.4.5, allows the analysis of parameters and communication.
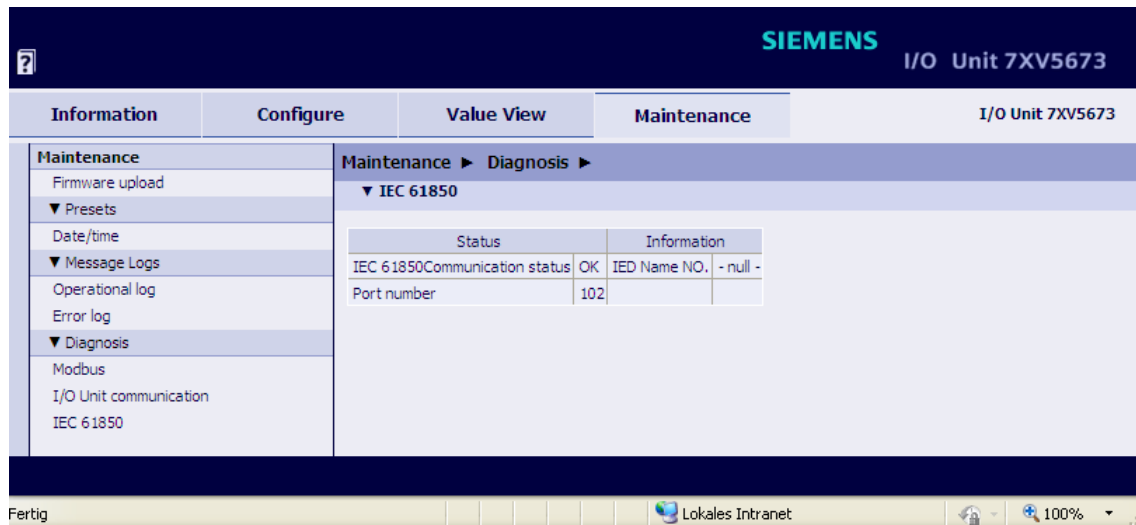
Fig. 8-12   Diagnosis IEC 61850

Statuses

With IEC 61850, the following statuses are displayed:

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

Port number: Set port number, 102

Information

IED Name NO.:   Default: 1

9 Maintenance, Storage, Transport

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9.1 Maintenance

Except for a battery replacement, the SICAM I/O 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 (ordering code E50417-B1050-C484) describes how to replace the battery.

9.2 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.

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.

NOTE

In this context, pay attention to the commissioning notes in chapter 4.7.

9.3 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.

10 Failures and LED Indications

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10.1 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 4.2 at the intended location
- Compliance with the ambient conditions specified in chapter 11.2.3 of the technical data
- Correct connection of supply voltage and grounding conductors according to chapter 4.3
- Correct connection of communication lines according to chapter 4.3.2

Function Checks

Additionally, check the following aspects:

- Correct functioning of peripheral devices (for example connected PC)
- Compliance with the system requirements specified in chapter 4.4
- Compliance with the access rights according to chapter 4.5
- Compliance with the commissioning sequence of the device according to chapter 4.7
- Evaluation of the LED failure indications, see chapter 10.3.

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10.2 Commissioning during Failures

10.2.1 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**.

Figures 10-1   Boot Loader

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

✧ Click the **Run Application** button.

The following message appears:
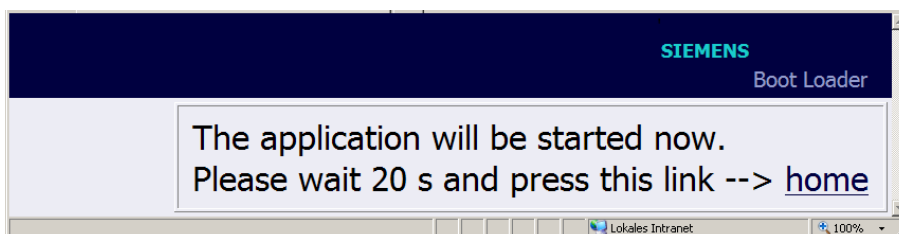
Figures 10-2   Boot Loader Message of Run Application

♦ 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:
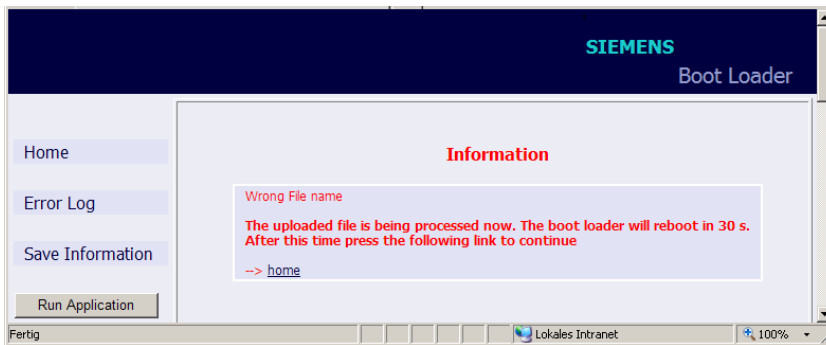
Figures 10-3   Information in the Boot Loader

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

The user interface opens.

10.2.2   Manual Start of the Boot Loader

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

♦ If the SICAM I/O Unit is still energized by the supply voltage, switch off the supply voltage.

