

SIMATIC NET

TeleControl Configuration - DNP3

Configuration Manual

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Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

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indicates that death or severe personal injury **will** result if proper precautions are not taken.

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indicates that death or severe personal injury **may** result if proper precautions are not taken.

CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

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We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Preface

Validity of this manual

This manual is valid for all communications modules of the SIMATIC NET range listed below which support the telecontrol protocol DNP3.

Note the structure of the documentation.

Supported modules

You can find the devices for which the configuration manual is valid in the section Communications modules (Page 11).

Structure of the documentation

The documentation for the SIMATIC NET communications modules for Telecontrol consists of the following manuals in each case:

- Manual or operating instructions
- One or more configuration manuals

The documentation for the modules specified above consists of the following manuals and contents:

- **Manual / Operating instructions**

Valid for the respective module or module group

- Application and functions
- Requirements (CPUs, configuration software, etc.)
- Hardware description
- Installation, wiring, commissioning, operation
- Diagnostics, maintenance
- Technical specifications, approvals, accessories

- **SINAUT ST7 system manual**

- **Volume 1 - System and hardware**

Valid for: TIM 3V-IE, TIM 3V-IE Advanced, TIM 4R-IE

Hardware description, installation, wiring, commissioning, operation, technical specifications, approvals

- **Volume 2 - Configuration under STEP 7 V5**

Valid for: TIM 3V-IE, TIM 3V-IE Advanced, TIM 4R-IE

- **Volume 3 - Configuration under STEP 7 Professional (TIA Portal)**

Valid for all ST7-capable communications modules

- **Configuration manual DNP3**

Configuration and diagnostics in STEP 7 Professional (TIA Portal)

Valid for all SIMATIC NET communications modules that support the DNP3 protocol.

- **Configuration manual IEC**

Configuration and diagnostics in STEP 7 Professional (TIA Portal)

Valid for all SIMATIC NET communications modules that support the protocol IEC 60870-5-101/104.

You can find the Internet links for the manuals in the Bibliography (Page 187).

Abbreviations/device names

This manual often uses the following abbreviations/acronyms:

- **Module / device**

Names for the respective communications modules

- **WBM**

"WBM" is the acronym for the "Web Based Management", the pages of the TIM Web server for configuration and diagnostics data.

New in this release

First issue

Current manual release on the Internet

You will also find the current version of this manual on the Internet pages of Siemens Industry Online Support:

Link: (<https://support.industry.siemens.com/cs/ww/en/ps/21764/man>)

Required experience

Knowledge in the following areas is required for configuration and diagnostics of the devices:

- Setting up industrial networks with security functions
- Data transfer via WAN networks
- SIMATIC STEP 7 Professional

Cross references

In this manual there are often cross references to other sections.

To be able to return to the initial page after jumping to a cross reference, some PDF readers support the command <Alt>+<left arrow>.

License conditions

Note

Open source software

The product contains open source software. Read the license conditions for open source software carefully before using the product.

The manual for the relevant product provides information on finding the license conditions.

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Link: (<http://www.siemens.com/industrialsecurity>)

SIMATIC NET glossary

Explanations of many of the specialist terms used in this documentation can be found in the SIMATIC NET glossary.

You will find the SIMATIC NET glossary here:

- SIMATIC NET Manual Collection or product DVD

The DVD ships with certain SIMATIC NET products.

- On the Internet under the following address:

Link: (<http://support.automation.siemens.com/WW/view/en/50305045>)

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Functions and requirements

1.1 Communications modules

Communications modules for the telecontrol protocol DNP3

The following SIMATIC NET communications modules can be used for the telecontrol protocol DNP3.

You will find the TIM 4R-IE DNP3 with article number 6NH7803-4BA00-0AA0 twice in the STEP 7 catalog, as built-in unit (S7-300 rack) and as stand-alone device.

Meaning of symbols in the table:

- X = Supported
- - = Not supported

Table 1- 1 Communications modules for DNP3

Module Article number	Number of inter- faces *		Station type			STEP 7 product	Required firmware
	IE	RS	Master	Node station	Station		
TIM 1531 IRC 6GK7 543-1MX00-0XE0	3	1	X	X	X	STEP 7 Professional	V2.0
TIM 4R-IE DNP3 / TIM 4R-IE DNP3 Stand-alone 6NH7803-4BA00-0AA0	2	2	X	X	X	STEP 7 Professional	V3.2
TIM 3V-IE DNP3 6NH7803-3BA00-0AA0	1	1	X	X	X	STEP 7 Professional	V3.2
CP 1243-8 IRC 6GK7 243-8RX30-0XE0	1	- ***	-	-	X	STEP 7 Basic ** / Professional	V3.1
CP 1243-1 6GK7 243-1BX30-0XE0 6AG1 243-1BX30-2AX0	1	-	-	-	X	STEP 7 Basic ** / Professional	V3.1
CP 1542SP-1 IRC 6GK7 542-6VX00-0XE0	1	-	-	-	X	STEP 7 Professional	V2.0

* IE = Ethernet interfaces, RS = serial interfaces

** STEP 7 Basic with connection of the CP to a third-party master. See note below.

*** The connection of a TS-Module to the CP 1243-8 IRC is not supported for DNP3.

Notes on the table

Notes on the columns:

- **Station type "Node station"**

A node station is located in the plant hierarchy between the master station and other lower-level stations. The module requires at least two interfaces.

In the configuration, the "network node type" of the interface connected to the master station is configured as "Node station". See section Networking of the interfaces (Page 38) for information on this.

- **STEP 7 product with S7-1200 CPs**

S7-1200 CPs can be configured under STEP 7 Basic for connection to a third-party master.

You need STEP 7 Professional project to connect the CPs to SIMATIC NET master or node stations configured in STEP 7.

- **Firmware**

The required firmware versions of the modules relate to the complete configuration described in this manual. You can find the required STEP 7 version for this in the section Software requirements (Page 15).

Modules with lower firmware versions can be configured in older STEP 7 versions with a deviating scope of functions.

1.2 Configuration examples

Below, you will find several configuration examples with the communications modules that can be used.

Communication via Ethernet / Internet, sending e-mails

In the sample configuration shown, S7 stations communicate with the master station via the Ethernet interfaces of the different modules.

With their Ethernet interfaces, TIM modules enable connection to a redundant master station.

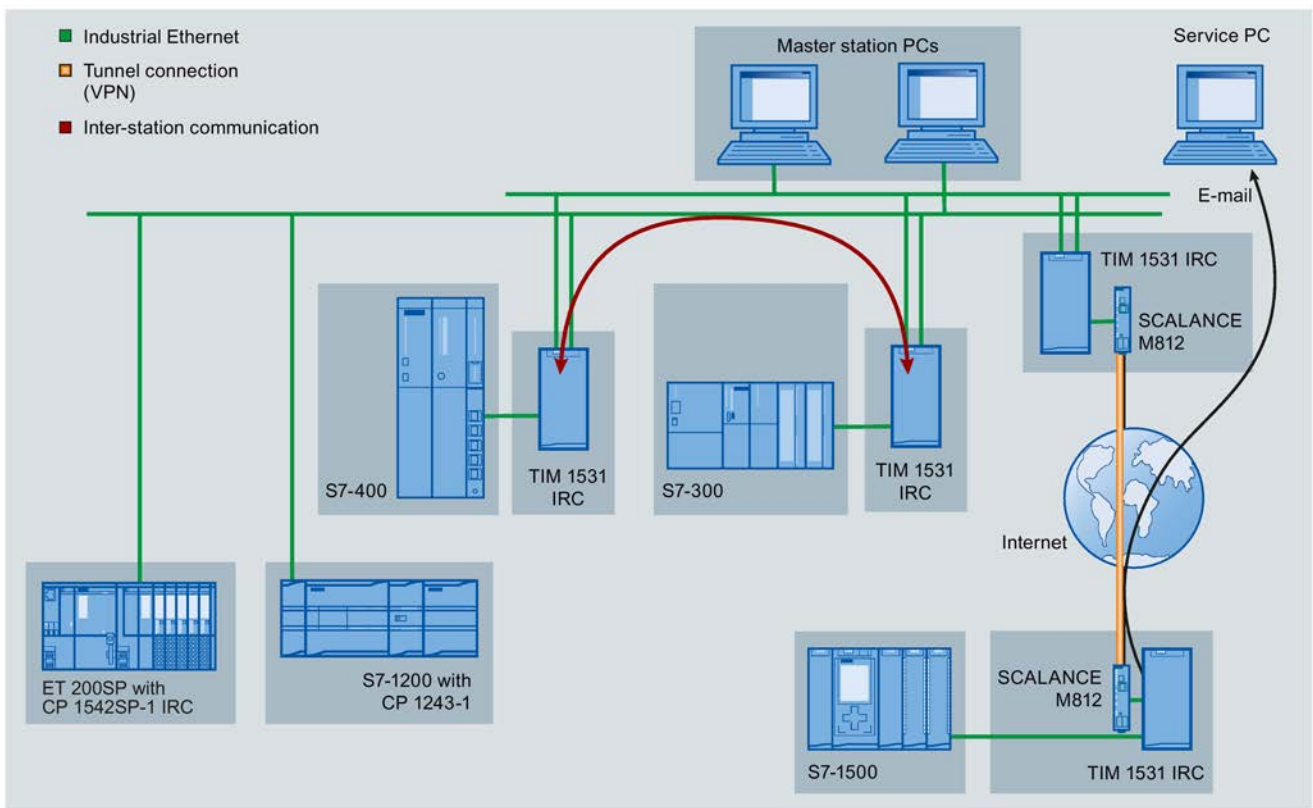


Figure 1-1 Communication via Ethernet / Internet

E-mails

The modules can generate and send e-mails due to events. The following recipients are possible:

- PCs with an Internet connection
- Cell phones
- SIMATIC stations with the appropriate program blocks

Inter-station communication

Direct inter-station communication between S7 stations with a TIM is possible via IP-based networks.

Inter-station communication, in contrast, runs via a master station that forwards the frames to the target subscriber.

Path redundancy using the serial interface

In the following example, the Ethernet interface and the serial interface are used with the TIM 1531 IRC to set up redundant transmission paths.

- Ethernet interface for communication via Ethernet / Internet
- Serial interface for communication via a WAN network (dedicated line or dialup network)

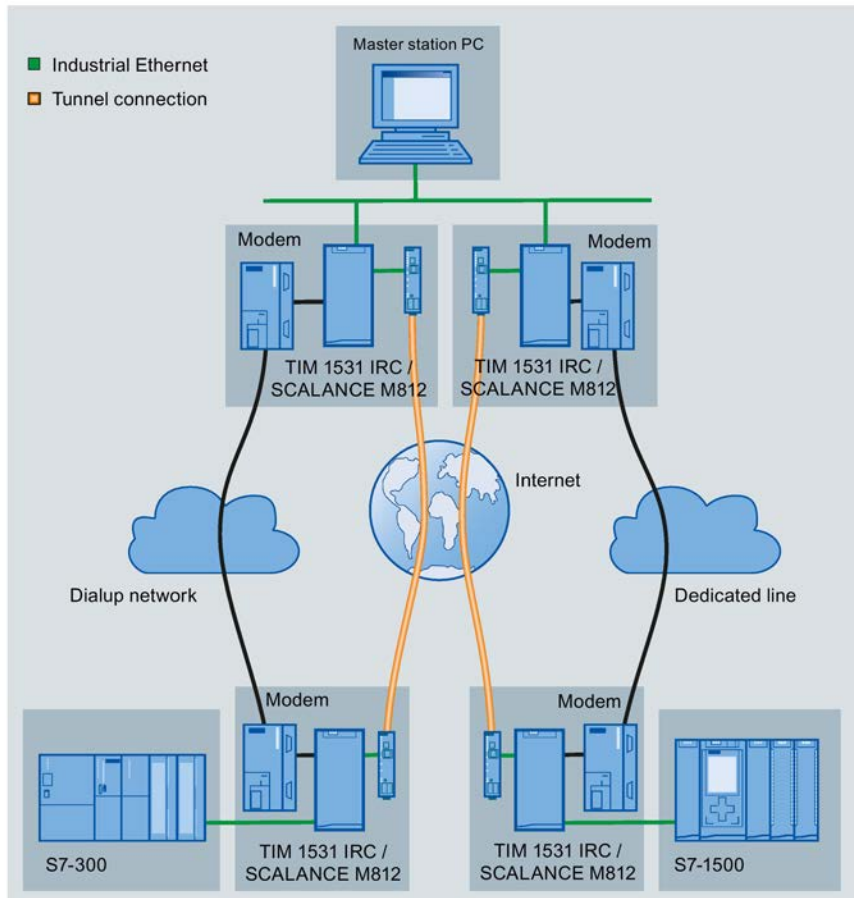


Figure 1-2 Communication via redundant paths

Path redundancy is also possible over two Ethernet networks.

1.3 Usable CPUs

Compatible CPUs

The following can be configured as assigned CPUs of the communications modules:

- **TIM 1531 IRC**

- S7-1500

All CPUs as of firmware version V2.1

- S7-300

All CPUs with PROFINET interface

- S7-400

All CPUs with PROFINET interface

- **CP 1243-1 / CP 1243-8 IRC**

CPU with firmware version as of V4.2

- **CP 1542SP-1 IRC**

CPUs as of firmware version V2.0:

- CPU 1510SP-1 PN
- CPU 1510SP F-1 PN
- CPU 1512SP-1 PN
- CPU 1512SP F-1 PN

You will find more detailed information on the CPUs and the BusAdapters in the manual /5/ (Page 188).

1.4 Software requirements

Software for configuration and online functions

To configure the modules, the following configuration tool is required:

- STEP 7 Professional V15.1

1.5 Performance data and configuration limits

1.5.1 TIM 1531 IRC

Connection resources

- **Telecontrol connections**

The number of connections or communications partners is limited for the two interface types and every individual interface.

Note that redundant connection paths of a connection between two partners require two connection resources on each partner.

- Max. number of connections: 128

Distribution over 4 interfaces can take place in any way (max. 128 per interface).

- **E-mail**

A connection to send e-mails can be established during runtime.

- **S7 connections**

- Max. 4 connection resources for PG/OP connections (see below)

- **PG/OP connections**

4 connection resources for connections to the engineering station or HMI devices (included in the configuration limits of the S7 connections, see above)

- **PG routing**

Max. 4 connections at the same time

- **Online functions**

See PG/OP connections

- **HTTP/HTTPS**

Max. 2 connections per Ethernet interface

Number of data points for the data point configuration

The maximum number of configurable data points is 3000.

Message memory: Send buffer / SD card

The TIM has a frame memory (send buffer) for the values of data points configured as an event.

The send buffer has the following maximum size (number of events):

- 250000

The size of the frame memory is divided equally among all configured communications partners.

You will find details of how the send buffer works (storing and sending events) as well as the options for transferring data in the section Process image, type of transmission, event classes (Page 113).

For information on saving events on an optional SD card, see section Basic settings (Page 33).

Messages: E-mail

Up to 10 messages which the TIM can send as e-mails can be configured in STEP 7.

- Number of characters per e-mail

Maximum number of characters that can be transferred per e-mail: 256 ASCII characters including any value sent at the same time

1.5.2 TIM 4R-IE DNP3 / TIM 3V-IE DNP3

Number of DNP3 connections

You will find the connection resources in the form of the table after the following listing.

TIM configured as DNP3 master station / node station

- **TIM 4R-IE DNP3**

Number in total: Max. 128,
of which:

- Pro Ethernet interface:
 - Configured with master station function: Max. 64
 - Configured with station function: Max. 16
- Pro RS-232 interface:
 - Configured with master station function: Max. 32
 - Configured with station function: Max. 16

- **TIM 3V-IE DNP3**

Number in total: Max. 8,
of which:

- Via the Ethernet interface: Max. 8
- Via the RS-232 interface: Max. 8

TIM configured as DNP3 station

- **TIM 4R-IE DNP3**

Number in total: Max. 32,
of which:

- Per Ethernet interface Max. 16
- Per RS-232 interface: Max. 16

- **TIM 3V-IE DNP3**

Number in total: Max. 8,
of which:

- Via the Ethernet interface: Max. 8
- Via the RS-232 interface: Max. 8

Note

Double the connection resources with direct communication between stations (only via Ethernet or dial-up network)

Note that when there is direct communication between two stations, 2 connection resources are occupied per station: One for the master station connection, one for the station connection.

Table 1- 2 Overview of the connection resources

TIM type	Subscriber type / interface configuration	Max. number of connections per TIM in total	Interface	Network type	Max. number of connections per interface
TIM 4R-IE DNP3	Master station	128 *	Ethernet 1	TCP	64
			Ethernet 2	TCP	64
			RS232 no. 1	Dedicated line	32
				Dialup network	32
			RS232 no. 2	Dedicated line	32
				Dialup network	32
	Station	32	Ethernet 1	TCP	16
			Ethernet 2	TCP	16
			RS232 no. 1	Dedicated line	16
				Dialup network	16
			RS232 no. 2	Dedicated line	16
				Dialup network	16
TIM 3V-IE DNP3	Master station / node station	8	Ethernet	TCP	8
			RS232	Dedicated line	8
				Dialup network	8
	Station	8	Ethernet	TCP	8
			RS232	Dedicated line	8
				Dialup network	8

* The total number of 128 also applies to the TIM 4R IE DNP3 as a node station. The maximum number per interface is obtained from the information in the "Master station" or "Station" rows.