♦ Press the IP-Addr. push-button at the SICAM I/O Unit (see chapter 4.7.2), 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. button.

SICAM I/O Unit starts the Boot Loader with the **Boot Loader** HTML page (see Figure 10-1).

10.3 Indications Signaled by LEDs

SICAM I/O 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
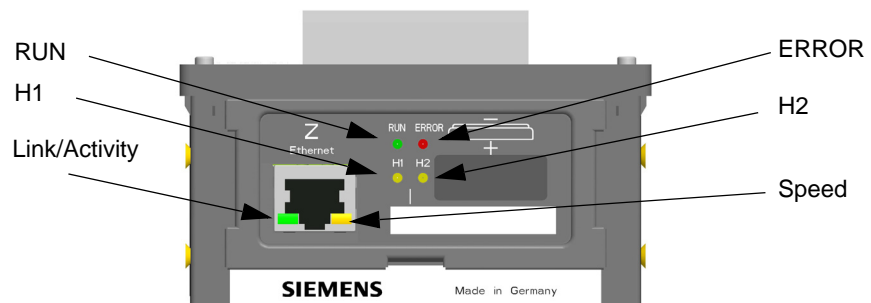
Figures 10-4   Designation of the LEDs

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

🟨 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

Table 10-1   Indications Signaled by LEDs

LED	Meaning
RUN ERROR ⚪ ⚪ H1 H2 ⚪ ⚪	Device switched off
RUN ERROR ⚪ 🔴 H1 H2 ⚪ ⚪	No firmware loaded

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Table 10-1   Indications Signaled by LEDs (cont.)
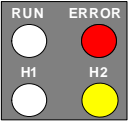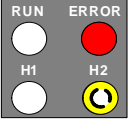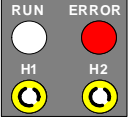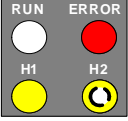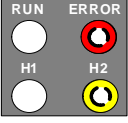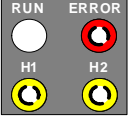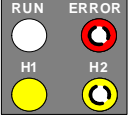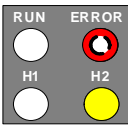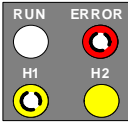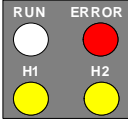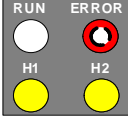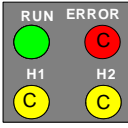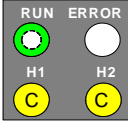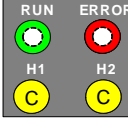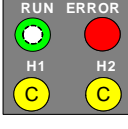
LED	Meaning
Boot Loader	
	IP-Addr. push-button pressed during power-on
	Boot loader started after IP-Addr. push-button was pressed during power-on
	DHCP active (H1 switches off after reception of the IP address via DHCP)
	Default IP address by pressing the IP-Addr. push-button
	Boot loader started; no process application exists.
	DHCP active (H1 switches off after reception of the IP address via DHCP)
	Default IP address by pressing the IP-Addr. push-button

Table 10-1   Indications Signaled by LEDs (cont.)

LED	Meaning
	Boot loader was started because an error occurred in the process application.
	DHCP active (H1 switches off after reception of the IP address via DHCP)
	Boot loader started, process application is being loaded.
	Double IP address is detected.
Process Application	
	Normal mode: IP address has been configured or received from DHCP.
	DHCP: LED RUN (green) is lit after the IP address is received by the DHCP server
	Default IP address is applied by pressing the IP-Addr. push-button.
	Double IP address is detected.

10.4   Troubleshooting and Repair

General Troubleshooting

The user is not authorized to troubleshoot the defective device beyond the measures described in chapter 10.1 and chapter 10.3 or make repairs himself. Special electronic modules are inserted in the SICAM I/O 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 6.2.5.2, section **File download** → **Save**.

The error messages can be printed as described in chapter 6.2.5.2, section **File download** → **Open**.

11 Technical Data

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11.1 General Device Data

11.1.1 Power Supply

Direct Voltage

Rated input voltages	24 V to 250 V
Admissible input voltage tolerance	±20 %
Maximum power consumption	6 W
Bridging time for failure/short-circuit, IEC 60255–11	$\geq$ 50 ms at V $\geq$ 110 V
	$\geq$ 10 ms at V < 110 V

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 power consumption	12 VA
Bridging time for failure/short-circuit, IEC 60255–11	$\geq$ 50 ms at V = 110 V
	$\geq$ 50 ms at V = 230 V

11.1.2 Binary Inputs and Binary Outputs

Binary Inputs

Number	6
Rated input voltage range	24 V to 250 V
Threshold voltages (adjustable)	
Threshold voltage 19 V (at rated voltage 24 V)	U high $\geq$ 19 V U low $\leq$ 10 V
Threshold voltage 88 V (at rated voltage 110 V)	U high $\geq$ 88 V U low $\leq$ 44 V
Threshold voltage 176 V (at rated voltage 220 V)	U high $\geq$ 176 V U low $\leq$ 88 V
Maximum input voltage	300 V

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Relay Outputs (Binary Outputs)

Number		
Type of relay	NO relay	CO relay
Number	4	2
Output values		
Switching capacity	On: 1000 W/VA Off: 30 VA; 40 W ohmic 25 W/VA at L/R $\leq$ 40 ms	
Contact voltage AC and DC	250 V	
Permissible current per contact	continuous: 5 A switching on and holding: 30 A for 1 s (make contact)	
Short-time current across closed contact	250 A at 30 ms	
Total permissible current for contacts connected to common potential	5 A	
Switching time (OOT)	$\leq$ 5 ms; (OOT = Output Operating Time) additional delay of the output medium used	
Rated data of the output contacts		
120 V ac	5.0 A, GP	
277 V ac	5.0 A, GP	
277 V ac	0.7 HP	
B300		
R300		
Anti-interference capacitor across the contacts	4.7 nF, ± 20 %, AC 250 V	
Contact life		
Expected contact life	> 10^7, mechanical, at 300 switching cycles/min	
Expected contact life (resistive load)	> 10^5, electric (AC), at 20 switching cycles/min	

Transmission Times Between 2 Devices from Binary Input to Relay Output

Transmission times between 2 devices from applying the signal voltage on the binary input of the 1st device to triggering the parameterized relay contact (binary output) on the 2nd device

Ethernet transmission		
Conditions: Software filter time of the binary inputs: $\geq$ 2 ms		
Local communication net (only I/O mirror server/client)		
Minimum Transmission Time	Medium Transmission Time	Maximum Transmission Time
9.7 ms	10.97 ms	12.00 ms

Optical transmission		
Condition: Software filter time of the binary inputs: $\geq$ 2 ms		
Baud Rate	Minimum Transmission Time	Medium Transmission Time	Maximum Transmission Time
187 500 bit/s	10.1 ms	10.68 ms	11.6 ms
115 200 bit/s	9.9 ms	10.57 ms	11.4 ms
57 600 bit/s	12.4 ms	13.81 ms	15.7 ms
38 400 bit/s	11.6 ms	15.41 ms	18.9 ms
19 200 bit/s	15.4 ms	20.03 ms	24.3 ms
9600 bit/s	21.1 ms	32.56 ms	42.3 ms
4800 bit/s	34.9 ms	52.81 ms	74.6 ms
2400 bit/s	55.4 ms	87.85 ms	139.2 ms
1200 bit/s	112.6 ms	179.41 ms	268.9 ms

11.1.3   Communication Interfaces

Ethernet

Ethernet, electrical	Operation	With device internal software
	Connection	Device top side RJ45 connector socket 100BaseT acc. to IEEE802.3 LED yellow: 10/100 Mbit/s (off/on) LED green: connection/no connection (on/off)
	Protocols	Modbus TCP Modbus UDP IEC 61850
	Voltage strength	DC 700 V
	Transmission rate	10/100 Mbit/s
	Cable for 100Base-T	100 Ω to 150 Ω STP, CAT5
	Max. cable lenght 100Base-T	100 m, if well installed

Serial Interface

RS485	SICAM I/O Unit 7XV5673-0JJ10-1AA1		
	Connection	Terminal side, 9 pin D-sub socket	
	Protocol/Operating mode	Modbus RTU	I/O mirror
	Baud rate (adjustable)	Min. 1 200 bit/s Max. 115 000 bit/s; Default setting 19 200 bit/s	Min. 1 200 bit/s Max. 187 500 bit/s; Default setting 115 200 bit/s
	Maximum distance of transmission	Max. 1 km, three-wire line, twisted, shielded	
	Transmission level	Low: -5 V to -1.5 V High: +5 V to +1.5 V	
	Reception level	Low: $\leq$ -0.2 V High: $\geq$ +0.2 V	
	Bus termination	Not integrated, bus termination using plugs with integrated bus terminating resistors (see Figure 11-1)	
Optical	SICAM I/O Unit 7XV5673-0JJ20-1AA1		
	Connection	Terminal side, ST connector plug, 820 nm Bending radiuses: According to optical fiber cable used	
	Protocol/Operating mode	Modbus RTU	I/O mirror
	Baud rate	Min. 1 200 bit/s Max. 115 000 bit/s; Default setting 19 200 bit/s	Min. 1 200 bit/s Max. 187 500 bit/s; Default setting 115 200 bit/s
	Maximum distance of transmission	Max. 2000 m at 62.5 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	

Termination of RS485 Bus (Terminal J)
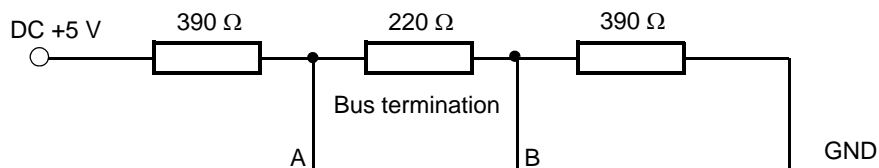
Figure 11-1   Bus Termination of the RS485 Interface with Pullup/pulldown Resistors

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 11-1, 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 "Catalogue 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 Supply voltage for terminating resistors (max. 100 mA)
2	Not assigned	7	RTS Direction control (if required for an external conversion)
3	A RS485 connection pin A	8	B RS485 connection pin B
4	Not assigned	9	Not assigned
5	GND (towards DC +5 V)		

11.1.4 Environmental Data

Temperature data	Open type; surrounding air temperature	tsurr: max. 70 °C (158 °F), normal operation
	Operating temperature	-25 °C to +70 °C or -13 °F to +158 °F
	Temperature during transport	-25 °C to +70 °C or -13 °F to +158 °F
	Temperatur during storage recommendation	-25 °C to +70 °C or -13 °F to +158 °F +10 °C to +35 °C or +50 °F to +95 °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