Number of communications objects per TIM

The maximum number of communications objects for DNP3 communication per TIM is 100.

Size of the message memory for events

- TIM 3V-IE DNP3: 64 000 events
- TIM 4R-IE DNP3: 200 000 events

Number of S7 connections via Ethernet

In addition to the DNP3 connections, the number of possible S7 connections via the Ethernet interface is as follows:

- **TIM 4R-IE DNP3**

Number in total: Max. 5,
of which:

- 2 configurable S7 connections
- 2 PG connections
- 1 OP connection

- **TIM 3V-IE DNP3**

Number in total: Max. 3,
of which:

- 2 PG connections
- 1 OP connection

No S7 connections can be established via the serial interface.

Number of MODBUS slaves per station

The maximum number of MODBUS slaves that can be connected to the serial interface of a TIM depends on the configured interface standard:

- RS-232: Maximum of 1 MODBUS slave
- RS-485: Maximum of 8 MODBUS slaves

1.5.3 CP 1243-8 IRC

Number of CMs/CPs per station

In each S7-1200 station, up to three CMs/CPs can be plugged in and configured, of which a maximum of one CP 1243-8 IRC.

Connection resources

- **Telecontrol connections**

The CP can establish connections to up to 4 communications partners.

The partners can be linked redundantly.

- **TCP connections**

The CP can establish connections to up to 4 communications partners (S7 stations).

- **Online functions**

1 connection resource is reserved for online functions.

- **S7 connections**

8 connection resources for S7 connections (BSEND/BRCV)

- **S7 routing**

Max. 4 connections at the same time

- **PG/OP connections**

- 2 connection resources for PG connections
- 1 connection resource for OP connections

Number of data points for the data point configuration

The maximum number of configurable data points is 200.

Frame memory (send buffer)

The CP has a frame memory (send buffer) for the values of data points configured as an event.

The send buffer has a maximum size of 64000 events. The size of the frame memory is divided equally among all configured communications partners. It can be set in STEP 7, refer to the section Communication with the CPU (Page 62).

You will find details of how the send buffer works (storing and sending events) as well as the options for transferring data in the section Process image, type of transmission, event classes (Page 113).

Messages: E-mail

Up to 10 messages to be sent as e-mails can be configured in STEP 7.

- Maximum number of characters that can be transferred per e-mail: 256 ASCII characters including any value sent at the same time

IPsec tunnel (VPN)

Up to 8 IPsec terminals can be established for secure communication with other security modules.

Firewall rules

The maximum number of firewall rules in advanced firewall mode is limited to 256.

The firewall rules are divided up as follows:

- Maximum 226 rules with individual addresses
- Maximum 30 rules with address ranges or network addresses
(e.g. 140.90.120.1 - 140.90.120.20 or 140.90.120.0/16)
- Maximum 128 rules with limitation of the transmission speed ("Bandwidth limitation")

1.5.4 CP 1243-1

Number of CMs/CPs per station

In each S7-1200 station, up to three CMs/CPs can be plugged in and configured; this allows three CP 1243-1 modules.

To use telecontrol communication, three CP 1243-1 modules can be plugged in per station.

Connection resources

- **Telecontrol connections**

The CP can establish connections to the following master station types:

- To up to four non-redundant or redundant connected masters

- **S7 connections and TCP / UDP / ISO-on-TCP connections**

Max. 14 connection resources, can be distributed as required for:

- S7 connections (PUT/GET)
- Connections via program blocks (OUC) to S7 stations

- **Online functions**

1 connection resource is reserved for online functions.

- **PG/OP connections**

- 1 connection resource for PG connections
- 3 connection resources for OP connections

Number of data points for the data point configuration

The maximum number of configurable data points is 200.

Frame memory (send buffer)

The CP has a frame memory (send buffer) for the values of data points configured as an event and that are sent to the communications partner.

The send buffer has a maximum size of 64000 events divided into equal parts for all configured communications partners. The size of the frame memory can be set in STEP 7, refer to the section Process image, type of transmission, event classes (Page 113).

Messages (e-mail)

- Sending of up to 10 messages (e-mails) can be configured with the message editor.
- Sending e-mails via the TMAIL_C program block

IPsec tunnel (VPN)

Up to 8 IPsec terminals can be established for secure communication with other security modules.

Firewall rules

The maximum number of firewall rules in advanced firewall mode is limited to 256.

The firewall rules are divided up as follows:

- Maximum 226 rules with individual addresses
- Maximum 30 rules with address ranges or network addresses (e.g. 140.90.120.1 - 140.90.120.20 or 140.90.120.0/16)
- Maximum 128 rules with limitation of the transmission speed ("Bandwidth limitation")

1.5.5 CP 1542SP-1 IRC

Number of CPs per station

In each ET 200SP station, up to three special modules can be plugged in and configured; this allows a maximum of two CP 154xSP-1 modules.

For details of the permitted special modules and the slot rules, refer to the manual.

Connection resources

Connection resources

Number of connections via Industrial Ethernet, maximum of 32 in total, of which:

- S7: Max. 16
- TCP/IP: Max. 32
- ISO-on-TCP: Max. 32
- UDP: Max. 32

Also:

- Online connections of the engineering station (STEP 7): Max. 2
- TCP connections for HTTP

For HTTP access up to 12 TCP connection resources are available that are used by one or more Web browsers to display data of the CP.
- PG/OP connections (HMI): In total maximum of 16, of which:
 - Connection resources for PG connections: Max. 16
 - Connection resources for OP connections: Max. 16

Telecontrol

- **Telecontrol connections**

Connections to up to four single or redundant masters can be established.
- **E-mail (via message editor)**

Up to 10 e-mails to be sent can be configured.

Maximum number of characters that can be transferred per e-mail: 256 ASCII characters including any value sent at the same time
- **Frame memory (send buffer)**

The CP has a frame memory (send buffer) for the values of data points configured as an event.

The volume of the send buffer is divided equally among all configured communications partners. The size of the send buffer can be configured in STEP 7, refer to the section Communication with the CPU (Page 62).

The maximum size of the send buffer is:

100000 events

You will find details of how the send buffer works such as storing events as well as the options for transferring the data in the section Process image, type of transmission, event classes (Page 113).
- **Data points**

The maximum number of configurable data points is 500.

1.6 PG routing

PG routing between telecontrol modules

PG routing is supported between the modules listed in the table and via the specified media.

A requirement is that the options "S7 communication" and "Online functions" are enabled in the "Communication types" parameter group.

Module Medium	TIM 1531 IRC	CP 1243-8 IRC	CP 1542SP-1 IRC
TIM 1531 IRC	Ethernet (S7)	Ethernet (S7)	Ethernet (S7)
CP 1243-8 IRC	Ethernet (S7)	-	-
CP 1542SP-1 IRC	Ethernet (S7)	-	-

Max. number of S7 routing connections: 4

Communication mechanisms

2.1 Addressing and network configuration

Address information of the station

The following station information is required for the configuration:

- Station address (DNP3 address) of the station
- Listener port of the station. The master needs the port number to establish the connection.
- Address of the station

- IP address

or

- Name that can be resolved with DNS

If you use DNS, there must be a DNS server (see below) and this must be reachable for the module.

- DNS server address(es)

You require the DNS server address if you address the master using a name that can be resolved by DNS.

- Partner number

Masters that communicate with a station require the partner number of the station in order to assign the data points to be transferred.

With S7-1200 CPs that can only function as stations, the partner number of the master is assigned by the system.

Address information of the master

The following information on the master is required for the configuration:

- Station address of the master
- Listener port of a third-party device with the function "Master"
- Address of the master

- IP address

or

- Name that can be resolved with DNS

If you use DNS, there must be a DNS server (see below) and this must be reachable for the module.

- DNS server address(es)

You require the DNS server address if you address the master using a name that can be resolved by DNS.

- Partner number

Stations that communicate with the master require the partner number of the master in order to assign the data points to be transferred.

With S7-1200 CPs that can only function as stations, the partner number of the master is assigned by the system.

Redundant masters

The two devices of a redundant master have an identical station address.

They only require different IP addresses or host names.

Configurations with connections over the Internet: VPN connections

For connections running via the Internet, dynamic IP addresses can be used.

To allow communication in both directions and to ensure that the data is protected during transfer, a connection with a VPN tunnel is necessary. For this the security modules of the SCALANCE S or SCALANCE M series are available.

Remember the following points when configuring:

- You configure the IP address of the master station on the master.
- When configuring the interface of the station module, you configure the IP address of the router.
- You perform the VPN configuration with SCALANCE S/M both for the station and for the master station in STEP 7.

2.2 Communications options

Communication paths

The following communication channels are possible:

- Connections between master and station
- Redundant connections

If two subscribers can be reached via different networks, you can create a maximum of two connections between the subscribers to establish path redundancy.

- Direct communication

With direct communication, stations communicate directly with each other without the frames being transmitted from a master station or station. Two stations can thus communicate directly with each other.

You define the function when configuring a data point via the "Master function" parameter, see section "General" tab (Page 112).

As a further requirement, the "Spontaneous" option must be activated in the telecontrol connection.

The function is supported by the following modules:

- TIM 1531 IRC as of firmware V2.0
- TIM 3V-IE DNP3 / TIM 4R-IE DNP3 as of firmware V3.2

2.3 Connection establishment

Connection establishment with DNP3

With the DNP3 protocol, the master establishes the connection (call operation / polling).

If an established connection is interrupted, a master module tries to re-establish the connection.

Note**Connection interrupted by the mobile wireless network provider**

When using mobile wireless services, remember that existing connections can be interrupted by mobile wireless network providers for maintenance purposes.

Spontaneous mode

Enabling the "Unsolicited reporting" parameter in the "Unsolicited responses" parameter group in the "Settings DNP3 station" of an interface enables the unsolicited transmission of data from a station. In this case, dial-up network connections can be established by the communications module as client in order to send data of events spontaneously.

Connection establishment in Open User Communication and PG/OP communication

In Open User Communication in an S7 station, the CPU is the connection partner.

Connections are established as soon as the corresponding program blocks are called on the CPU.

This also applies to the situation when a different S7 station sends data. In this case, the receiver station calls the corresponding receiver modules.

2.4 Acknowledgment

The receipt of sent frames is monitored and acknowledged differently depending on the communication type and the telecontrol protocol.

Acknowledgment in DNP3

The basic acknowledgment mechanisms are configured for the data link layer, see section Transmission settings – DNP3 (Page 53).

A station module acknowledges a request from the master with its response frames.

The acknowledgment of unsolicited frames that a station module sends to the master is configured in the "Settings DNP3 station" parameter group, see section Settings DNP3 station (Page 56).

Acknowledgment in Open User Communication

The successful sending and receipt of frames is indicated by status displays of the program blocks.

With TCP segments, the protocol-specific acknowledgement mechanisms are used.

Configuration

3.1 Security recommendations

Observe the following security recommendations to prevent unauthorized access to the system.

General

- You should make regular checks to make sure that the device meets these recommendations and other internal security guidelines if applicable.
- Evaluate your plant as a whole in terms of security. Use a cell protection concept with suitable products.
- Do not connect the device directly to the Internet. Operate the device within a protected network area.
- Keep the firmware up to date. Check regularly for security updates of the firmware and use them.
- Check regularly for new features on the Siemens Internet pages.
 - You can find information on Industrial Security here:
Link: (<http://www.siemens.com/industrialsecurity>)
 - You can find information on security in industrial communication here:
Link: (<http://w3.siemens.com/mcms/industrial-communication/en/ie/industrial-ethernet-security/Seiten/industrial-security.aspx>)
 - You will find a publication on the topic of network security (6ZB5530-1AP0x-0BAx) here:
Link:
(http://w3app.siemens.com/mcms/infocenter/content/en/Pages/order_form.aspx?nodeKey=key_518693&infotype=brochures)
Enter the following filter: 6ZB5530

Physical access

Restrict physical access to the device to qualified personnel.

Network attachment

Do not connect the module directly to the Internet. If a connection of the module to the Internet is required, use the security variants of the telecontrol protocols or use protection mechanisms in front of the module. Protection mechanisms are for example a SCALANCE M router or a SCALANCE S security module with firewall.

Security functions of the product

Use the options for security settings in the configuration of the product. These includes among others:

- Protection levels
Configure a protection level of the CPU.
You will find information on this in the information system of STEP 7.
- Security function of the communication
 - Using the security functions of the telecontrol protocols.
 - Use the secure protocol variants, for example NTP (secure) or SNMPv3.
 - Leave access to the Web server deactivated.

Passwords

- Define rules for the use of devices and assignment of passwords.
- Regularly update the passwords to increase security.
- Only use passwords with a high password strength. Avoid weak passwords for example "password1", "123456789" or similar.
- Make sure that all passwords are protected and inaccessible to unauthorized personnel.
See also the preceding section for information on this.
- Do not use one password for different users and systems.

Protocols

Secure and non-secure protocols

- Only activate protocols that you require to use the system.
- Use secure protocols when access to the device is not prevented by physical protection measures.
 - The NTP protocol provides a secure alternative with NTP (secure).
 - The HTTP protocol provides a secure alternative with HTTPS when accessing the Web server.
- Deactivate DHCP at interfaces to public networks such as the Internet, for example, to prevent IP spoofing.

Table: Meaning of the column titles and entries

The following table provides you with an overview of the open ports on this device.

- **Protocol / function**
Protocols that the device supports.
- **Port number (protocol)**
Port number assigned to the protocol.

- **Default of the port**
 - Open
The port is open at the start of the configuration.
 - Closed
The port is closed at the start of the configuration.
- **Port status**
 - Open
The port is always open and cannot be closed.
 - Open after configuration
The port is open if it has been configured.
 - Open (login, when configured)
As default the port is open. After configuring the port, the communications partner needs to log in.
 - Closed after configuration
The port is closed because the module is always client for this service.
- **Authentication**
Specifies whether or not the protocol authenticates the communications partner during access.

Protocol / function	Port number (protocol)	Default of the port	Port status	Authentication
DNP3	20000 (UDP)	Closed	Open after configuration	Yes, when secure authentication is enabled.
S7 and online connections	102 (TCP)	Open	Open after configuration *	No
Online security diagnostics (CP 1243-x / CP 1542SP-1 IRC)	8448 (TCP)	Closed	Open after configuration	Yes
HTTP	80 (TCP)	Closed	Open after configuration	No
HTTPS	443 (TCP)	Closed	Open after configuration	Yes
SNMP	161 (UDP)	Closed	Open after configuration	Yes (with SNMPv3)

* For information on avoiding opening port 102 during diagnostics, see section Online security diagnostics via port 8448 (CP) (Page 135).

Ports of communication partners and routers

Make sure that you enable the required client ports in the corresponding firewall on the communications partners and in intermediary routers.

These can be:

- NTP / 123 (UDP)
- DNS / 53 (UDP)
- DHCP / 67, 68 (UDP)
- SINEMA RC Autoconfiguration / 443 (TCP) - can be set
- SINEMA RC and OpenVPN / 1194 (UDP) - can be set in SINEMA RC

3.2 Communication types

"Communication types"

In this parameter group, you enable the communication capability of the module.

Depending on the module type, you can define the telecontrol protocol and other communication types.

- **Enable telecontrol communication**

Enables telecontrol communication with the communication partners.

- **Protocol type**

- ST7
- DNP3
- IEC 60870-5

- **Enable online functions**

Enables access to the CPU for the online functions via the CP (diagnostics, loading project data etc.). If the function is enabled, the engineering station can access the CPU via the CP.

If the option is disabled, you have no access to the CPU via the CP with the online functions. Online diagnostics of the CPU with a direct connection to the interface of the CPU remains possible, however.

- **Enable S7 communication**

Enables the functions of S7 communication with a SIMATIC S7 in the module.

If you configure S7 connections to the relevant station, and these run via the module, you need to enable this option.

- **Activate telecontrol communication via SINEMA Remote Connect**

Configurable with:

- CP 1243-1
- CP 1243-8 IRC
- CP 1542SP-1 IRC

For more, see the appendix SINEMA Remote Connect (CP) (Page 161).

- **Read IP address via DCP**

Only configurable with: TIM 3V-IE DNP3 / TIM 4R-IE DNP3

Allows the IP address of the module to be read out via DCP (Discovery and basic Configuration Protocol).

3.3 Basic settings / Options

3.3.1 Basic settings

DNP3 basic settings

Not all parameters are displayed with every module type.

- **Listener port**

Own listener port of the module. The master needs the port number to establish the connection.

The port number applies to all interfaces of the communications module.

Range of values: 1024...65535

Default: 20000

- **Max. number of registered tags**

Maximum level of PLC tags registered on the assigned CPU for automatic change control. With registered PLC tags, the communications module is notified as soon as the value changes in the CPU tag management.

The PLC tags are registered in the order in which they were created.

Range of values: 1...32767

Default: 500

Virtual terminal objects

These parameters of the TIM 1531 IRC are not currently supported.

Retentive saving of events

These parameters are available with the TIM 1531 IRC.

If you use an optional SD card in the TIM, in this parameter group you set the conditions for saving the values of frames whose data points are configured as an event.