11.1.5 General Data

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

11.2 Test Data

11.2.1 Electrical Tests

Standards

Standards:	IEC 60255 IEEE Std C37.90, see individual functions VDE 0435 For more standards see also individual functions

Insulation Test

Standards:	IEC 60255-27 and IEC 60870-2-1
Voltage test (routine test) of - auxiliary voltage - binary inputs and relay outputs	DC 3.6 kV AC 3.25 kV, 50 Hz
Voltage test (routine test) of isolated communication ports only - J (RS485) - Z (Ethernet)	AC 500 V, 50 Hz DC 700 V
Impulse voltage test (type test) of all process circuits (except for communication ports) against the internal electronics	6 kV (peak value); 1.2 µs/50 µs; 0.5 J; 3 positive and 3 negative impulses at intervals of 1 s
Impulse voltage test (type test) of all process circuits against each other (except for communication ports) and against the PE terminal of class III	5 kV (peak value); 1.2 µs/50 µs; 0.5 J; 3 positive and 3 negative impulses at intervals of 1 s

EMC Tests for Immunity (Type Tests)

Standards:		IEC 60255-6 and -22, (product standards) IEC/EN 61000-6-2 VDE 0435 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; τ = 15 µs; 400 Surges per s; Test duration 2 s; R_i = 200 Ω
Electrostatic discharge, Class III 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 IEC 61000-4-3, IEC 60255-22-3		10 V/m; 80 MHz to 2.7 GHz; 80 % AM; 1 kHz
Fast transient bursts, Class III IEC 61000-4-4, IEC 60255-22-4, IEEE C37.90.1		4 kV; 5 ns/50 ns; 5 kHz; burst length = 15 ms; repetition rate 300 ms; both polarities: R_i = 50 Ω; test duration 1 min
High energy surge voltages (SURGE), Installation Class III IEC 61000-4-5, IEC 60255-22-5,		Impulse: 1.2 µs/50 µs
	Auxiliary voltage	Common mode: 2 kV; 12 Ω; 9 µF Diff. mode:1 kV; 2 Ω; 18 µF
	Measuring inputs, binary inputs and relay outputs	Common mode: 2 kV; 42 Ω; 0.5 µF Diff. mode: 1 kV; 42 Ω; 0,5 µF
HF on lines, amplitude-modulated, Class III IEC 61000-4-6, IEC 60255-22-6		10 V; 150 kHz to 80 MHz; 80 % AM; 1 kHz
Power system frequency magnetic field IEC 61000-4-8, Class IV;		30 A/m continuous; 300 A/m for 3 s;
Radiated Electromagnetic Interference IEEE Std C37.90.2		Radiated Electromagnetic Interference IEEE Std C37.90.2
Damped oscillations IEC 61000-4-18		2.5 kV (peak value); 100 kHz; 40 pulses per s; Test Duration 2 s; Ri = 200 Ω

EMC Test for Noise Emission (Type Test)

Standard:	IEC/EN 61000-6-4
Radio noise voltage to lines, only auxiliary voltage IEC-CISPR 11	150 kHz to 30 MHz Limit Class B
Interference field strength IEC-CISPR 11	30 MHz to 1000 MHz Limit Class B

11.2.2 Mechanical Stress Tests

Vibration and Shock Stress during Stationary Operation

Standards:	IEC 60255-21 and IEC 60068
Oscillation IEC 60255-21-1, Class II; IEC 60068-2-6 test Fc	Sinusoidal 10 Hz to 60 Hz: ±0.075 mm amplitude; 60 Hz to 150 Hz: 1 g acceleration frequency sweep rate 1 octave/min 20 cycles in 3 orthogonal axes.
Shock IEC 60255-21-2, Class I; IEC 60068-2-27 test Ea	Semi-sinusoidal 5 g acceleration, duration 11 ms, each 3 shocks in both directions of the 3 axes
Seismic Vibration IEC 60255-21-3, Class II; IEC 60068-3-3 test Fc	Sinusoidal 1 Hz to 8 Hz: ±7.5 mm amplitude (horizontal axis) 1 Hz to 8 Hz: ±3.5 mm amplitude (vertical axis) 8 Hz to 35 Hz: 2 g acceleration (horizontal axis) 8 Hz to 35 Hz: 1 g acceleration (vertical axis) Frequency sweep 1 octave/min 1 cycle in 3 orthogonal axes

Vibration and Shock Stress during Transport

Standards:	IEC 60255-21 and IEC 60068
Oscillation IEC 60255-21-1, Class 2; IEC 60068-2-6 test Fc	Sinusoidal 5 Hz to 8 Hz: ±7.5 mm amplitude; 8 Hz to 150 Hz: 2 g acceleration Frequency sweep 1 octave/min 20 cycles in 3 orthogonal axes
Shock IEC 60255-21-2, Class 1; IEC 60068-2-27 test Ea	Semi-sinusoidal 15 g acceleration, duration 11 ms, each 3 shocks (in both directions of the 3 axes)
Continuous Shock IEC 60255-21-2, Class 1; IEC 60068-2-29 test Eb	Semi-sinusoidal 10 g acceleration, duration 16 ms, each 1000 shocks (in both directions of the 3 axes)

11.2.3 Climatic Stress Tests

Temperatures

Standards:	IEC 60255-6
Type test (in acc. with IEC 60068-2-1 and -2, Test Bd for 16 h)	-25 °C to +85 °C or -13 °F to +185 °F
Permissible temporary operating temperature (tested for 96 h)	-20 °C to +70 °C or -4 °F to +158 °F
Recommended for permanent operation (in acc. with IEC 60255-6)	-10 °C to +55 °C or +14 °F to +131 °F
Limit temperatures for storage	-25 °C to +55 °C or -13 °F to +131 °F
Limit temperatures for transport	-25 °C to +70 °C or -13 °F to +158 °F
Storage and transport with factory packaging	

Humidity

Permissible humidity	Mean value per year $\leq$ 75 % relative humidity; on 56 days of the year up to 93 % relative humidity; condensation must be avoided!
Siemens recommends that all devices be installed such that they are not exposed to direct sunlight, nor subject to large fluctuations in temperature that may cause condensation to occur.	

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11.3 Dimensions

Mass	approx. 0.550 kg
Dimension (W x H x D)	96 mm x 96 mm x 100 mm 3.78 inch x 3.78 inch x 3.94 inch
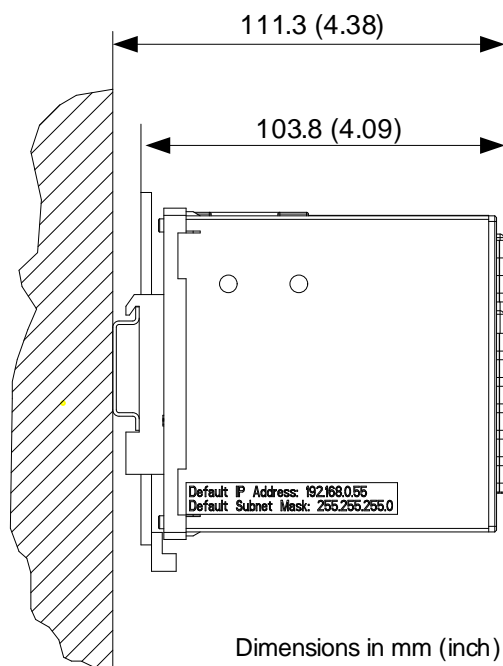
Figure 11-2   Dimensional Drawing of the I/O Unit 7XV5673

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12 Operational Indications

Indication (Relevant for Operating Mode)	Description	Notes
Device OK	Device startup successful and ready for operation.	Indication on: Device startup successful and ready for operation.
Start Up	Device has been started up or restarted.	Indication on: Device has been started up or restarted.
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. Indication on: No time message was received during the set timer ("**Error indication after**"). The time stamp is set after the "**Error indication after**" timer has expired and no synchronization message was received. Parameter range: see chapter 6.3.3.5 Error sources with RTC: - no valid time after device startup Error sources with NTP or fieldbus: - „**Error indication after**" timer expires and no synchronization message was received
	Error during internal time synchronization	Indication on: RTC time invalid Indication off: After setting the clock via HTML (see chapter 6.3.3.5) During battery failure at device startup
Time Set	The time was set.	Indication on: Time set Only when setting the clock via HTML

Indication (Relevant for Operating Mode)	Description	Notes
Default IP Address	The IP-Addr. button has been pressed for more than 3 s.	Indication on: IP-Addr. push-button was pressed The device restarts and applies the default IP address.
Primary NTP Server Error	Faulty or no response from the primary NTP server	Indication on: Error Indication off: Valid time messages has been received for a period of 10 min Only for time synchronization via Ethernet NTP (see chapter 6.3.3.5)
Secondary NTP Server Error	Faulty or no response from the secondary NTP server	Indication on: Error Indication off: Valid time messages has been received for a period of 10 min Only for time synchronization via Ethernet NTP (see chapter 6.3.3.5)
Daylight Saving Time	Switching between daylight saving time/standard time	Indication on: Daylight saving time Indication off: Standard time
Ethernet Link Error	Ethernet connection error on port 1 of the Ethernet switch (without Y-cable available)	Indication on: Error Indication off: Ethernet link recognized
Ethernet Link 2 Error	Ethernet connection error on port 2 of the Ethernet switch (available only with Y-cable)	Indication on: Error Indication off: Ethernet link recognized
Modbus TCP OK (Modbus TCP Server)	At least one Modbus TCP connection 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. Indication off: No Modbus message was received during the set monitoring time. See chapter 6.3.3.6
Modbus Serial OK (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. Indication off: No serial message was received during the set monitoring time. See chapter 6.3.3.8
Settings Load	Starting to change the parameters of the passive parameter set.	Indication on: Start of changes Indication off: Changes complete

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Indication (Relevant for Operating Mode)	Description	Notes
Settings Check	The passive parameter set is to be activated; the internal parameter check is running.	Indication on: Check started Indication off: Check complete
Settings Activate	The passive parameter set is enabled and the device works with these parameters.	Indication on: Activation started Indication off: Activation complete
Indication x from Remote	x = 1 to 6 Status of the indications that can be set to control the LEDs and the relay outputs via the communication	Indication on: ON Indication off: OFF Message invalid: Not yet updated via the communication or again invalid via the communication
Binary input x - Terminal block N	x = 1 to 3 Terminal block N	-
Binary input x - Terminal block P	x = 1 to 3 Terminal block P	-
I/O Ethernet OK (Ethernet I/O mirror (server or client) and Modbus UDP server)	Client mode: **ON**: The connected server replied within the response timeout (but not with a Modbus Exception Response). **OFF**: The connected server has not replied to the request of the client or replied with the Modbus Exception Response. Server mode: **ON**: At least one valid Modbus UDP telegram was received (which does not lead to a Modbus Exception Response.) **OFF**: No Modbus UDP telegram was received within the set monitoring time.	