You set the general behavior via the following parameters:

- **Activate retentive saving**
Activates the retentive saving of events on the SD card in the event of connection disruptions.
- **Number of events before saving**
Saving events on the SD card starts when the number of events in the send buffer configured here is reached after a connection failure.
- **Interruption time before saving**
Saving events on the SD card starts when the time of the connection interruption configured here is reached.

For the maximum number of savable events, see section Performance data and configuration limits (Page 16).

IP routing

These parameters are available with the TIM 1531 IRC.

Note

The function is not intended for large data volumes.

Restrict routing via the TIM to approx. 1 Mbit/s so that productive operation of the TIM is not impaired.

IP routing

- **Allow IP routing**
Enables IP routing via the interfaces of the module.
- **Routing method**
Defines the paths for IP routing:
 - Local: IP routing only between the Ethernet interfaces of the module
 - Via subnets: IP routing via a maximum of 10 configurable routers that can be accessed via the module's interfaces.

Router addresses

- **Ethernet interface**
Ethernet interface of the module via which IP routing is to be configured. The IP addresses of the interfaces used for IP routing need to be permanently configured.
An interface can be selected several times for different routes.

Note**Consistency of the address parameters**

STEP 7 does not check the consistency between manually configured addresses and the parameters of the module's Ethernet interfaces.

Ensure consistency with the address parameters of the respective interface.

- **Address type**
Selection of the IP version of the address parameters configured below (IPv4 / IPv6)
When using IPv6 addresses, you must enable IPv6 for the respective interface.
- **Network address**
Network address of the routing destination (IP address * subnet mask)
- **Subnet mask / Prefix**
Subnet mask (IPv4) or prefix (IPv6) of the routing destination
- **Router address**

3.3.2 Options

The following parameters are only valid for the following modules:

- TIM 3V-IE DNP3
- TIM 4R-IE DNP3

Frame memory

- **Frame memory size**
Size of the memory in which the frames to be sent are stored for all configured WAN drivers. If the value 0 is entered, the entire free memory following startup is used.
Range of values: 0...1024
Default: 0
- **Size of memory block**
Size of the blocks into which the global frame memory is segmented. Each frame to be sent occupies at least this space in the memory. The default size is 128 bytes.

RAM

- **RAM size**
Size of the RAM memory. This area in the main memory of the TIM that is created temporarily for test purposes is deleted after the TIM restarts. The value is preset at 100 kB.

Basic data point settings of the TIM

Frame receipt

- **Check of the source address**

If the option is activated, the address of the communications partner is checked in receive frames. All data frames that do not originate from configured partners are discarded.

If the TIM is to receive and process data frames from several partners, the option must be deactivated.

CPU sampling cycle

- **Number of data points in the normal cycle**

Number of data points that were assigned to the normal read cycle.

Assignment in the data point configuration, see section "General" tab (Page 112).

- **Number of data points in the fast cycle**

Number of data points that were assigned to the fast read cycle.

Assignment in the data point configuration, see section "General" tab (Page 112).

- **Read max.**

Maximum number of data points read from the CPU per sampling cycle.

Range of values: 0 ... 32000

Default: 1

With the setting 0 (zero), the function is disabled (no limitation).

For the read cycle, see section Read cycle (Page 115).

3.4 Configuration of interfaces, networks and network nodes

3.4.1 WAN settings of the interfaces

WAN settings

The following parameters determine the properties of the interfaces and the connected WAN networks.

First, configure the respective module interface. The subsequently connected WAN network adopts the most important settings.

- **WAN type**

Selection of the WAN type of the interface:

- IP-based

Default setting of the Ethernet interface

- Classic WAN

Default setting of a serial interface

- **Network type**

For IP-based WAN:

- DNP3

- Neutral

For classic WAN:

- Dedicated line

- Dialup network

Note that conventional WAN networks are only supported for TIM modules.

- **Network node type**

Decides the Network node type of the interface:

- Master station

- Node station

For modules that act as node station, the interfaces are configured as follows:

- Interface in the direction of the master station: "Node station"

- Interface in the direction of the lower-level network: "Master station"

- Station

You will find an illustration in the section Networking of the interfaces (Page 38).

- **Modem type**

The modem type for connection to the serial interface must be configured for the network type "Dialup network" and, in the case of the classic TIM modules, also for the network type "Dedicated line".

The entries have the following meanings:

- MD2

Dedicated line modem (network type "Dedicated line")

- MD3

Modem for analog dialup networks (network type "Dialup network")

- MD4

ISDN modem (network type "Dialup network")

- MD720

The GSM modem MD720 is not supported because it uses frame format FT2.

- Third-party modem

Any compatible modem for the network types "Dedicated line" or "Dialup network" (analog / ISDN / GSM)

3.4.2 Networking of the interfaces

Module interfaces

The arrangement of the module interfaces in the STEP 7 device symbol (network view) corresponds largely to the structure of the respective device.

For example, the interfaces of a TIM 1531 IRC are arranged as follows:

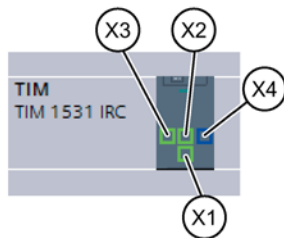


Figure 3-1 Device symbol of the TIM with interface numbers

Networking interfaces

To network an interface depending on the initial situation you have different options:

- Creating a subnet
- Connecting two target devices via a new subnet
- Connecting devices to existing subnet
- Selecting an existing subnet from the "Subnet" list

You will find the description of the individual methods in the STEP 7 information system.

Networking WAN interfaces

Recommendation networking:

To network the interfaces with a WAN network, the following procedure is recommended:

1. Network the WAN networks in the network view of STEP 7.

In the graphic network view, you have an overview of the subnets of the entire system in the project.

2. First configure the interface parameters described in the section WAN settings of the interfaces (Page 36):

- WAN type
- Network type
- Network node type
- Modem type

3. Select the relevant interface to create a new WAN network. Alternatively:

In the parameter group "Network interface with" of the interface:

- Using the "Add new subnet" button

On the interface in the device symbol of the module:

- Using the shortcut menu "Create subnet"
- Graphically by dragging (holding the mouse pointer pressed) to the interface symbol of the communications partner

A new WAN network is created that adopts the network type from the connected interface.

Network representation of a classic WAN

A classic WAN network is displayed in blue.

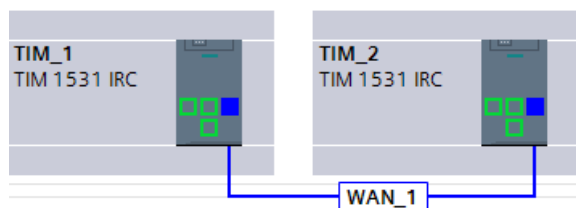


Figure 3-2 TIM modules, serial interfaces networked via classic WAN.

Network with node stations

In the following figure, the center TIM is a node station. The "Network node type" parameter of the interfaces is configured as follows:

- Interface in the direction of the master station: "Node station"
- Interface in the direction of the lower-level network: "Master station"

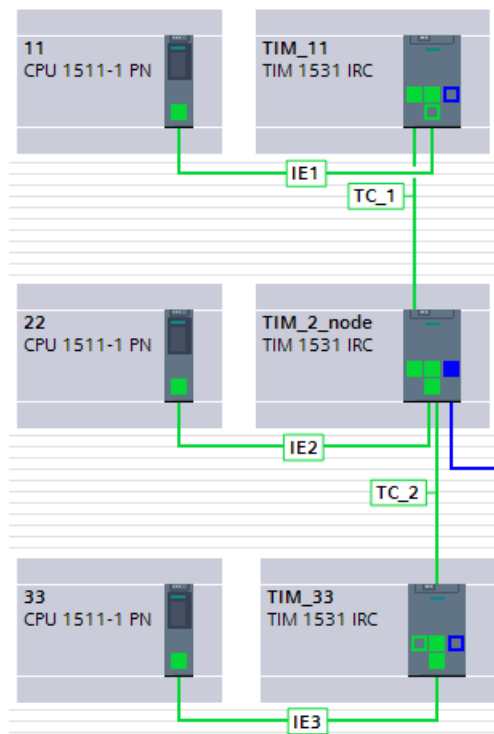


Figure 3-3 Network with master station (top), node station (center) and station (bottom)

3.5 Ethernet interface

3.5.1 Ethernet interface > address parameters

Ethernet interface > Ethernet addresses > IP protocol ...

In the following parameter groups configure the IP address parameters of the Ethernet interface.

You will find information on configuration in the STEP 7 information system.

Ethernet interface > Port [Xn P1]

You will find information on configuration in the STEP 7 information system.

See also

Configuring WAN networks (Page 51)

3.5.2 Advanced options

3.5.2.1 TCP connection monitoring

Ethernet interface > Advanced options > TCP connection monitoring

The settings of the two parameters at the Ethernet interface govern TCP connections via this interface.

You can adapt the parameters in the properties of the telecontrol connections for each connection segment.

- **TCP connection monitoring time**

Function: If no data traffic takes place within the TCP connection monitoring time, the module sends a keepalive frame to the communication partner.

With the setting 0 (zero), the function is disabled.

Default setting: 180 s

Permitted range

- TIM 1531 IRC
1...65535 s
- CP 1243-1 / CP 1243-8 IRC / TIM 3V-IE DNP3 / TIM 4R-IE DNP3
0...65535 s
- CP 1542SP-1 IRC
0...32767 s

- **TCP keepalive monitoring time**

After sending a keepalive frame, the module expects a response from the communication partner within the keepalive monitoring time. If the module does not receive a response within the configured time, it closes the connection.

With the setting 0 (zero), the function is disabled.

Default setting: 10 s

Permitted range

- TIM 1531 IRC
1...65535 s
- CP 1243-1 / CP 1243-8 IRC
0...65535 s
- TIM 3V-IE DNP3 / TIM 4R-IE DNP3
1...255 s
- CP 1542SP-1 IRC
0...32767 s

3.5.2.2 Transmission settings

You will find the specific parameters of the telecontrol protocol in the section DNP3 parameters of the interfaces (Page 53).

3.5.3 Web server access

3.5.3.1 CP

Access to the Web server of the CPU

The Web server is located in the CPU. Via the CP, you have access to the Web server of the CPU.

From a PC you can access the Web server of the station if the PC is connected to the system network via LAN.

You will find information on the Web server of the S7-1200 in the manual /7/ (Page 189).

You will find information on the Web server of the ET 200SP in the manual /8/ (Page 189).

3.5.3.2 TIM 1531 IRC

Access to the Web server

You can activate access to the Web server of the TIM via HTTP/HTTPS for each individual Ethernet interface.

As default access is disabled. Refer to the explanations in section Web server (Page 59).

You enable the Web server and make further settings in the parameter group "Web server", see section Security recommendations (Page 29). There you can also enable or disable access.

For access to the Web server you need to enable access on the Ethernet interface ("Access to the Web server") and enable the Web server itself "Web server".

3.6 Serial interface

3.6.1 Advanced options

3.6.1.1 Dedicated line

Settings dedicated line

Settings serial interface

- **Interface standard**

Standard of the serial interface: RS232 / RS485

Select the following value:

- RS232

When a modem with an RS-232 interface is connected to the interface of the TIM

- RS485

When a modem with an RS-485 interface is connected

With parallel connection of several modems to the interface of the TIM (star-shaped network)

- **RS-485 termination**

Enable this option when connecting a terminating resistor for the RS-485 bus when a star-shaped network is connected.

- **Operating mode**

Only configurable with: TIM 3V-IE DNP3 / TIM 4R-IE DNP3

The operating mode of the interface specifies the mode of the data transfer. Range of values:

- Interrupt (block) - for the send and receive direction
- DMA - for the send and receive direction.
- Interrupt (individual characters) - only for the receive direction

A maximum of one of two serial interfaces of a module may be operated in DMA mode.

Max. number of spontaneous frames

Only configurable with: TIM 3V-IE DNP3 / TIM 4R-IE DNP3

Only for interfaces with the Network node type "Station" / "Node station".

- **Max. number of spontaneous frames**

The parameter decides after how many frames the master station has the opportunity of transferring its pending frames to the station. As maximum, the configured number of spontaneous frames that are pending at the time of the first call frame are transferred.

Default setting: 200. Permitted range: 0...255

If 0 (zero) is set, all spontaneous frames are sent at the call.

- **Limit for locked frames**

Frames are marked as locked when they cannot be transferred to the communications partner due to communication problems.

The parameter specifies the maximum quota of locked frames in the send buffer. If the value is exceeded, the image procedure is used for new frames to prevent the send buffer from overflowing.

Default setting: 50. Permitted range: 0...90

If 0 (zero) is set, all spontaneous frames are sent at the call.

Connection establishment

Only configurable with: TIM 3V-IE DNP3 / TIM 4R-IE DNP3

- **Extra transmission time**

Time offset with slow networks to prevent premature canceling of connection establishment.

Default setting: 10. Permitted range: 0...65535 ms

With the setting 0 (zero), the function is disabled.

In dedicated line networks, the value is usually 0.

Time options

- **RTS/CTS delay time**

The RTS/CTS delay (ms) can be required when a modem is connected via a serial interface.

Default setting: 0. Permitted range: 0...65535 ms

– Value = 0

After setting the RTS signal, (turn transmitter on) transmission only starts when the CTS signal (Clear To Send) was set by the modem.

– Value > 0

Transmission is not delayed until the CTS signal of the modem.

After the RTS signal has been set, transmission is delayed for the configured time and then started immediately.

- **Send delay time (after CTS)**

The delay time (ms) is used when readiness to send (CTS signal) is received from the modem and when 0 (null) has been configured for the "RTS/CTS delay time".

- Value = 0

Transmission is not delayed until the CTS signal of the modem.

- Value > 0

As soon as the CTS signal is received from the modem, the send delay time is started. Sending starts after the time has elapsed.

Default setting: 0. Permitted range: 0...65535 ms

- **RTS off delay**

Only configurable with: TIM 1531 IRC

The RTS OFF delay (ms) defines when the module takes back the RTS signal after sending.

- Value = 0

The module takes the RTS signal back immediately after sending the last character.

- Value > 0

Once the last character has been sent, the RTS OFF delay elapses before the module takes back the RTS signal.

Default setting: 0. Permitted range: 0...65535 ms

- **Polling monitoring time**

Only configurable with: TIM 3V-IE DNP3 / TIM 4R-IE DNP3

Only for interfaces with the Network node type "Station" / "Node station".

Time (s) after which the TIM expects to be polled. After this time elapses, the TIM sends a message to its local CPU indicating that the master station is disrupted.

Default setting: 30. Permitted range: 0...65535 s

- Parameters configured:

After the configured time elapses, the module sends a message to its local CPU.

- Parameter not configured at a transmission speed of 9600 bps:

After 4 seconds without frame traffic, the module outputs a message.

- Parameter not configured at a transmission speed of 1200 bps:

After 32 seconds without frame traffic, the module outputs a message.

- **Max. allowed disruption time**

Only configurable with: TIM 3V-IE DNP3 / TIM 4R-IE DNP3

Tolerance time for a detected connection problem with the CPU.

If there is still a disruption on the connection when the set time has elapsed, the disruption is signaled to all connection partners of the disrupted station.

Default setting: 0. Permitted range: 0...255 s

With the setting 0 (zero), the function is disabled.

Polling parameters

- **Ratio "Polling / Spontaneous"**

Can only be configured with TIM 3V-IE DNP3 / TIM 4R-IE DNP3 for interfaces with the network node type "Master station".

Max. number of spontaneous frames that can be sent from a master station between two calls.

Default setting: 0

Permitted range: 0...255. With the setting 0 (zero), the function is disabled.

The value 1 is set permanently for the network node types "Station" and "Node station".

- **Stations per polling sub-cycle**

Only configurable with: TIM 3V-IE DNP3 / TIM 4R-IE DNP3

Only for interfaces with the Network node type "Master station".

Number of stations that can be called in the sub-cycle per polling cycle of the master station.

Default setting: 0

Permitted range: 0...255. With the setting 0 (zero), the function is disabled.

Form of transfer

Only configurable with: TIM 3V-IE DNP3 / TIM 4R-IE DNP3

- **Form of transfer**

Defines the form of transfer of events.

- Type-specific

This is the bundled transfer of events according to data types typical for DNP3. First the existing binary events are sent, then all analog values and finally all counted value changes. This makes the frames somewhat more compact and transmission more efficient.

- Chronological

In this mode, events are transmitted strictly chronologically. The optimizing effect of grouping into blocks of the same data type as described in the DNP3 specification (see above) is lost. This mode is primarily intended for control systems that archive events strictly chronologically.

3.6.1.2 Dialup network

Settings dialup network

Only the configurable parameters are explained.

Settings serial interface

- **Interface standard**

Standard of the serial interface: RS232 / RS485 - can be switched over

Select one of the following values:

- RS232

When a modem is connected to the interface of the TIM

- RS485

Connection of the internal terminating resistor of the TIM

With parallel connection of several modems to the interface of the TIM (star-shaped network)

- **RS-485 termination**

Enable the option when connecting a terminating resistor for the RS-485 bus when a star-shaped network is connected.

Max. number of spontaneous frames

Only with CP 1243-8 IRC

- **Max. number of spontaneous frames**

Only for interfaces with the Network node type "Station" / "Node station".