Indication (Relevant for Operating Mode)	Description	Notes
I/O Ethernet Fail > 0,05 % (Ethernet I/O mirror (server or client) and Modbus UDP server)	Client mode: **ON**: The calculated % value increases by 0.05 % (that is, more than 1 faulty telegram per 2000 requests.) **OFF**: The calculated % value drops by 0.05 % or resetting the counter of faulty telegrams was executed. Server mode: **ON**: The calculated % value increases by 0.05 % (that is, more than 1 faulty telegram per 2000 requests.) **OFF**: The calculated % value drops by 0.05 % or resetting the counter of faulty telegrams was executed. Update cycle with this message: Every second	Calculation for client mode: % value = faulty answers/requests $\times$ 100 Faulty answers are: no answer (response timeout) Modbus Exception Response Error in telegram format Calculation for server mode: % value = incorrect receive telegrams/ (incorrect + correct receive telegrams) $\times$ 100 - Incorrect receive telegrams are: - Error in telegram format - Telegrams that cause an Exception Response
I/O Serial OK Serial I/O mirror (server or client)	Client mode bidirectional: **ON**: The connected server replied within the response timeout (but not with a Modbus Exception Response). **OFF**: The connected server has not replied to the request of the client or replied with the Modbus Exception Response. Client mode unidirectional: The message is always **OFF**. Server mode: **ON**: At least one valid Modbus RTU telegram was received (this does not lead to a Modbus Exception Response.) **OFF**: No Modbus RTU telegram was received within the set monitoring time.	

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Indication (Relevant for Operating Mode)	Description	Notes
I/O Serial Fail > 0,05 % (Serial I/O mirror (server or bidirectional client))	Client mode bidirectional: **ON**: The calculated % value increases by 0.05 % (that is, more than 1 faulty telegram per 2000 requests.) **OFF**: The calculated % value drops by 0.05 % or resetting the counter of faulty telegrams was executed. Server mode: **ON**: The calculated % value increases by 0.05 % (that is, more than 1 faulty telegram per 2000 requests.) **OFF**: The calculated % value drops by 0.05 % or resetting the counter of faulty telegrams was executed. Update cycle with this message: Every second	Calculation for client mode: % value = faulty answers/requests $\times$ 100 Faulty answers are: - No reply (response timeout) - Modbus Exception Response - Error in telegram format Serial parity or frame errors are not viewed in client mode, because they are included in the response timeout. Calculation for server mode: % value = incorrect receive telegrams/ (incorrect + correct receive telegrams) $\times$ 100 - Incorrect receive telegrams aresind: - Error in telegram format - Telegrams that cause an Exception Response - Serial parity or frame error (each serial error is considered/counted as one telegram)
I/O Mirror OK (Ethernet I/O mirror (server or client) Serial I/O mirror (server or client))	Client mode bidirectional serial: **ON**: I/O mirror client has the data exchange status. **OFF**: I/O mirror client has no data exchange status. Client mode unidirectional serial: *I/O Mirror OK* is always **ON**. *I/O Serial OK* is always **OFF**.	**ON** includes that *I/O Ethernet OK* or *I/O Serial OK* has to have the state **ON**. **OFF**: *I/O Ethernet OK* or *I/O Serial OK* can have the state **ON**.
I/O Ethernet Reset Counter (Ethernet I/O mirror (server or client) and Modbus UDP server)	Resetting of all internal diagnosis counter for I/O Ethernet communication, including the counter for faulty telegrams, which are used for the analysis of *I/O Ethernet Fail > 0.05 %*.	-
I/O Serial Reset Counter (Serial I/O mirror (server or bidirectional client))	Resetting of all internal diagnosis counter for I/O serial communication, including the counter for faulty telegrams, which are used for the analysis of *I/O Serial Fail > 0.05 %*.	-

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13   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 I/O Unit 7XV5673, order number E50417-H1040-C484-A3.

13.1 Process Connections

13.1.1 Binary Inputs

Parameter	Default Setting	Setting Range
Threshold value voltage can be set for all binary inputs individually	19 V	19 V 88 V 176 V
Software filter time can be set for each terminal block individually	1 (*2) ms	2 ms to 120 000 ms
Binary input indication can be set for all binary inputs individually	For example for Terminals P8/9: Binary input 1 - Terminal block P	Arbitrary text; name of the indication

13.1.2 Binary Outputs (Relay Outputs)

Parameter	Default Setting	Settings
Indication (can be set individually for all relay outputs)	-none-	-none- Device OK Battery Failure Settings Load Settings Check Settings Activate Modbus TCP OK Ethernet Link Error Modbus Serial OK Time Synchronization Error Primary NTP Server Error Secondary NTP Server Error Daylight Saving Time Ethernet Link 2 Error Default IP Address Indication 1 from Remote Indication 2 from Remote Indication 3 from Remote Indication 4 from Remote Indication 5 from Remote Indication 6 from Remote Binary In 1 - Terminal block N Binary In 2 - Terminal block N Binary In 3 - Terminal block N Binary In 1 - Terminal block P Binary In 2 - Terminal block P Binary In 3 - Terminal block P I/O Ethernet OK I/O Ethernet Fail > 0.05 % I/O Serial OK I/O Serial Fail > 0.05 % I/O Mirror OK
Invert source (can be set individually for all relay outputs)	no	no yes
Operating mode (can be set individually for all relay outputs)	Persistent	Persistent Persistent with fail safe Pulse Pulse with retrigger

13.1.3 LEDs

Parameter	Default Setting	Settings
RUN	Device OK	Cannot be parameterized
ERROR H1 H2	-none-	-none- Device OK Battery Failure Settings Load Settings Check Settings Activate Modbus TCP OK Ethernet Link Error Modbus Serial OK Time Synchronization Error Primary NTP Server Error Secondary NTP Server Error Daylight Saving Time Ethernet Link 2 Error Default IP Address Indication 1 from Remote Indication 2 from Remote Indication 3 from Remote Indication 4 from Remote Indication 5 from Remote Indication 6 from Remote Binary In 1 - Terminal block N Binary In 2 - Terminal block N Binary In 3 - Terminal block N Binary In 1 - Terminal block P Binary In 2 - Terminal block P Binary In 3 - Terminal block P I/O Ethernet OK I/O Ethernet Fail > 0.05 % I/O Serial OK I/O Serial Fail > 0.05 % I/O Mirror OK
Indication inverted	no	no yes

13.2 Administrative

13.2.1 Indication Properties

Parameter	Default Setting	Settings
Indication x from Remote (x = 1 to 6)	Not configured	Not configured On Off On/Off
Binary Out y - Terminal Block z (y = 1 to 3, z = N or P)	Not configured	Not configured On Off On/Off
Binary In y - Terminal Block z (y = 1 to 3, z = N or P)	Not configured	Not configured On Off On/Off

13.2.2 Time Synchronization

Parameter	Default Setting	Settings
Source of time synchronization	Internal	Internal Ethernet NTP Fieldbus
Time zone offset to UTC	+00:00	-12 to +13 (hours) (in increments of 0.5 h)
Daylight Saving Time switchover	yes	no yes
DST offset to UTC	+01:00	0 to + 2 (hours) (in increments of 0.5 h)
Start of DST	March Last week Sunday 02:00 AM	January to December First week Second week Third week Fourth week Last week Sunday to Saturday 0:00 to 23:00 (full hour)
End of DST	October Last week Sunday 03:00 AM	January to December First week Second week Third week Fourth week Last week Sunday to Saturday 0:00 to 23:00 (full hour)

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Additional parameters if the source is Ethernet NTP		
Primary NTP server IP Address	192.168.0.254	Any
Secondary NTP server IP Address	192.168.0.253	Any
Error indication after	10 min	2 min to 120 min
Additional parameters if source is fieldbus (Modbus RTU)		
Error indication after	10 min	2 min to 120 min

13.2.3 Ethernet Communication

Parameter	Default Setting	Setting Ranges
IP Address [1]	192.168.0.55	Any, 0.0.0.0 for DHCP
Subnet mask [1]	255.255.255.0	Any
Default gateway [1]	192.168.0.1	Any
Bus protocol/Operating mode	Modbus TCP	-none- Modbus TCP Modbus UDP I/O Mirror client I/O Mirror server IEC 61850
Modbus TCP		
Use a user-port number [2]	no	no yes
User-port number [2]	10000	10000 to 65535
Access rights for user port	Full	Full Read only
Access rights for user port 502	Full	Full Read only
Keep Alive time	10 s	0 s = switch off 1 s to 65 535 s
Communication supervision time	600 * 100 ms	0 s = none 100 ms to 6 553 400 ms
Modbus UDP		
Port number	51000	10000 to 65535
Access rights	Full	Full Read only
Communication supervision time	8 * 10 ms	0 ms = invalid 10 ms to 60 000 ms
I/O Mirror Client **(can only be parameterized, if no I/O mirror mode is selected under Serial Communication)**		
Server IP address	192.168.0.56	Any
Server port	51000	10000 to 65535

Response timeout	3 * 10 ms	0 ms = invalid 10 ms to 60 000 ms
I/O Mirror Server **(can only be parameterized, if no I/O mirror mode is selected under Serial Communication)**		
Port number	51000	10000 to 65535
Communication supervision time	8 * 10 ms	0 ms = invalid 10 ms bis 60 000 ms
Bus Protocol IEC 61850 [3]		
IEC 61850 Edition	Edition 1	Edition 1 Edition 2
IED name number [4]	1	0 to 65534
Multicast MAC address [4]		[xx-xx-xx-xx-xx-xx] hexadecimal
App ID [4]		[xxxx] hexadecimal
VLAN ID [4]		[xxx] hexadecimal
VLAN priority [4]	4	0 to 7
Retransmit MIN [4]	5	1 ms to 500 ms
Retransmit MAX [4]	3000	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 changed the IEC 61850 settings, the device must be restarted.

4) The parameters stated here are only used when **yes** is selected for "**Use settings in the table below**" (see Bild 6-36). This allows for a simple configuration of the GOOSE publishers without using DIGSI and the SICAM I/O Mapping Tool.