The parameter decides after how many messages the master station has the opportunity of transferring its pending messages to the station. As maximum, the configured number of spontaneous frames that are pending at the time of the first call frame are transferred.

Default setting: 200. Permitted range: 0...255

If 0 (zero) is set, all spontaneous frames are sent at the call.

Connection establishment

Only with CP 1243-8 IRC

- **Extra transmission time**

Time offset (s) with slow networks to prevent premature stopping of connection establishment.

Default setting: 10. Permitted range: 0...65535. With the setting 0 (zero), the function is disabled.

The following values are usual:

- Mobile wireless networks: 10
- Wireless or satellite transmission: 0 .. 1

Call parameters

- **Data format dial phase**

Only configurable with: CP 1243-8 IRC / TIM 3V-IE DNP3 / TIM 4R-IE DNP3

Defines the frame format.

Select the appropriate combination of number of data bits, parity and stop bits.

TIM 1531 IRC uses the format FT3.

- **Dialing command**

Dialing command for the local modem

Possible values:

- D (AT command)
- DP (AT command, pulse dialing)
- DT (AT command, tone dialing)

When possible use the dialing command "D".

- **Dialing prefix**

Access number (outside line) for a private branch exchange (typical entry 0 or 9) or for an alternative telephone provider.

Permitted range: Max. 12 digits

With direct connection to the dial-up network and without an alternative telephone provider, this parameter can remain empty.

- **Own phone number**

Entry of your own telephone number for the network node including the area code.

Permitted values:

- Digits 0 ... 9
- Plus character (+) as placeholder for the trunk prefix (usually 00 or 09) before the international area code

Example: +1230123456789

AT initialization

- **User-defined**

If the option is enabled the AT initialization string for the basic settings of the modem can be assigned manually.

If the option is disabled, the AT initialization string is preset for the specific modem:

- MD3 : AT\$S45=3\N0F0&W
- MD4 : AT\$S45=83\$P1\N0&W

- **Initialization string**

Input box for the AT initialization string

Transmission setting for conditionally spontaneous messages

- **Transmission criterion**

Only configurable with: CP 1243-8 IRC / TIM 3V-IE DNP3 / TIM 4R-IE DNP3

With TIM 1531 IRC, the settings are transferred by the partner; if the send buffer overflows, the "Degree of filling" setting is used.

Only for interfaces with the Network node type "Station" / "Node station".

The transmission criterion controls connection establishment for the transmission of conditional spontaneous messages. This reduces the number of connection retries.

Range of values:

- Standard conditions

No connection will be established due to the existence of conditionally spontaneous messages .

Only in the following cases will a connection be established to send conditional spontaneous messages.

- Threatened overflow of the send buffer
- Connection establishment by the communications partner

- Degree of filling

The TIM only establishes a connection when the configured fill level of the send buffer for conditional spontaneous messages is exceeded.

In the input box, enter the fill level (%) of the send buffer at which when exceeded the TIM establishes a connection.

- Time

The TIM sends conditional spontaneous messages at a configured time of day, configurable with "Hours" / "Minutes".

- Time scheme

The TIM sends the conditional spontaneous messages cyclically at a configurable interval, configurable with "Hours" / "Minutes".

Time options

- **Call acceptance delay**

Only with CP 1243-8 IRC

Wait time (s) before accepting an incoming call

Due to the wait time acceptance of the call is possible for the TIM when a telephone is connected to a shared telephone connection to the TIM.

Default setting: 0. Permitted range: 0...30

- **Dial test interval**

The test interval (min) is started when no connection could be established by the communications module after 3 attempts. When the test interval elapses, the communications module attempts to establish a connection again.

If it fails to establish the connection again, the test interval is restarted.

If a new frame is pending for transfer during the test interval in a master station TIM, the TIM attempts to establish a connection immediately.

Default setting: 5. Permitted range: 0...255

- **Max. connection duration**

Only for interfaces with the Network node type "Master station".

Maximum connection duration (s) for a dial-up connection. When the time elapses, the connection is terminated. Frames that are still pending for transmission in the station are transferred the next time a connection is established.

With 0 (null), the dial-up connection is retained until all pending data has been transferred.

Default setting: 5. Permitted range: 0...65535

- **Repetition factor**

The repetition factor determines how often a data frame that has not been acknowledged positively is repeated.

- **Abort delay time**

Only with CP 1243-8 IRC

Duration (s) a dial-up connection is retained when the send buffer of the TIM is full and the TIM can send no further messages or data to the CPU.

During the abort delay time, received messages are acknowledged negatively and the communications partner repeats sent and negatively acknowledged messages.

When the abort delay time elapses, the connection is terminated.

Default setting: 20. Permitted range: 0...255

Form of transfer

Only with CP 1243-8 IRC

- **Form of transfer**

Specifies the form in which data messages are sent.

- Type-specific

This is the bundled transfer of events according to data types typical for DNP3. First the existing binary events are sent, then all analog values and finally all counted value changes. This makes the frames somewhat more compact and transmission more efficient.

- Chronological

In this mode, events are transmitted strictly chronologically. The optimizing effect of grouping into blocks of the same data type as described in the DNP3 specification

(see above) is lost. This mode is primarily intended for control systems that archive events strictly chronologically.

Mobile wireless settings

Communication using mobile wireless networks is not supported.

3.6.1.3 Transmission settings

You will find the specific parameters of the telecontrol protocol in the section DNP3 parameters of the interfaces (Page 53).

3.7 Configuring WAN networks

Parameters of classic WAN networks

If you first configure the "WAN settings" parameter group of the communications module interfaces, the most important settings of the interface are taken from the connected WAN network when a new network is generated.

The classic WAN networks, shown in blue in STEP 7, have the following parameter groups.

General

Like for any other network, this is where you configure the name and the S7 subnet ID.

Network settings

Network configuration

- **Protocol type**

The following telecontrol protocols are available:

- ST7
- DNP3
- IEC 60870

- **Network type**

The network type is taken from the connected interface:

- Dedicated line
- Dialup network

Access method

Only with dedicated line

- **Access method**

The access method is preset and cannot be changed:

- Polling

Frame parameters

The parameters are preset and cannot be changed.

- **Frame format**

- FT3

- **Acknowledgment type**

- Short acknowledgment (1 byte)

- **Repetition factor**

The repetition factor determines how often a data frame that has not been acknowledged positively is repeated:

- 3

- **Max. frame length**

Maximum size of a data frame within the network:

- 240

Network settings

- **Dependence on direction**

Direction dependency of the network

- Duplex
- Half duplex

- **Transmission speed**

Speed at which the communications module and modem communicate.

From the drop-down list, select a value that is supported by all connected modems.

Time-of-day synchronization

- **Enable time-of-day synchronization for WAN**

When the parameter is enabled, you specify whether the time for the time-of-day synchronization of the connected stations should be transmitted via the WAN network.

You specify the synchronization cycle if the parameter is enabled.

Note

Transfer of the setting by stations

The connected TIM modules adopt the settings made here on the network.

For information on the time-of-day concept, see section Time-of-day synchronization (Page 67).

Station list

This is where you can find an overview table of the stations connected to the network with their most important parameters.

The WAN address is the station address.

3.8 DNP3 parameters of the interfaces

3.8.1 Transmission settings – DNP3

Transmission settings – DNP3

- **Max. time between Select and Operate**

Max. time period (seconds) between command preselection (Select) and command input (Operate)

- Master station:

If no command input follows a command preselection in the master station within the configured period, the command must be selected again. Having to enter the command twice reduces the risk of accidental operation in the master station.

- Station:

In order for a received command to be sent to the CPU and thereby take effect, the device must not receive any further command frames between Select and Operate.

Range of values: 1..65535

Default setting: 1

If a master sends an object with function code 7 "DIRECT_OPERATE" to the station, the station does not evaluate the time period configured here.

- **Connection monitoring time (application layer)**

(Application layer confirmation timeout)

Period of time (seconds) in which the module expects a sign of life on the application layer from its partner.

- Master (master station):

Time period in which the master expects a sign of life from the station.

If the configured time is exceeded, the master sends a frame to the station. If this frame is not acknowledged by the station, the master classifies the station as not accessible, terminates the connection and then re-establishes it.

Commands:

If a connection with a station is interrupted or disrupted, command frames are repeated a maximum of three times before they are discarded by the master.

- Station:

In the station, the parameter is used to calculate the waiting times during connection establishment.

With redundant paths, the following applies: If the acknowledgment is not received, the transmission path is classified as disrupted.

Range of values: 0 ... 65535 s

Default: 5

With the setting 0 (zero), the function is disabled.

Data link layer

- **Frame repetition**

Maximum number of retries to send a frame if no acknowledgment is received from the partner on the data link layer.

- With serial connections, repetitions can be useful if the connection quality is not good.
- With Ethernet connections, it is recommended that you configure the value 0, since required repetitions are carried out by the protocol implementation.

Range of values: 0 ... 255

Default setting: 0

With the setting 0 (zero), the function is disabled.

- **Acknowledgment**

Condition under which the module requests an acknowledgment of receipt from the partner (sending of the "CONFIRMED_USER_DATA" function code):

- Never
No acknowledgments are requested.
- Always
Acknowledgments are always requested.
- For segmentation
Acknowledgments are only requested for data frames which are divided into several segments due to their length.

With Ethernet connections, the DNP3 specification recommends that acknowledgment requests are not used on the data link layer.

On connections that are liable to disturbances, for example wireless links, the configuration of acknowledgment requests can be useful on the data link layer.

- **Confirmation timeout**

Time period (seconds) in which a confirmation (acknowledgment) is expected from the partner on the data link layer. If no acknowledgment is received within the configured time period, data transmission is repeated, see the "Frame repetition" parameter above.

Range of values: 0...65535

Default setting: 2

The default value of 2 seconds usually only needs to be increased for slow serial connections.

With the setting 0 (zero), the function is disabled.

3.8.2 Settings DNP3 master

Master-specific DNP3 parameters

You can find the following parameters in the "Settings DNP3 master" parameter group of the interfaces of the communications module set on the "Master station" network node type.

- **Polling basic interval**

This is where you define the basic interval for station calls by the master station.

Value range: 0 ... 65535 seconds

Default: 30

With the setting 0 (zero), the function is disabled. No cyclic polling takes place, not even for the parameters listed below, the calculation of which is based on the polling basic interval.

Basis for further parameters

The Polling basic interval is used to calculate the following parameters in the connection editor (editor "Network data > Telecontrol > DNP3"):

- Event polling interval
- Class 0 polling interval
- Duration of the polling cycle, see "Polling mode" parameter.

For information on the parameters, see section Connection table (Page 92).

- **Max. number of events per call**

Maximum number of events that can be sent in the response frame of the station after being called by the master station.

Range of values: 0 ... 65535

Default: 0

With the setting 0 (zero), the function is disabled (no limitation).

3.8.3 Settings DNP3 station

DNP3 parameters of the station / node station

You can find the following parameters in the "Settings DNP3 station" parameter group of the interfaces of the communication module set on the "Station" or "Node station" network node type.

Monitoring parameters

- **Disturbance bit**

The station can use bit 1.6 of the Internal Indication Byte (IIN1.6) in the Application Response Header to indicate a fault in the CPU to the master.

If this option is activated, the bit is set to "1" when the CPU is in STOP state.

- **IP address check**

This parameter is used for security when establishing a connection between a station and the master.

- Check IP address

When this option is activated, the station checks the partner's IP address in addition to the station address when a connection is requested.

If the IP address of the partner does not match the address of a configured partner of the station, the station rejects the connection.

- Do not check IP address

The station does not check IP addresses for incoming TCP connection requests.

Event properties

- **Event class for image memory**

Selection of an event class in which only the last current values are stored in the send buffer. Older events are overwritten in the send buffer (image memory method).

The parameter is not available with the TIM 3V-IE DNP3 / TIM 4R-IE DNP3. These modules operate according to the "Default" setting.

- Class x events

Only the current value of events of the selected class is stored in the send buffer (image memory method).

- Standard

All values of events of classes 1 and 2 are stored in the send buffer.

The current value is stored in the send buffer only for events of class 3 (image memory method).

You can find details of how the image memory and send buffer work as well as the options for transferring data in the section Process image, type of transmission, event classes (Page 113).

- **Buffer for class 1 / 2 / 3 events**

For each of the three event classes, this is where you specify the number of events after which the stored events are sent to the communication partner.

Note that the maximum size of the send buffer is divided over all connected DNP3 master stations.

Permitted range: 1 ... 255

- **Delay time class 1 / 2 / 3 events**

Here, for each of the three event classes you specify the maximum time in seconds for which the events can be stored in the send buffer before they are sent to the communications partner.

This requires unsolicited transmission to be configured (see below).

Permitted range: 0 ... 65535

With the setting 0 (zero), the function is disabled.

Node station

This parameter is only available for interfaces for which the network node type is set to "Node station".

- **Response without current station image**

With an interface of the "Node station" network node type, the communication module of the node station keeps the station process image in the image memory for each lower-level DNP3 station.

- Option enabled

The module replies to a class 0 call even if the process image in the image memory of the node station is not up to date. When a master station calls, the data of all connected stations is sent to the master station, even if the data of one or more stations is not up-to-date.

- Option disabled

The module replies to a class 0 call only if the process image in the image memory of the node station is up to date.

Unsolicited sending

- **Unsolicited reporting:**

Transfer mode for events

- Yes

Event frames are transferred immediately.

With this option, the station independently establishes a connection with the master.

If unsolicited transmission in the master is disabled, the master sends the "DISABLE_UN SOLICITED" function code (unsolicited frames cannot be sent by the station). In this case, the station saves the events without sending them immediately.

- No

Event frames are only transmitted when data is requested from the master.

For consistent configuration, you should select the same setting for the station and the master station.

Note

Setting for dedicated lines

When connecting a serial interface to a DNP3 dedicated line with the "half-duplex" setting, you must set the parameter to "No".

To avoid collisions, you should also use this setting when connecting to full-duplex multidrop dedicated lines.

- **Max. number of retries**

Maximum number of repetitions of unsolicited frames if no acknowledgment is received from the master. After reaching the configured number, the station terminates the connection.

Range of values: 0...255

Default setting: 3

- **Monitoring time for spontaneous frames**

(Unsolicited Confirmation Timeout period)

Time period (seconds) in which the station expects an acknowledgment of unsolicited frames from the master. If no acknowledgment is received within the configured time period, the data transmission is repeated.

The sent frames are deleted from the send buffer only when the station receives the acknowledgment from the master.

Range of values: 1...65535

Default setting: 5

3.9 Web server

The Web server of the TIM

The TIM provides you with the functionality of a Web server for access using a Web browser. The following functions are available via the Web server:

- Read access
 - A selection of diagnostics data
 - A selection of configuration data
- Write access
 - Setting the time
 - Firmware update
 - Module restart
 - Reset to factory settings
 - Recording of statistics values of the Ethernet interfaces

For a description of the content, refer to the section WBM of the TIM 1531 IRC (Page 167).

Access rights via "Global security settings"

The rights for access to the Web server are configured in STEP 7 in the Global security settings. Only users created there can log on with the Web server using HTTP/HTTPS.

The following preset roles are relevant for Web server access:

- NET Standard
- NET Diagnose

The required rights for diagnostics, access to the Web server and reading and writing data are thus enabled.

You will find further help on the roles and rights of users in the STEP 7 information system.

Access to the Web server and starting Web diagnostics

To be able to connect to the Web server of the TIM, access to the Web server must be enabled for every Ethernet interface, see also section Web server access (Page 42). As default access is disabled.

For information on starting Web diagnostics, see section Web diagnostics of the TIM 1531 IRC (Page 61).

"Web server" parameter group

General

- **Enable Web server on this module**

Enables data processing in the Web server of the TIM and allows access to this data.

- **Allow access only using HTTPS**

Allows access to the Web server only with the secure protocol HTTPS.

Note

"Allow access only using HTTPS" (security function enabled)

Note the following when the "Allow access only using HTTPS" option is enabled in the "Web server" parameter group:

- The data is transferred encrypted.

Requirements

- The roles specified above with the corresponding rights must be assigned to the user.
 - If the firewall is activated, the HTTP/HTTPS protocols must be allowed.
-

Automatic update

- **Enable automatic update**

Enables automatic updating of the displayed values.

If the option is disabled, only the values at the time of connecting to the Web server are displayed.

- **Update interval**

Select the interval at which you require an update of the displayed values.

Default setting: 30. Permitted range: 5...999

Overview of the interfaces

Here you can see the releasing access to the Web server via the Ethernet interfaces of the TIM.

You can activate access to the Web server of the TIM via HTTP/HTTPS for each individual Ethernet interface.

The settings for activation in the parameter groups "Web server access" and "Web server" are adopted reciprocally in the other parameter group.

3.10 Web diagnostics

3.10.1 Web diagnostics of the TIM 1531 IRC

Requirements

- The Web server of the module is enabled in the configuration, "Web server" parameter group, and the interface is selected.
- The interface is enabled for access to the Web server in the configuration, "Ethernet interface > Access to Web server" parameter group.

Starting Web diagnostics

1. Establish a physical connection between the engineering station and the SIMATIC station.
2. Set the PC interface in such a way that the module can be reached.
Further help is available in the "Set PG/PC Interface" dialog box.
3. In the STEP 7 project, click the "Web diagnostics" button under the "Web diagnostics" parameter group to establish the connection to the Web browser of the module.

The content is supplied by the integrated Web server of the module. For information on operation and on the contents, see section WBM of the TIM 1531 IRC (Page 167).

3.11 DNS configuration

DNS server

A DNS server may be required when the module itself, a communications partner, or for example an e-mail server should be reachable via the host name (FQDN).

DNS server for e-mail server address

During e-mail configuration, the address of the mail server via which the e-mails are sent must be specified. The address of the mail server can be specified as an IP address or as an FQDN.

If you specify the server address as an FQDN you need to configure a DNS server. In this case the IP address of the mail server is determined via the configured DNS server.

3.12 Communication with the CPU

Communication with the CPU

Using the first three parameters you specify the CPU access by the TIM in the CPU scan cycle. You will find the structure of the CPU scan cycle in the section Read cycle (Page 115).

The fourth parameter "Frame memory size" decides the size of the send buffer of the TIM for frames of data points that are configured as an event.

- **Cycle idle time**

Wait time between two scan cycles of the CPU memory area

- **Max. number of write jobs**

Maximum number of write jobs to the CPU memory area within a CPU scan cycle

- **Max. number of read jobs**

Maximum number of low-priority read jobs from the CPU memory area within a CPU scan cycle.

- **Frame memory size**

Here, you set the size of the frame memory for events (send buffer).

The size of the frame memory is divided equally among all configured communications partners. For information on the size of the frame memory, see "Performance data and configuration limits".

You will find details of how the send buffer works (storing and sending events) as well as the options for transferring data in the section Process image, type of transmission, event classes (Page 113).

Watchdog bit

- **TIM monitoring / CP monitoring**

Via the watchdog bit, the CPU can be informed of the status of the telecontrol communication of the communications module.

CP time

- **CP time to CPU**

Using this function, the CP can make its time of day available to the CPU.

You will find details in the STEP 7 information system.

CP diagnostics

With the parameter group, you have the option of reading out advanced diagnostics data from the CP using PLC tags.

- **Enable advanced CP diagnostics**

Enable the option to be able to use advanced CP diagnostics.

If the option is enabled, at least the "Diagnostics trigger tag" must be configured.

The following PLC tags for the individual items of diagnostics data can be enabled selectively, depending on the functions supported by the CP.

- **Diagnostics trigger tag**

If the PLC tag (BOOL) from the user program of the CPU is set to 1, the CP updates the values of the PLC tags that can then be configured for the advanced diagnostics.

After writing the current values to the following PLC tags, the CP sets the "Diagnostics trigger tag" to 0, signaling to the CPU that the updated values can be read from the PLC tags.

Note

Fast setting of the diagnostics trigger tag

Triggers must not be set faster than at a minimum interval of 500 milliseconds.

- **Frame memory overflow warning**

PLC tag (data type Byte) for the send buffer overflow pre-warning. Bit 0 is set to 1 when 80% of the fill level of the send buffer is reached.

- **Frame memory occupation**

PLC tag (data type DWord) for the occupation of the send buffer. The number of saved frames is specified.

- **Current IP address**

PLC tag (data type String) for the current IP address of the CP.

- **VPN IPsec status**

The PLC tag (BOOL) indicates whether a VPN IPsec tunnel is established:

- 0 = No tunnel established
- 1 = Tunnel established

- **Connection to SINEMA Remote Connect**

The PLC tag (BOOL) indicates whether there is a connection to the SINEMA RC server:

- 0 = No connection established
- 1 = Connection established

PLC tags for partner status / path status

Via the PLC tag that can be configured here, you can monitor the following information about the reachability of the communications partners:

- **Partner status**

Reachability of the remote communications partner

- **Path status**

Status of the connection path or the redundant connection paths to the remote communications partner

For information on communication and the possible connection paths, see section Communications options (Page 26).

For every configured communications partner to which a single or redundant telecontrol connection is created, you can create a PLC tag of the type Word.

Assignment of the PLC tags for partner status / path status

In the two bytes of the PLC tag of the data type Word (DB, memory bit, output) the following information is output:

- **Byte 0: Partner status**
- **Byte 1: Path status**

Byte 0 "Partner status"

Byte 0 codes information on the reachability of the communications partner, on the existing connections and connection paths and on the status of the send buffer of the TIM.

Table 3- 1 Assignment of byte 0: Meaning of the bit statuses

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Path redundancy	Connection mode	Temporary connection *	(Re-served)	Frame memory **		Path status	Partner status
0: No redundancy 1: Redundancy exists	0: Permanent 1: Temporary	0: Partner not reachable 1: Partner reachable *	-	0: Send buffer OK 1: Memory occupation > 80 % 3: Overflow (memory allocation 100 %)		0: Not all paths reachable 1: All paths reachable	0: Partner not reachable 1: Partner reachable

** Partners that support temporary connections are set to "accessible" if the partner itself terminates the connection and there is no connection established.

** Status of the send buffer:

If Bit 2 or Bit 2+3 is set on a send buffer overflow or prewarning, the two bits are only reset when the memory occupation falls below 50%.

For information on the send buffer, see section Process image, type of transmission, event classes (Page 113).

Byte 1 "Path status"

Byte 1 shows the status of the connection path (configured connection) to the partner from the point of view of the local TIM.

A maximum of 2 paths (main and substitute path) to a partner can be configured, see section Communications options (Page 26).

Both connection paths must start or end on a local TIM.

The byte shows the following:

- The paths via which the partner can be reached.
- The path currently being used
- The TIM interface via which the main path was configured.
- The TIM interface via which the substitute path was configured.

The path of a connection is specified as a combination of the used interfaces of the TIM and the status of the path.

Byte assignment

Byte 1 is assigned as follows:

- Two bits for the interface of the main path
- Two bits for the interface of the substitute path
- Two bits for the status of the main path
- Two bits for the status of the substitute path

Table 3- 2 Assignment of byte 1:

Bits 6 + 7	Bits 4 + 5	Bits 2 + 3	Bits 0 + 1
Configured interface		Path status	
Coding for substitute path	Coding for main path	Substitute path (2nd path)	Main path (1st path)

- **Configured interface**

The TIM interfaces "Ethernet 1" (IE1), "Ethernet 2" (IE2), "Ethernet 3" (IE3) and WAN1 are numbered through from 0 . 3 (decimal):

- 0 = Ethernet interface IE1 (X1)
- 1 = Ethernet interface IE2 (X2)
- 2 = Ethernet interface IE3 (X3)
- 3 = Serial interface WAN1 (X4)

Status of bit 5 (7)	Status of bit 4 (6)	Meaning
0	0	Coding for Ethernet interface X1 (decimal: No. 0)
0	1	Coding for Ethernet interface X2 (decimal: no. 1)
1	0	Coding for Ethernet interface X3 (decimal: no. 2)
1	1	Coding for serial interface X4 (decimal: no. 3)

- **Path status**

- Main path = 1. Path (bits 0 + 1)
- Substitute path = 2nd path (bits 2 + 3)

Status of bit 1 (3)	Status of bit 0 (2)	Meaning bit 1	Meaning bit 0
0	0	Bit 1: Path not current	Bit 0: Subscriber not reachable
0	1	Bit 1: Path not current	Bit 0: Subscriber reachable
1	0	Bit 1: Path current	Bit 0: Subscriber not reachable
1	1	Bit 1: Path current	Bit 0: Subscriber reachable

Coding options of byte 1

Same coding of the configured interface for the main and the substitute path means that there is no path redundancy (only one interface configured). The path status is output via the bits of the main path (1st path).

Table 3- 3 Coding options for the path status

Configured interface		Path status	
Coding for substitute path	Coding for main path	Substitute path (2nd path)	Main path (1st path)
0 0	0 0 (Coding for IE1)	Irrelevant (not redundant)	Status IE1
0 0	0 1 (Coding for IE2)	Status IE1	Status IE2
0 0	1 0 (Coding for IE3)	Status IE1	Status IE3
0 0	1 1 (Coding for WAN1)	Status IE1	Status WAN1
0 1	0 0	Status IE2	Status IE1
0 1	0 1	Irrelevant (not redundant)	Status IE2
0 1	1 0	Status IE2	Status IE3
0 1	1 1	Status IE2	Status WAN1
1 0	0 0	Status IE3	Status IE1
1 0	0 1	Status IE3	Status IE2
1 0	1 0	Irrelevant (not redundant)	Status IE3
1 0	1 1	Status IE3	Status WAN1
1 1	0 0	Status WAN1	Status IE1
1 1	0 1	Status WAN1	Status IE2
1 1	1 0	Status WAN1	Status IE3
1 1	1 1	Irrelevant (not redundant)	Status WAN1

3.13 Time-of-day synchronization

Time-of-day synchronization and security

If you enable the security functions in modules with security, you will find the parameter group under "Security".

When security functions are enabled, you need to regularly synchronize the time of day of the communications module.

Basics of time-of-day synchronization

With telecontrol applications that require time-of-day synchronization, you need to synchronize the time of day of the communications module regularly. If you do not synchronize the time of day, there may be deviations of several seconds per day in the time information of the stations.

The communications module can obtain the time of day from an external source (for the methods see below) and forward the time of day to the station or the connected WAN networks.

When an external time source is used, the connected S7 station can obtain the current time of day both via the CPU and via a communications module (TIM, CP).

Note

Recommendation: Time-of-day synchronization only by 1 module

Only have the time of day of the station from an external time source synchronized by a single module so that a consistent time of day is maintained within the station.

If the CPU takes the time from a communications module, disable time-of-day synchronization of the CPU.

If you have the time synchronized on the communications module and on the CPU via NTP, use the same NTP server to maintain a consistent time of day within the station if possible.

Time-of-day concept

Before configuring time-of-day synchronization, specify the following:

- Specify the time source in the network.
- Specify the time master in the network.
- Specify the network or networks via which the time of day will be forwarded by the time master to the time slaves.

Synchronization methods of the communications modules

The modules support the following methods and functions (receiving/forwarding) of time-of-day synchronization:

- **TIM 1531 IRC**

- No time source
- From NTP server
- From WAN
- To local station
- To WAN

- **TIM 3V-IE DNP3 / TIM 4R-IE DNP3**

- From NTP server
- From local station
- From WAN
- To local station
- To WAN

- **CP 1243-1 / CP 1243-8 IRC**

The CP can only be a time slave for the connected subnet.

- Time from partner
- NTP
- Time from CPU
- Forwarding the time to the CPU

- **CP 1542SP-1 IRC**

The CP can only be a time slave.

- Time from partner
- NTP

CPs do not support forwarding the time to connected subnets.

Methods for receiving the time of day

- **NTP / NTP (secure)**

Network Time Protocol

Time-of-day synchronization only via Ethernet

The secure method NTP (secure) uses authentication with symmetrical keys. Various configurable hash algorithms are available for the integrity check.

In the global security settings, you can create and manage NTP servers of the type NTP (secure).

Recommendation with NTP:

Synchronization with an external clock at intervals of approximately 10 seconds is recommended. This achieves as small a deviation as possible between the internal time and the UTC time.

Note on the TIM 1531 IRC:

When an FQDN is used as address of the NTP server, up to 240 characters can be entered.

- **From WAN (TIM)**

The TIM adopts the time of day from a subscriber in the connected network.

The following can be time masters:

- A synchronized CPU
- A subscriber with a time receiver
- A master station PC connected to the Ethernet network

- **Time from partner (CP 1243-1 / CP 1243-8 IRC)**

The CP adopts the time-of-day from the communications partner in the master station.

- **Time from CPU (CP 1243-1 / CP 1243-8 IRC)**

As of V4.2, the CPU 1200 synchronizes all CMs/CPs of the station with a synchronization cycle of 10 seconds.

Parameters of the CPU:

If the option "CPU synchronizes the modules of the device" is enabled, you can initiate synchronization of all telecontrol CPs of the station with firmware \geq V2.1.77 with the CPU time in a synchronization cycle of 10 seconds.

- **Setting the time of day manually using the WBM (TIM 1531 IRC)**

If you have configured a time source for the TIM, you can also set the time via the WBM, see section System time (Page 172).

Forwarding time of day by the TIM

The TIM can forward its time of day as follows:

- **To connected networks**

Configuration with "Time of day synchronization" > "Send time" or "Receive time"

The procedure for configuration differs in Ethernet and classic WAN networks, see below.

- **On the assigned CPU**

- Configuration with "Time of day synchronization" > "Send time"

- Configuration with "Communication with the CPU" > "Time to CPU"

With this method the time-of-day is made available to the CPU via a PLC tag.

Decide on one of the two methods for forwarding to the CPU and disable the other.

Time of day forwarding by a CP 1200

- **Forwarding the time to the CPU (CP 1243-1 / CP 1243-8 IRC)**

Requirement: CP firmware \geq V3.0 and CPU firmware \geq V4.2

If both modules in the station have the specified firmware versions, the time of day of the CP is automatically forwarded to the CPU. Since the CPU automatically adopts the CP time, you no longer require the forwarding option using the PLC tag, like with CP firmware < V3.

If the option "CPU synchronizes the modules of the device" is enabled for the CPU in "PROFINET interface > Time synchronization", all smart modules of the station are synchronized with the CPU time.

Configuration with the TIM and with WAN networks

Parameter groups for time-of-day synchronization

For configuring the time-of-day synchronization the following parameter groups are available:

- **TIM**

- **Receive time**

Here you specify via which of the connected networks the TIM will receive the time of day. You configure this parameter group for the TIM modules with the network type "Node station" and "Station".

Here is where you also configure the NTP servers if the TIM is to be synchronized directly via NTP. This is usually only one TIM that functions as time master in the network.

- **Send time**

Here you specify the networks on which the TIM will forward the time of day.

You configure this parameter group for TIM modules with the network type "Master station" in other word on the TIM that functions as time master in the network.

- **Classic WAN network**

For classic networks the "Time-of-day synchronization" is enabled in the parameter group of the same name. You also specify the synchronization cycle.

The settings for synchronization are then adopted by all connected TIM modules.

The send direction of the time-of-day frames is derived automatically from the node type of the connected interfaces:

Master station ⇒ Node station ⇒ Station

The settings for the network are not necessary with time-of-day synchronization via Ethernet.

Configuring the synchronization via Ethernet

Time master

1. In the parameter group "Receive time" of the TIM to be time master configure the time source with one of the following options:

- From NTP server
- From local station
(take the time from the assigned CPU)
- Receive time from WAN
(take the time from a network)

2. Configure the interface of the TIM via which time frames will be forwarded in the parameter group "WAN settings" as network node type "Master station".

The function is supported for the Ethernet interface with the MSC protocol and for the serial interface with the setting "network type" = "Neutral".

3. In the parameter group "Send time" for the interface from step 2 enable the option "Forward time to WAN".

Via the connected network the time frames are forwarded in the network.

4. If necessary, enable the "To local station" option in the "Send time" parameter group if the assigned CPU should also be synchronized.

Time slaves

1. Configure the interfaces of the other TIM modules that will be time slaves in the parameter group "WAN settings" as network node type "Node station" or "Station".

The function is supported for the Ethernet interface with the MSC protocol and for the serial interface with the setting "network type" = "Neutral".

2. Network the interfaces of the TIM modules involved with each other and with the interface of the time master.

3. For the stations set the parameters of time-of-day synchronization in the parameter group "Receive time".

4. If necessary, enable the "To local station" option in the "Send time" parameter group if the assigned CPU should also be synchronized.

Configuring the synchronization via classic WAN networks

TIM modules (time master and slaves)

1. In the parameter group "Receive time" of the TIM to be time master configure the time source with one of the following options:
 - From NTP server
 - From local station
(take the time from the assigned CPU)
 - Receive time from WAN
(take the time from a network)
2. Configure the interface of the master TIM as network node type "Master station".
3. Configure the interfaces of the other TIM modules (time slaves) as network node type "Node station" or "Station".
4. If necessary, enable the "To local station" option in the "Send time" parameter group of the stations if the assigned CPU should also be synchronized.

WAN network

1. In the parameter group "Time-of-day synchronization" of the network enable the option "Enable time-of-day synchronization for WAN".
2. There configure the required synchronization cycle.
3. Network the interfaces of all TIM modules involved with the WAN network.
The settings configured for the WAN network are adopted in the following parameter groups of the connected TIM modules:
 - For the time master (Master station): "Send time" parameter group
 - For the time slaves (node stations / station) "Receive time" parameter group

3.14 E-mail configuration

Configuring e-mails in STEP 7

In the "E-mail configuration" entry, you configure the protocol to be used and the data for access to the e-mail server.

In the message editor ("Messages" entry in STEP 7), you configure the individual e-mails, see section Messages (Page 130).

E-mail configuration

If you want to use the secure transfer of e-mails, the module must have the current date and the current time of day.

With the default setting of the SMTP port 25, the module transfers unencrypted e-mails.

If your e-mail service provider only supports encrypted transfer, use one of the following options:

- Port no. 587

By using STARTTLS, the module sends encrypted e-mails to the SMTP server of your e-mail service provider.

Recommendation: If your e-mail provider offers both options (STARTTLS / SSL/TLS), you should use STARTTLS with port 587.

- Port no. 465

By using SSL/TLS (SMTPS), the module sends encrypted e-mails to the SMTP server of your e-mail service provider.

Ask your e-mail service provider which option is supported.