13.2.4   Serial Communication

Parameter	Default setting	Settings
Bus protocol/Operating mode	Modbus RTU	-none- Modbus RTU I/O Mirror client I/O Mirror server
Modbus RTU		
Device address	1	1 to 247
Baud rate	19 200 bit/s	1200 bit/s 2400 bit/s 4800 bit/s 9600 bit/s 19 200 bit/s 38 400 bit/s 57 600 bit/s 115 200 bit/s

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Parity	Even	None, 1 stop bit Even Odd None, 2 stop bit
Access rights	Full	Full Read only
Communication supervision time	600 * 100 ms	0 s = none 100 ms to 6 553 400 ms
If there is an FO interface: Fiber optical idle state	Light OFF	Light OFF Light ON
I/O Mirror Client **(can only be parameterized, if no I/O mirror mode is selected under Serial Communication)**		
Communication mode	Bidirectional	Bidirectional Unidirectional
Response timeout (only in communication mode, bidirectional)	3 * 10 ms	10 ms to 60 000 ms (Settings recommended by Siemens see chapter 8.3.2.1)
Baud rate	115 200 bit/s	1200 bit/s 2400 bit/s 4800 bit/s 9600 bit/s 19 200 bit/s 38 400 bit/s 57 600 bit/s 115 200 bit/s 187 500 bit/s
Send time synchronization	no	yes (every minute) no
If there is an FO interface: Fiber optical idle state	Light OFF	Light OFF Light ON
I/O Mirror Server **(can only be parameterized, if no I/O mirror mode is selected under Serial Communication)**		
Baud rate	115 200 bit/s	1200 bit/s 2400 bit/s 4800 bit/s 9600 bit/s 19 200 bit/s 38 400 bit/s 57 600 bit/s 115 200 bit/s 187 500 bit/s
Communication supervision time	8 * 10 ms	0 s = invalid 10 ms to 60 000 ms (Settings recommended by Siemens see chapter 8.3.2.2)
If there is an FO interface: Fiber optical idle state	Light OFF	Light OFF Light ON

13.2.5   Device and Language

Parameter	Default Setting	Settings
Device name	I/O Unit 7XV5673	Max. 32 characters
Language	ENGLISH (US)	ENGLISH (US) DEUTSCH (DE)
Date/time format	YYYY-MM-DD, Time with 24 hours	YYYY-MM-DD, Time with 24 hours YYYY-MM-DD, Time with 12 h AM/PM DD-MM-YYYY, Time with 24 hours DD-MM-YYYY, Time with 12 h AM/PM MM/DD/YYYY, Time with 24 hours 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
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

Client	Device in the communication network that sends data requests or commands to the server devices and receives responses from them
CO	**C**hange **O**ver: Type of relay
CRC	**C**yclic **R**edundancy **C**heck: The cyclic redundancy check is a method of determining a test value for data (for example for data transmission in computer networks) with the purpose to detect errors during the transmission or duplication of data.

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

FO	**F**iber **o**ptical
FW	**F**irm**w**are: Program code for execution in a microcontroller

G

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

H

Holding register	Area for representing data in Modbus communication
HTML	**H**yper**t**ext **M**arkup **L**anguage; application in World Wide Web

I

IEC **I**nternational **E**lectrotechnical **C**ommission, standards organization; Communication standard for substations and protection equipment

IP **I**nternet **P**rotocol

IP address Addresses in computer networks based on the Internet protocol

J

JavaScript Script language mainly used by Web browsers

K

Keep Alive KeepAlive on TCP level is a feature intended to verify the availability and functioning of the communication partner (client) and to maintain a TCP network link if the network is inactive.

The server sends KeepAlive messages (TCP packets without data) to the client in regular intervals (KeepAlive time) while the network is inactive, and the client responds to these messages.

If the client does not respond to a KeepAlive message, the server assumes that the link is down or the client is inactive and closes the TCP link.

L

LED **L**ight-**E**mitting **D**iode

LSB **L**east **S**ignificant **B**it

M

MAC Address **M**edia **A**ccess **C**ontrol address: Hardware address that clearly identifies the device on the network.

MBAP **M**od**b**us **A**pplication **P**rotocol

MBAP Header Header of a Modbus TCP message consisting of these 4 parts: Transaction identifier (2 bytes), protocol identifier (2 bytes), length (2 bytes), unit identifier (1 byte).

Modbus The Modbus protocol is a communication protocol based on a client-server architecture.

Modbus RTU Modbus **R**emote **T**erminal **U**nit: Modbus protocol type for transmitting data over serial networks (for example RS485)

Modbus TCP Modbus **T**ransmission **C**ontrol **P**rotocol: Modbus protocol type for transmitting data as TCP/IP packets; TCP port 502 is reserved for Modbus TCP.

Modbus UDP Modbus **U**ser **D**atagram **P**rotocol: Modbus protocol type for transmitting data as UDP/IP packets

MSB **M**ost **S**ignificant **B**it

N

NO **N**ormally **o**pen: Type of relay

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

R

Response time Time the output needs to react to a signal change at the device input. Time measured from an instant change at the AC input until the corresponding change of a DC output quantity has reached 90% of its final value.

RJ45 Ethernet plug connector

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

S

	Server	Sends data upon request by the client
	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

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

U

	UDP/IP	**U**ser **D**atagram **P**rotocol/**I**nternet **P**rotocol: Family of network protocols
	UTC	**U**niversal **T**ime **C**oordinated: Universal time standard referred to the time at the prime meridian

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