Importing the certificate with encrypted transfer

To be able to use encrypted transfer, you need to load the certificate of your e-mail account in the certificate manager of STEP 7. You obtain the certificate from your e-mail service provider.

Use the certificate by taking the following steps:

1. Save the certificate of your e-mail service provider in the file system of the engineering station.
2. Import the certificate into your STEP 7 project with "Global security settings > Certificate manager".
3. Use the imported certificate with every module that uses encrypted e-mails via the "Certificate manager" table in the local "Security" parameter group.

For the procedure, refer to the section Certificate manager (Page 81).

3.15 Subscriber numbers

Subscriber numbers

In this folder, you configure the station address and the assignment of the CPU depending on the communication module:

- **CPs and TIM modules in the rack**

- DNP3 station address

The CPU is assigned automatically to the communication module via the rack.

- **Stand-alone TIM**

- DNP3 station address
- Assigned CPU

The drop-down list only shows the CPUs that are networked with the TIM.

TIM 3V-IE DNP3 / TIM 4R-IE DNP3: Address 0 is invalid.

3.16 SNMP

SNMP

The scope of performance of the modules is given in the relevant manual.

If the security functions are enabled, you have the following selection and setting options, depending on the module.

SNMP

- **"Enable SNMP"**

If the option is enabled, communication via SNMP is released on the device. As default, SNMPv1 is enabled.

If the option is disabled, queries from SNMP clients are not replied to either via SNMPv1 or via SNMPv3.

- **"Use SNMPv1"**

Enables the use of SNMPv1 for the device. For information on the configuration of the required community strings see below (SNMPv1).

- **"Use SNMPv3"**

Enables the use of SNMPv3 for the device. For information on the configuration of the required algorithms see below (SNMPv3).

SNMPv1

The community strings need to be sent along with queries to the device via SNMPv1.

Note the use of lowercase letters with the preset community strings!

- **"Reading community string"**

The string is required for read access.

Leave the preset string "public" or configure a string.

- **"Allow write access"**

If the option is enabled write access to the device is released and the corresponding community string can be edited.

- **"Writing community string"**

The string is required for write access and can also be used for read access.

Leave the preset string "private" or configure a string.

Note

Security of the access

For security reasons, change the preset and generally known strings "public" and "private".

SNMPv3

The algorithms need to be configured for encrypted access to the device via SNMPv3.

- **"Authentication algorithm"**

Select the authentication method to be used from the drop-down list.

- **"Encryption algorithm"**

Select the encryption method to be used from the drop-down list.

User management

In the user management that you will find in the global security settings, assign the various users their role.

Below the properties of the roles you can see the rights list of the particular role, for example the various types of access using SNMP. For new roles, you can freely configure individual rights.

You will find information on users, roles and the password policy in the information system of STEP 7.

3.17 Security (CP) and certificates

3.17.1 Parameters

- DNP3 security options

With the CP 1243-1 / CP 1542SP-1 IRC, the settings on Secure Authentication are configured in the segments of the telecontrol connections as of firmware version V3.1. You will find the description in section Telecontrol connections (Page 86).

- SINEMA Remote Connect

You will find the description in the appendix SINEMA Remote Connect (CP) (Page 161).

3.17.2 Security user

Creating a security user

You need the relevant configuration rights to be able to configure security functions. For this purpose, you need to create at least one security user with the corresponding rights.

Navigate to the global security settings > "User and roles" > "Users" tab.

1. Create a user with the associated parameters such as authentication mode, session duration, etc.
2. Assign this user the role "NET Standard" or "NET Administrator" in the area below "Assigned roles".

After logging on, this user can make the necessary settings in the STEP 7 project.

In the future, continue to log on as this user when working on security parameters.

3.17.3 Log settings - Filtering of the system events

Communications problems if the value for system events is set too high

If the value for filtering the system events is set too high, you may not be able to achieve the maximum performance for the communication. The high number of output error messages can delay or prevent the processing of the communications connections.

In "Security > Log settings > Configure system events", set the "Level:" parameter to the value "3 (Error)" to ensure the reliable establishment of the communications connections.

Use of SYSLOG only with 1 VPN connection

If you want to use SYSLOG with level 7 (debug) via VPN connections, this is only possible with a single configured VPN connection.

3.17.4 VPN

3.17.4.1 VPN (Virtual Private Network)

VPN - IPsec

Virtual Private Network (VPN) is a technology for secure transportation of confidential data in public IP networks, for example the Internet. With VPN, a secure connection (IPsec tunnel) is set up and operated between two secure IT systems or networks via a non-secure network.

The IPsec tunnel forwards all data even from protocols of higher layers (HTTP, FTP, etc.).

The data traffic between two network components is transported unrestricted through another network. This allows entire networks to be connected together via a neighboring or intermediate network.

Properties

- VPN forms a logical subnet that is embedded in a neighboring (assigned) network. VPN uses the usual addressing mechanisms of the assigned network, however in terms of the data, it transports its own frames and therefore operates independent of the rest of this network.
- VPN allows communication of the VPN partners with the assigned network.
- VPN is based on tunnel technology and can be individually configured.
- Communication between the VPN partners is protected from eavesdropping or manipulation by using passwords, public keys or a digital certificate (authentication).

Areas of application

- Local area networks can be connected together securely via the Internet ("site-to-site" connection).
- Secure access to a company network ("end-to-site" connection)
- Secure access to a server ("end-to-end" connection)
- Communication between two servers without being accessible to third parties (end-to-end or host-to-host connection)
- Ensuring information security in networked automation systems
- Securing the computer systems including the associated data communication within an automation network or secure remote access via the Internet
- Secure remote access from a PC/programming device to automation devices or networks protected by security modules via public networks.

Cell protection concept

With Industrial Ethernet Security, individual devices or network segments of an Ethernet network can be protected:

- Access to individual devices and network segments protected by security modules is allowed.
- Secure connections via non-secure network structures becomes possible.

Due to the combination of different security measures such as firewall, NAT/NAPT routers and VPN via IPsec tunnels, security modules protect against the following:

- Data espionage
- Data manipulation
- Unwanted access

3.17.4.2 Creating a VPN tunnel for S7 communication between stations

Requirements

To allow a VPN tunnel to be created for S7 communication between two S7 stations or between an S7 station and an engineering station with a security CP (for example CP 1628), the following requirements must be met:

- The two stations have been configured.
- The CPs in both stations must support the security functions.
- The Ethernet interfaces of the two stations are located in the same subnet.

Note

Communication also possible via an IP router

Communication between the two stations is also possible via an IP router. To use this communications path, however, you need to make further settings.

Procedure

To create a VPN tunnel, you need to work through the following steps:

1. Creating a security user
If the security user has already been created: Log on as this user.
2. Enable the "Activate security features" option
3. Creating the VPN group and assigning security modules
4. Configure the properties of the VPN group
5. Configure local VPN properties of the two CPs

You will find a detailed description of the individual steps in the following paragraphs of this section.

Select "Activate security features"

After logging on, you need to select the "Activate security features" check box in the configuration of both CPs.

You now have the security functions available for both CPs.

Creating the VPN group and assigning security modules

1. In the global security settings, select the entry "Firewall" > "VPN groups" > "Add new VPN group".
2. Double-click on the entry "Add new VPN group", to create a VPN group.
Result: A new VPN group is displayed below the selected entry.
3. In the global security settings, double-click on the entry "VPN groups" > "Assign module to a VPN group".
4. Assign the security modules between which VPN tunnels will be established to the VPN group.

Note**Current date and current time on the CP for VPN connections**

Normally, to establish a VPN connection and the associated recognition of the certificates to be exchanged, the current date and the current time are required on both stations.

The establishment of a VPN connection to an engineering station that is also the telecontrol server at the same time (TCSB installed), runs as follows along with the time of day synchronization of the CP:

On the engineering station (with TCSB), you want the CP to establish a VPN connection. The VPN connection is established even if the CP does not yet have the current time. Otherwise the certificates used are evaluated as valid and the secure communication will work.

Following connection establishment, the CP synchronizes its time of day with the PC because the telecontrol server is the time master if telecontrol communication is enabled.

Configure the properties of the VPN group

1. Double-click on the newly created VPN group.

Result: The properties of the VPN group are displayed under "Authentication".

2. Enter a name for the VPN group. Configure the settings of the VPN group in the properties.

These properties define the default settings of the VPN group that you can change at any time.

Note**Specifying the VPN properties of the CPs**

You specify the VPN properties of the CPs in the "Security" > "Firewall" > "VPN" parameter group of the relevant module.

Result

You have created a VPN tunnel. The firewalls of the CPs are activated automatically: The "Activate firewall" check box is selected as default when you create a VPN group. You cannot deselect the check box.

Download the configuration to all modules that belong to the VPN group.

3.17.4.3 VPN communication with SOFTNET Security Client (engineering station)

Set up VPN tunnel communication between the SOFTNET Security Client and the CP as described in section Creating a VPN tunnel for S7 communication between stations (Page 77).

VPN tunnel communication works only if the internal node is disabled

Under certain circumstances the establishment of VPN tunnel communication between SOFTNET Security Client and the CP fails.

SOFTNET Security Client also attempts to establish VPN tunnel communication to a lower-level internal node. This communication establishment to a non-existing node prevents the required communication being established to the CP.

To establish successful VPN tunnel communication to the CP, you need to disable the internal node.

Use the procedure for disabling the node as explained below only if the described problem occurs.

Disable the node in the SOFTNET Security Client tunnel overview:

1. Remove the checkmark in the "Enable active learning" check box.

The lower-level node initially disappears from the tunnel list.

2. In the tunnel list, select the required connection to the CP.

3. With the right mouse button, select "Enable all members" in the shortcut menu.

The lower-level node appears again temporarily in the tunnel list.

4. Select the lower-level node in the tunnel list.

5. With the right mouse button, select "Delete entry" in the shortcut menu.

Result: The lower-level node is now fully disabled. VPN tunnel communication can be established.

3.17.4.4 Establishment of VPN tunnel communication between the CP and SCALANCE M

Create a VPN tunnel between the CP and a SCALANCE M router as described for the stations.

VPN tunnel communication will only be established if you have selected the check box "Perfect Forward Secrecy" in the global security settings of the created VPN group ("VPN groups > Authentication").

If the check box is not selected, the CP rejects establishment of the tunnel.

3.17.4.5 CP as passive subscriber of VPN connections

Setting permission for VPN connection establishment with passive subscribers

If the CP is connected to another VPN subscriber via a gateway, you need to set the permission for VPN connection establishment to "Responder".

This is the case in the following typical configuration:

VPN subscriber (active) ⇔ gateway (dyn. IP address) ⇔ Internet ⇔ gateway (fixed IP address) ⇔ CP (passive)

Configure the permission for VPN connection establishment for the CP as a passive subscriber as follows:

1. In STEP 7, go to the devices and network view.
2. Select the CP.
3. Open the parameter group "VPN" in the local security settings.
4. For each VPN connection with the CP as a passive VPN subscriber, change the default setting "Initiator/Responder" to the setting "Responder".

3.17.5 Certificate manager

Assignment of certificates

If you use communication with authentication for the module, for example SSL/TLS for secure transfer of e-mails, certificates are required. You need to import certificates of non-Siemens communications partners into the STEP 7 project and download them to the module with the configuration data:

1. Import the certificates of the communications partners using the certificate manager in the global security settings.
2. Then assign the imported certificates to the module in the table below the local security settings of the module.

For a description of the procedure, refer to the section Handling certificates (Page 81).

You will find further information in the STEP 7 information system.

3.17.6 Handling certificates

Certificate for authentication

If you have configured secure communication with authentication for the module, own certificates and certificates of the communications partner will be required for communication to take place.

All nodes of a STEP 7 project with enabled security functions are supplied with certificates. The STEP 7 project is the certification authority.

For the secure transfer of e-mails via SSL/TLS and SSL certificate is created for the module. It is visible in STEP 7 in "Global security settings > Certificate manager > Device certificates".

The table "Device certificates" shows the issuer, validity, use of a certificate (service/application) and the use of a key. You can call up further information about a certificate by selecting the certificate in the table and selecting the shortcut menu "Show".

The table also shows all other certificates generated by STEP 7 and all imported certificates.

If the module communicates with non-Siemens partners when the security functions are enabled, the relevant certificates of the communications partners must be exchanged. To do this, follow the steps below:

1. Importing third-party certificates from communications partners
⇒ Global security settings of the project (certificate manager)
2. Assigning certificates locally
⇒ Local security settings of the module ("Certificate manager" table)

These two steps are described in the next two sections.

Importing third-party certificates from communications partners

Import the certificates of the communications partners of third-party vendors using the certificate manager in the global security settings of the STEP 7 project. Follow the steps outlined below:

1. Save the third-party certificate in the file system of the PC of the connected engineering station.
2. In the STEP 7 project open the global certificate manager:
Global security settings > Certificate manager
3. Open the "Trusted certificates and root certification authorities" tab.
4. Click in a row of the table can select the shortcut menu "Import".
5. In the dialog that opens, import the certificate from the file system of the engineering station into the STEP 7 project.

Assigning certificates locally

To be able to use an imported certificate for the TIM, you need to specify it in the "Security" parameter group of the TIM. Follow the steps outlined below:

1. In the STEP 7 project select the module.
2. Navigate to the parameter group "Security > Certificate manager".
3. In the table, double-click on the cell with the entry "<Add new>".

The "Certificate manager" table of the Global security settings is displayed.

4. In the table. select the required third-party certificate and to adopt it click the green check mark below the table.

The selected certificate is displayed in the local table of the module.

Only now will the third-party certificate be used for the module.

Exporting certificates for applications of third-party vendors

For communication with applications of third-party vendors, the third-party application generally also requires the certificate of the module.

You export the certificate of the module for communications partners from third-party vendors in much the same way as when importing (see above). Follow the steps outlined below:

1. In the STEP 7 project open the global certificate manager:
Global security settings > Certificate manager
2. Open the "Device certificates" tab.
3. In the table select the row with the required certificate and select the shortcut menu "Export".
4. Save the certificate in the file system of the PC of the connected engineering station.

Now you can transfer the exported certificate of the module to the system of the third-party vendor.

Change certificate: Subject Alternative Name

STEP 7 adopts the properties "DNS name", "IP address", and "URI" from the parameter "Subject Alternative Name" (Windows: "Alternative applicant name") from the STEP 7 configuration data.

You can change this parameter of a certificate in the certificate manager of the global security settings. To do this, select the a certificate in the table of device certificates and call the shortcut menu "Renew". Properties of the parameter "Alternative name of the certificate owner" changed in STEP 7 are not adopted by the STEP 7 project.

3.18 Protection (TIM 1531 IRC)

You can find a description of handling certificates in the section Certificate manager (Page 81).

3.18.1 Protection

Protection functions

The module provides various access levels to restrict access to certain functions.

NOTICE
<p>Configuring an access level does not replace the know-how protection</p> <p>Configuring access levels prevents unauthorized changes to the module by restricting the download rights.</p> <p>This does not, however, provide write or read protection for blocks on a memory card. Use the know-how protection to protect the code of blocks on the memory card.</p>

The table of access levels

You configure the access levels in the table. The green check mark in the columns on the right of the particular access level indicate the maximum possible operations without knowing the password for this access level.

The default access level is "Full access (no protection)". Every user can read and modify the configuration. No password has been configured and no password is required for online access.

You can configure the following access levels:

- **Full access (no protection)**

The configuration and the blocks can be read and modified by anybody.

- **Read access**

With this access level, without entering the password, only read access to the hardware configuration and the blocks is possible; in other words, you cannot download the blocks or hardware configuration to the TIM without entering the password. Without the password, writing test functions and firmware updates are also not possible.

- **No access (complete protection)**

If the module is completely protected, neither read nor write access to the hardware configuration and blocks is possible.

If you want to use the functions of the unmarked access levels, you will need to enter a password.

With the legitimization provided by using the password, you once again have full access to the module.

Behavior of a password-protected module during operation

Protection of the module is effective after the settings have been loaded on the module.

Before an online function is executed, a check is made to establish whether or not it is permitted. If there is password protection, you will be prompted to enter the password.

Example:

The module was configured for read access and you want to use the "Modify tags" function. Since this is write access, the configured password must be entered before the function can be executed.

The functions protected by the password can only be executed by one PG/PC at any one time. Another PG/PC cannot log on.

The access rights to the protected data apply for the duration of the online connection or until the access rights are canceled again with "Online > Delete access rights".

Each access level allows unrestricted access to certain functions even without entering a password, for example identification using the "Accessible devices" function.

3.18.2 Configuring access protection

Configuration

You can enter several passwords setting up different access rights for different user groups.

The passwords are entered in the table so that precisely one access level is assigned to each password.

The "Access level" column shows how the password takes effect.

Example:

You select the access level "No access (complete protection)" for the module and enter your own password for each of the access levels higher up the table.

For users that do not know any of the passwords, the module is completely protected.

For users who know one of the set passwords the effect depends on the table row in which the password is located:

- The effect of the password in row 1 "Full access (no protection)" is as if the CP was unprotected. Users that know this password have unrestricted access to the module.
- The effect of the password in row 2 "Read access" is as if the module was write-protected. Despite knowing the password, users that know this password only have read access to the module.
- The effect of the password in row 3 "No access (complete protection)" is as if the CP was write and read protected. Users that know this password only have read access to the module.

Procedure

Follow the steps below to set the parameters for the access levels of the module:

1. Open the module properties in the Inspector window.
2. Open the "Protection" entry in the navigation panel.
A table with the possible access levels is displayed in the Inspector window.
3. Select the required access level in the first column of the table. The green check mark in the columns on the right of the particular access level indicate which operations are still possible without entering the password.
4. If you have selected an access level other than "Full access":
 - Assign a password for full access in the "Password" column in the first row (full access).
 - Repeat the selected password in the "Confirm password" column to protect against incorrect entries.
 - Make sure that the password is adequately secure; in other words, that it does not include a pattern that can be machine read!
 - The entry of the password in the first row "Full access (no protection)" is obligatory and allows a user who knows the password unrestricted access to the module, regardless of the selected access level.

5. As necessary, assign other passwords to the required access levels if the selected access level permits this.
6. Download the hardware configuration so that the access level takes effect.

Result

The hardware configuration and the blocks are protected from unauthorized online access according to the set access level. If an operation cannot be executed without a password due to the set access level, a dialog appears prompting entry of a password.

3.19 Telecontrol connections

3.19.1 Telecontrol connections

Telecontrol connections

Telecontrol relationships between the communications modules involved are required for telecontrol communication. Depending on the module type and the firmware version, you perform the configuration in the following parameter groups:

- "Partner stations" parameter group
- or
- "Network data" editor

Configuration in the "Partner stations" parameter group

For S7-1200 telecontrol CPs up to V2.1, which only function as stations, the relationships to the master station or to the master are configured in the "Partner stations" parameter group. This is where you define the communication partners of the CPs.

All other settings required for communication with the master station are taken from the other configuration data of the CPs and do not have to be specially configured for the connections.

Configuration in the "Network data" editor

For all other telecontrol modules that do not fall into the above group, you need to configure telecontrol connections in the "Network data" editor.

The "Network data" editor is used for the following modules:

- CP 1243-1 / CP 1243-8 IRC as of firmware V3.1
- CP 1542SP-1 IRC as of firmware V2.0
- TIM 1531 IRC as of firmware V2.0
- TIM 3V-IE DNP3 / TIM 4R-IE DNP3 as of firmware V3.2

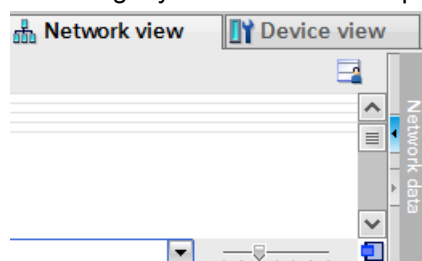
3.19.2 "Network data" editor

Opening the editor "Network data" > "TeleControl" tab

To open the editor, follow the steps below:

1. Open the network view of the project.

On the right you will find the collapsed "Network data" editor.



2. Open the "Network data" editor using the arrow symbol.

The editor is displayed with several tabs, on the left the "Network overview" tab.

3. Expand the editor until the "TeleControl" tab appears.

This tab is further divided into the following tabs:

- ST7
- DNP3
- IEC 60870

Depending on the protocol used, select the corresponding tab to configure the telecontrol connections.

Display and show/hide columns

	Connection	Starting po...	Start subs...	Start interface	Endpoint	End ...	Partner list	End interface/address
	*	*	*		*	*		
	Section_1	1	1	TIM_1 - Ethernet i...	2	2	2,3	TIM_2 - TIM_2 - Ethernet i.
	Section_2	2	2	TIM_2 - Ethernet i...	1	1	2,3	TIM_1 - TIM_1 - Ethernet i.
	Section_3	TIM_2	2	TIM_2 - Serial Inter.	3	3	1	TIM_3 - TIM_3 - Serial Inte
	Section_4	3	3	TIM_3 - Serial Inter.	1	1	1	TIM_2 - TIM_2 - Serial Inte
	Section_5	TIM_2	2	TIM_2 - Ethernet i...	1	1	3, 12	TIM_1 - TIM_1 - Ethernet i.
	Section_6	2	2	TIM_2 - Serial Inter.	3	3	3	TIM_3 - TIM_3 - Serial Inte
	Section_7	3	3	TIM_3 - Serial Inter.	2	2	2	TIM_2 - TIM_2 - Serial Inte
	Section_99	1	1	TIM_1 - Ethernet i...	Third-party device	99	99	192.168.2.99
	Section_8	1	1	TIM_1 - Ethernet i...	1200	12	12	TIM_2 - TIM_2 - Ethernet i.
	Section_9	TIM_2	2	TIM_2 - Ethernet i...	1200	12	1	S7-1200-Station_1 - CP 1..
	Section_10	1200	12	CP 1243-8 IRC - Et...	1	1	1	TIM_2 - TIM_2 - Ethernet i.

Figure 3-4 "Network data" editor, "Telecontrol > ..." tab

In the "Telecontrol connections" table, you can display or hide the columns, arrange them and optimize the column width. Right-click on a column header to access the shortcut menu.

- **Arrange columns**

If you click on a column header and hold down the left mouse button, you can move the column within the table.

- **Show/Hide**

You can show or hide individual columns using this function in the shortcut menu.

This increases the legibility of the table.

- **Show all columns**

Shows all columns of the table.

- **Optimize width / Optimize width of all columns**

You use these shortcut menus to optimize the width of the selected column or all columns in the table.

The column width adapts to the widest entry in this column.

Some fields of the table can be edited, in others you configure the parameter via a drop-down list.

Boxes with a missing or bad configuration are shown with a red background.

Names of the connections

You can adapt the default names of the connections.

A maximum of 129 characters from the following ASCII character sets (numbers decimal) are permitted:

- **No. 32..126**

Space , ! " # \$ % & ' () * + , - . / : ; < = > ? @ [\] ^ _ ` { | } ~

- **No. 128, 130..140, 142, 145..156, 158..159, 161..172**

€ , f „ … † ‡ ^ % ¢ Š ‹ Œ Ž ‘ ’ “ ” • — ~ ™ š › œ ž Ÿ ¡ ¢ £ ¤ ¥ ¦ § ¨ © ª « ¬

- **No. 174..255**

® ¯ ° ± ² ³ ´ µ ¶ · ¸ ¹ º » ¼ ½ ¾ ¿ À Á Â Ã Ä Å Æ Ç È É Ê Ë Ì Í Î Ï Ð Ñ Ò Ó Ô Õ Ö × Ø Ù Ú Û Ü Ý Þ ß à á â ã ä å æ ç è é ê ë ì í î ï ð ñ ò ó ô õ ö ÷ ø ù ú û ü ý þ ÿ

Error displays

Faulty connection points, networks or parameters are highlighted in red in the tables.

Causes of faulty connections include, for example:

- Starting point and endpoint are identical.
- The connection runs through an impermissible network.
- The connection runs through an invalid subscriber.

Delete invalid or redundant connections

If there are unauthorized or unwanted redundant connections, you must delete a connection path:

1. In the "Configured connection paths" table, select the unwanted connection path.
2. Click "Delete" in the shortcut menu.

3.19.3 Specifying connection paths

Rules for connection configuration

Note the following rules for connection configuration:

- Connections can be configured for the following networks:
 - Connections in Ethernet networks between TIM modules and CPs
 - Connections in classic WAN networks (dedicated line/dialup network) - only between TIM modules
- You can create connections between endpoints (subscribers) that are configured in the STEP 7 project.

Fields are available in the connection table for the address data and interface parameters of both endpoints.
- The endpoint of a connection is always the CPU, not the communications module.

Exception: Third-party device (see below)
- A connection segment must be created for the way there and the way back for each connection.

Example of a connection between Partner 1 and 2:

 - Connection segment 1 \Rightarrow 2
 - Connection segment 2 \Rightarrow 1
- A connection must run over a single subnet.
- You can create connections between an endpoint of the STEP 7 project and a "third-party device" that is not configured in STEP 7. The third-party device is located in another subnet and can be reached via a network gateway.

In this case, configure the network gateway as an endpoint of the connection.
- You can configure single and redundant connections between two subscribers.

- Two connections to a partner via the same interface of a module are not allowed.
- A connection via an inconsistent network is invalid.

Example of inconsistent networks:

- A subscriber of a connection segment is connected to another telecontrol protocol.
- Connections via nodes that are not configured as node stations.
- Subscriber with incompatible modems
- Incompatible settings of two modems in a connection
- Incompatible settings between modem and network parameters

Interface-specific configuration of the connection segments

Connections between two endpoints can run over multiple subscribers.

A connection segment between two subscribers can be used for multiple connections.

Individual settings can be configured for specific connection segments and the associated interfaces of the modules. For this reason, the individual connection segments between the interfaces of two devices are displayed in separate lines in the connection table.































	Connection	Starting po...	Start subs...	Start interface	Endpoint	End ...	Partner list	End interface/address
	*	*	*		*	*		
	Section_1	 1	1	TIM_1 - Ethernet i...	 2	2	2,3	TIM_2 - TIM_2 - Ethernet i...
	Section_2	 2	2	TIM_2 - Ethernet i...	 1	1	2,3	TIM_1 - TIM_1 - Ethernet i...
	Section_3	 TIM_2	2	TIM_2 - Serial Inter.	 3	3	1	TIM_3 - TIM_3 - Serial Inte...
	Section_4	 3	3	TIM_3 - Serial Inter.	 1	1	1	TIM_2 - TIM_2 - Serial Inte...
	Section_5	 TIM_2	2	TIM_2 - Ethernet i...	 1	1	3, 12	TIM_1 - TIM_1 - Ethernet i...
	Section_6	 2	2	TIM_2 - Serial Inter.	 3	3	3	TIM_3 - TIM_3 - Serial Inte...
	Section_7	 3	3	TIM_3 - Serial Inter.	 2	2	2	TIM_2 - TIM_2 - Serial Inte...
	Section_99	 1	1	TIM_1 - Ethernet i...	Third-party device	99	99	192.168.2.99
	Section_8	 1	1	TIM_1 - Ethernet i...	1200	12	12	TIM_2 - TIM_2 - Ethernet i...
	Section_9	 TIM_2	2	TIM_2 - Ethernet i...	1200	12	1	S7-1200-Station_1 - CP 1...
	Section_10	 1200	12	CP 1243-8 IRC - Et...	1	1	1	TIM_2 - TIM_2 - Ethernet i...

Figure 3-5 "Network data" editor, "Telecontrol > ..." tab

Creating connections and searching for connection paths

Follow these steps to create connections:

1. Click the "Starting point" field in the next free row.

A drop-down list with the available endpoints is displayed.

The first row below the table header is reserved for entering filters; see section Connection table (Page 92).

2. Select the starting point (CPU) from the table with a double-click.

3. Click the "Endpoint" field in the same row.

Select the endpoint (CPU) from the table with a double-click.

- Special case: "Third-party device":

If you want to create a third-party device as endpoint instead of an endpoint from a STEP 7 project, leave the default entry "Third-party device" in the cell.

Configure the interface of the starting point as well as the address data and other parameters of the third-party device by means of entries in the corresponding fields.

With a third-party device as endpoint, the connection search via the dialog described below is disabled.

After an endpoint is selected from the STEP 7 project, the starting point and endpoint are displayed in the table row. The other fields are usually empty and have a red background.

Once a connection has been created, the actual course of the connection is not always defined yet. Especially with larger networks, several connection paths are often possible.

To facilitate searching the connection path, the search function is available via the "Add new connection path" icon:



4. Leave the table row with the selected starting point and endpoint highlighted and click on the "Add new connection path" icon.

The dialog for defining connection paths opens:

Dialog "Add connection paths"

The possible connection paths are searched for automatically, which is indicated by the progress bar at the bottom of the dialog.

- The status and result of the search are displayed in the "Information" field below.
- The connection paths found are displayed in the "Select a connection path ..." upper table.
- Details for a selected connection path are shown in the "Connection path" table.
- When selecting a connection path, the "Preview" table shows which connection points of the selected connection path are transferred to the connection editor when you click "Add".

5. Select the desired connection path(s).

- If one or more connection paths are displayed in the upper table, select the desired connection path and click on "Add".

"Information" shows whether the connection path has been added or whether it has already been configured.

- If you want to use a redundant connection, select a second path and click on "Add".

Close the dialog using the "Close" button if the added connection paths correspond to the project defaults.






- If no connection is displayed in the table, there is a configuration error in the corresponding stations or networks.

In this case, close the dialog with the "Close" button and complete the configuration.

The "Connection path" table supports you in checking the connection paths. For every configured connection, the detailed connection path is shown here.

A station symbol with an identifier for the connection point is displayed in the "Position" column. The color of the identifier indicates the validity of the connection point:

- Blue: Valid connection point
- Red: Invalid connection point

Icon	Meaning
	Starting point
	Node-input
	Node-output
	Endpoint
	Examples of invalid connection points

Parameters of the connection table

Here, you configure the parameters of the connection table for each connection segment. You can find the description of the parameters in the section Connection table (Page 92).

The "Properties" tab, which shows additional parameters for each connection segment, is displayed below the connection table.

"Properties" tab of the connections

In the parameter groups, you can check the connection segment, correct it if necessary and configure additional properties.

You can find a description of the parameter groups in the section Parameters of the DNP3 connections (Page 97).

3.19.4 Connection table

Filter

The first row below the table header contains a filter function with which you can restrict the selection of configurable subscribers and connection options. Using filters reduces the number of combination possibilities and increases the clarity.

Once you have created some connection segments, enable the filter by entering a recurring name or partial name in the filter cell. The cell is given a colored background, see figure.






	Connection	Starting po...	Start subs...	Start interface	Endpoint	End ...	Partner list
	*	1	*		*	*	
	Section_1	1	1	TIM_1 - Ethernet interfac..	2	2	2,3
	Section_99	1	1	TIM_1 - Ethernet interfac..	Third-party device	99	99
	Section_8	1	1	TIM_1 - Ethernet interfac..	1200	12	12
	Section_10	1200	12	CP 1243-8 IRC - Ether..	1	1	1

Figure 3-6 Connection table

The filter "1" is set in the "Starting point" column.


Example:

You have created connections with the starting points "1200", "1" and "2".

When "1" is entered in the filter cell, only the segments whose starting points start with this partial string are shown: "1" and "1200"

Filters set in multiple columns multiply.

The selection "*" shows all existing connection segments.

The filter icon on the left in the first row () shows or hides an existing filter.

The filter can be applied to all columns with an asterisk (*) in the first cell.

Note:

If you have created connections and set a filter, you cannot create any new connections.

You need to reset the filter first in order to create new connections.

Parameters

If parameters are already used by the configuration, the values are transferred to the respective columns.

- **Name**

You can change the default name of the connection segment between two subscribers.

See section "Network data" editor (Page 87) for information on this.

- **Starting point**

Select the desired starting point of the connection from the drop-down list.

- The starting point of a connection is a CPU.

- **Start subscriber**

Station address of the starting point

- **Start interface**

Interface of the starting point module through which the connection runs.

- **Start interface (red.)**

Interface of the starting point module through which the redundant connection runs.

- **Endpoint**

Select the endpoint of the connection.

Endpoints of a connection can be:

- A CPU
- A third-party device

The network node type of third-party devices is configured in the parameter group of the connection, see section Third-party device parameters (Page 102).

- **End subscriber**

Station address of the endpoint

- **Partner list**

When a partner (endpoint) is selected that is located in the STEP 7 project, its station address is automatically found during the connection search and entered in the partner list.

In connection segments used for multiple connections, the station address of all destination subscribers is entered.

Note

Manual entry for third-party device

For a third-party device that is not configured in the STEP 7 project, you must enter the station address manually.

The station addresses are entered separated by commas.

- **End interface/address**

Interface of the endpoint module through which the connection runs.

For a third-party device that is not configured in the STEP 7 project, you must enter the IP address (Ethernet) or the telephone number (dial-up network) of the partner manually.

- **Port no.**

Relevant for third-party device (master / station)

Number of the listener port of the partner

For modules of the STEP 7 project, the value is taken from the configuration. It can be changed.

You need to enter the port number for a third-party device.

Range of values: 0 ... 65535

Default: 20000

- **Partner monitoring**

"Partner monitoring time"

Relevant for all subscriber types

If the station module does not receive a sign of life from the master on the application layer within the configured time, it classifies the connection as disrupted and terminates it.

After sending data, the master module expects a response from the station within the configured time.

Note

Redundant connection paths

If you configure redundant connection paths between two partners, configure the same time for both paths.

Range of values: 0 ... 65535

With the setting 0 (zero), the function is disabled.

- **Transport prot.**

Relevant for all subscriber types

Select the transport protocol:

- TCP
- UDP

- **Spontaneous**

Transfer mode for events

For modules of the STEP 7 project, the value is taken from the configuration and cannot be changed.

For information on the parameter, see section Settings DNP3 station (Page 56).

- **Event polling**

Relevant for master, third-party device (master)

The "Event polling interval" defines the cycle in which events of the station are queried by the DNP3 master station. The interval is specified as a multiple of the master's "Polling basic interval", see section Settings DNP3 master (Page 55).

- **Class 0 polling**

Relevant for master, third-party device (master)

The class 0 polling interval determines the cycle in which class 0 data from the image memory of the station is polled by general requests from the DNP3 master station. The interval is specified as a multiple of the parameter "Polling basic interval" of the master, see section Settings DNP3 master (Page 55).

The value configured for the station is transferred to the master station and stored there.

Range of values: 0 ... 65535

Default: 1

With the setting 0 (zero), the function is switched off, class 0 data is not transmitted cyclically.

- **Max. polling duration**

Relevant for master, third-party device (master)

Specifies the maximum time period during which the master may continuously call this station. Even if data is still pending for transmission in the station after this time, the calls from the master station are canceled. This means that the master station is once again available to other stations.

The value configured for the station is transferred to the master station and stored there.

Range of values: 0 ... 65535

Default: 10

With the setting 0 (zero), the function is disabled; in other words, the calling period is unlimited.

- **Polling mode**

Relevant for master, third-party device (master)

This is where you define the mode in which the master station calls the station.

The value configured for the station is transferred to the master station and stored there.

Ranges of values:

- **Cyclic**

The station is called cyclically. The duration of the polling cycle is calculated from the "Class 0 polling interval" parameter, see above.

- **After startup**

The station is only called after the initial startup and after a restart.

If no unsolicited transmission is enabled for a station, no data is transmitted during operation when this option is selected.

- **Conformity level**

Relevant for all subscriber types

Specifies the DNP3 conformity level (DNP3 implementation level) supported by the partner: Level 1, 2, 3, 4 and Level 4+

The conformity level referred to as Level 4+ contains the functional scope of Level 4 and also the support of additional data types / variations; see also data point types in the section Datapoint types (Page 109).

- **Temporary**

The parameter is not supported.

Parameters for redundant connection paths

If redundant connection paths are configured, these are configured in the same way as the main paths.

The parameters of the redundant connection paths are distinguished by the following suffix:

- *** (red)**

The parameters of the redundant connection paths have the same functions as those for the main path. See above for the meaning.

Examples:

- **Start interface (red.)**

Interface of the starting point module through which the redundant connection runs.

- **End interface (red.)**

Interface of the endpoint module through which the redundant connection runs.

3.19.5 Parameters of the DNP3 connections

3.19.5.1 General

If you select a connection in the "Telecontrol connections" table in the "Network data" editor, additional parameter groups for this connection are displayed in the "Properties" tab of the Inspector window.

In the parameter groups, you can check the connection, correct it if necessary and configure additional properties.

General

- **Connection**
Shows the name of the connection and the protocol.
You can also change the connection name here.
- **Connection points**
Shows the most important parameters of the connection.
You can also change the station address of a third-party device here.

3.19.5.2 TCP connection monitoring

Ethernet interface > Advanced options > TCP connection monitoring

The settings of the two parameters at the Ethernet interface govern TCP connections via this interface.

You can adapt the parameters in the properties of the telecontrol connections for each connection segment.

- **TCP connection monitoring time**
Function: If no data traffic takes place within the TCP connection monitoring time, the module sends a keepalive frame to the communication partner.
With the setting 0 (zero), the function is disabled.
Default setting: 180 s
Permitted range
 - TIM 1531 IRC
1...65535 s
 - CP 1243-1 / CP 1243-8 IRC / TIM 3V-IE DNP3 / TIM 4R-IE DNP3
0...65535 s
 - CP 1542SP-1 IRC
0...32767 s
- **TCP keepalive monitoring time**
After sending a keepalive frame, the module expects a response from the communication partner within the keepalive monitoring time. If the module does not receive a response within the configured time, it closes the connection.
With the setting 0 (zero), the function is disabled.
Default setting: 10 s
Permitted range
 - TIM 1531 IRC
1...65535 s

- CP 1243-1 / CP 1243-8 IRC
0...65535 s
- TIM 3V-IE DNP3 / TIM 4R-IE DNP3
1...255 s
- CP 1542SP-1 IRC
0...32767 s

If you have configured a redundant connection to a partner, the parameters can be set separately for both connection paths.

3.19.5.3 DNP3 security options

Secure Authentication

If the security function is enabled, the DNP3 master and station authenticate themselves with a secret key, the pre-shared key.

With the help of the common pre-shared key, after the first connection establishment between master and station, session keys are agreed that are then renewed cyclically. Renewal of the session keys is initiated by the master. The criteria for renewing the key are specified in the following parameters.

- Key exchange interval
- Authentication requests before key exchange

As soon as one of these conditions is met, the session key is renewed.

Parameters

- **Enable DNP3 security options**

Select the option if you want to use Secure Authentication.

- **IKE mode**

Selection of the mode for key exchange. Range of values:

- Aggressive Mode

The Aggressive Mode is somewhat faster but transfers the identity unencrypted.

- Main Mode

The Main Mode is the standard mode.

Default setting: Aggressive Mode

- **Security statistics**

Specifies whether the statistics of security events are sent to the master. Security events are authentication requests of the master to the station module. If this option is activated, all authentication requests are stored in the station module with date, time and result and sent to the master for further evaluation.

Range of values:

- Do not send security statistics
- Send security statistics

Default setting: Do not send security statistics

- **SHA-1 interlock**

Setting to select whether the module may use the secure hash algorithm SHA-1 if "SHA-256" was configured as the Secure hash algorithm and the master does not support SHA-256.

Range of values:

- SHA-1 mode not allowed

The module must not use SHA-1. If the master does not support SHA-256, no connection will be established.

- SHA-1 mode allowed

The module can use SHA-1 if the master does not support SHA-256.

Default setting: SHA-1 mode not allowed

- **Secure hash algorithm (SHA)**

Selection of the Secure Hash Algorithm (SHA)

Range of values:

- SHA-1
- SHA-256

Default setting: 256

- **Key wrap algorithm**

Selection of the Advanced Encryption Standard (AES)

Range of values:

- AES-128
- AES-256

Default setting: AES-128

- **Key length**

Specifies the length of the pre-shared key in bytes.

The following lengths are used depending on the key wrap algorithm.

- For AES-128: 16 bytes
- For AES-256: 32 bytes

- **Max. number of statistics queries**

If the configured number of statistics requests of the master is exceeded within the key exchange interval, the module enters a message in the diagnostics buffer of the CPU.

Range of values: 2...255 Default setting: 5

- **Authentication requests before key exchange**

Maximum number of authentication requests of the module to the master. When this number is reached, the session key is renewed.

Range of values: 1...10000 Default setting: 1000

Recommendation: Set the number for the station module twice as high as for the master.

- **Key exchange interval**

Period after which the key is exchanged again between the station module and the master. The interval must be matched up on both communications partners.

Range of values: 0...65535 min. at 0 (zero), the key is never changed (function disabled). Default setting: 15 min.

Recommendation: Set the key exchange interval for the station module twice as high as for the master.

- **Authentication timeout**

Maximum wait time of the module after an authentication request to the master. If the waiting time for the response from the master is exceeded, the module generates a security event and sends this to the master.

Range of values: 1... 65535 s Default setting: 5

- **Pre-shared key**

The pre-shared key can be configured in two ways:

- Manual configuration

Enter the pre-shared key in STEP 7 manually as a hexadecimal value.

- Import as file

Import the pre-shared key from the file system of the engineering station if the pre-shared key was generated by the master or another system.

The pre-shared key of a station module must be identical to the pre-shared key of the master.

3.19.5.4 Transmission settings – DNP3

Transmission settings DNP3

- **Form of transfer**

Defines the form of transfer of event frames.

- Type-specific

This is the bundled transfer of events according to data types typical for DNP3. First the existing binary events are sent, then all analog values and finally all counted value changes. This makes the frames somewhat more compact and transmission more efficient.

- Chronological

Events are transferred strictly chronologically. The optimizing effect of grouping into blocks of the same data type as described in the DNP3 specification (see above) is lost.

This form is primarily intended for control systems that archive events strictly chronologically.

Default: Type-specific

3.19.5.5 Third-party device parameters

Third-party device parameters

Only valid for partners that are not configured in the STEP 7 project.

- **Network node type third-party device / Network node type third-party device (red.)**

Configure the network node type of the third-party device that is accessible via a connection or via two redundant connection paths:

- Master station

(Master)

- Node station

For modules that act as a node station, the following applies:

The interface in the direction of the master station is configured as a "node station".

The interface in the direction of the lower-level network is configured as a "Master station".

- Station

3.20 Configuring data points

3.20.1 Data point configuration

Data point-related communication with the CPU

No program blocks need to be programmed for telecontrol modules with data point configuration to transfer user data between the station and communications partner.

The data areas in the memory of the CPU intended for communication with the communications partner are configured data point-related on the module. Each data point is linked to a PLC tag or the tag of a data block.

Requirement: Created PLC tags and/or data blocks (DBs)

PLC tags or DBs must first be created correspondingly on the CPU to allow configuration of the data points.

The PLC tags for data point configuration can be created in the standard tag table or in a user-defined tag table. All PLC tags intended to be used for data point configuration must have the attribute "Visible in HMI".

Address areas of the PLC tags are input, output or bit memory areas on the CPU.

Note

Number of PLC tags

Observe the maximum possible number of PLC tags that can be used for data point configuration.

The formats and S7 data types of the PLC tags that are compatible with the data point types of the modules can be found in the section Datapoint types (Page 109).

Access to the memory areas of the CPU

The values of the PLC tags or DBs referenced by the data points are read and transferred to the communications partner by the module.

Data received from the communications partner is written by the module to the CPU via the PLC tags or DBs.

Configuring the data points and messages in STEP 7

You configure the data points in STEP 7 in the data point and message editor. You can open both editors alternatively as follows:

- Selecting the communications module
Shortcut menu "Open the data point and messages editor"
- Via the project navigation:
Project > directory of the relevant station > Local modules > required communications module

By double-clicking on the entry, the data point or message editor opens.

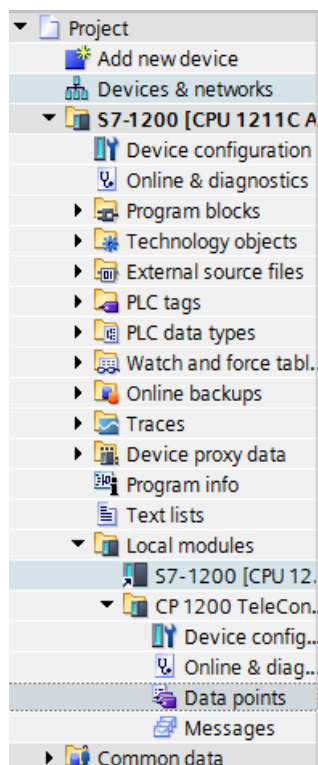


Figure 3-7 Configuring data points and messages

After opening the editor window using the two entries to the right above the table, you can switch over between the data point and message editor.

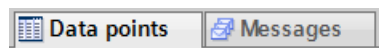


Figure 3-8 Switching over between the two editors

Creating objects

With the data point or message editor open, create a new object (data point / message) by double clicking "<Add object>" in the first table row with the grayed out entry.

A preset name is written in the cell. You can change the name to suit your purposes but it must be unique within the module.




		Name	PLC tag
1		DataPoint	"Tag_1-BI"
2		DataPoint_1	"Tag_2-BQ"
3		DataPoint_2	"Tag_1-BI"



Figure 3-9 Data point table

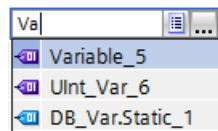
You configure the remaining properties of every object using the drop-down lists of the other table columns and using the parameter boxes shown at the bottom of the screen.

Assigning data points to their data source

After creating it, you assign a new data point to its data source. Depending on the data type of the data point a PLC tag can serve as the data source.

For the assignment you have the following options:

- Click on the table symbol  in the cell of the "PLC tag" column.
All configured PLC tags and the tags of the created data blocks are displayed. Select the required data source with the mouse or keyboard.
- Click the symbol .
A selection list of the configured PLC Tags and the blocks is displayed. From the relevant table, select the required data source.
- In the name box of the PLC tag, enter part of the name of the required data source.
All configured PLC tags and tags of the data blocks whose names contain the letters you have entered are displayed.



Select the required data source.

Note

Assignment of parameter values to PLC tags

The mechanisms described here also apply when you need to assign the value of a parameter to a PLC tag. The input boxes for the PLC tag (e.g.: PLC tag for partner status) support the functions described here for selecting the PLC tag.

Arranging columns and rows, showing/hiding columns

As with many other programs, you can arrange the columns and sort the table according to your needs in the data point or message editor:

- Arrange columns
If you click on a column header with the left mouse button pressed, you can move the column.

- **Sorting objects**

If you click briefly with the left mouse button on a column header, you can sort the objects of the table in ascending or descending order according to the entries in this column. The sorting is indicated by an arrow in the column header.

After sorting in descending order of a column the sorting can be turned off by clicking on the column header again.

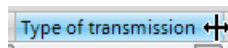
- **Adapting the column width**

You can reach this function with the following actions:

- Using the shortcut menu that opens when you click on a column header with the right mouse key.

"Optimize width", "Optimize width of all columns"

- If you move the cursor close to the limit of a column header, the following symbol appears:



When it does, click immediately on the column header. The column width adapts itself to the broadest entry in this column.

- **Showing / hiding columns**

You call this function using the shortcut menu that opens when you click on a column header with the right mouse key.

Copying data points and messages

As with many other programs, you can copy and paste objects in the data point or message editor.

If you right-click in the row of an object in the table, you can access this function from the shortcut menu:

- Cut
- Copy
- Paste

You can paste cut or copied objects within the table or in the first free row below the table.

You can also paste cut or copied objects into tables of other communications modules of the same type and with the same telecontrol protocol.

- Delete

If you hold down the <Ctrl> key, you can select several rows that are not contiguous.

With the <Shift> key pressed, you can select the beginning and the end of a contiguous area.

Exporting and importing data points

To simplify the engineering of larger plants, you can export the data points of a configured module and import them into other modules in the project. This is an advantage particularly in projects with many identical or similar stations or data point modules.

Communications modules with the same telecontrol protocol are compatible with each other. Data points can be imported and exported between compatible modules.

The export / import function is available when you select the module for example in the network or device view and select the relevant shortcut menu.

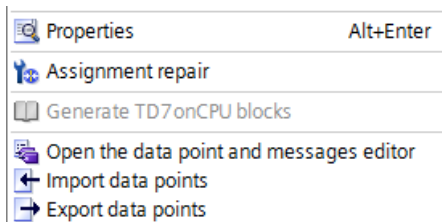


Figure 3-10 Shortcut menu of the module

When it is exported the data point information of a module is written to a CSV file.

It is not possible to import data points of an older project into a project that was created in STEP 7 V15.1 because the scope of parameters of certain data point types is not identical. However, the import works when missing parameters (see the following parameter descriptions) are added in the CSV file.

Export

When you call the export function, the export dialog opens. Here, you select the module or modules of the project whose data point information needs to be exported. When necessary, you can export the data points of all modules of the project together.

In the export dialog, you can select the storage location in the file directory. When you export the data of a module you can also change the preset file name.

When you export from several modules, the files are formed with preset names made up of the station name and module name.

The file itself contains the following information in addition to the data point information:

- Module name
- Module type
- CPU name
- CPU type

Editing the export files

You can edit the data point information in an exported CSV file. This allows you to use this file as a configuration template for many other stations.

If you have a project with many stations of the same type, you can copy the CSV file with the data points of a fully configured module for other as yet unconfigured stations and adapt

individual parameters to the particular station. This saves you having to configure the data points for every module in STEP 7. Instead, you simply import the copied and adapted CSV file to the other modules of the same type. When you import this file into another module, the changed parameter values of the CSV file are adopted in the data point configuration of this module.

The lines of the CSV file have the following content:

- Line 1: ,Name,Type,
This line must not be changed.
- Line 2: PLC,<CPU name>, <CPU type>,
Meaning: PLC (designation of the station class), CPU name, CPU type
Only the elements <CPU name> and <CPU type> may be changed.
The CPU type must correspond exactly to the name of the CPU in the catalog.
- Line 3: Module,<module name>,<module type>,
Meaning: Module (Designation of the module class), module type, module name
Only the elements <module name> and <module type> may be changed.
Be careful when changing the module names if you want to import data points into several modules (see below).
The module type must correspond exactly to the name of the module in the catalog.
- Line 4: Parameter names (English) of the data points
This line must not be changed.
- Lines 5..n: Values of the parameters according to line 4 of the individual data points
You can change the parameter values for the particular station.

Importing into a module

Before importing the data points make sure that the PLC tags required for the data points have been created.

Note that when you import a CSV file all the data points existing on the module will be deleted and replaced by the imported data points.

Select a module and select the import function from the shortcut menu of the module. The import dialog opens in which you select the required CSV file in the file directory.

If the information on the assignment of the individual data points to the relevant PLC tags matches the assignment in the original module, the data points will be assigned to the corresponding PLC tags.

When you import data points into a module, but some required PLC tags have not yet been created in the CPU, the corresponding data point information cannot be assigned. In this case, you can subsequently create missing PLC tags and then assign them the imported data point information. The "Assignment repair" function is available for this (see below).

If the names of the PLC tags in the module into which the import is made have different names than in the module that exported, the corresponding data points cannot be assigned to your PLC tags.

Importing into several modules

You can import the data points from several modules into the modules of a different project. To do this in the import dialog select all the required CSV files with the control key.

Before importing the data points, make sure that the respective stations have been created with CPUs of the same name, modules of the same name and PLC tags of the same name.

When you import the corresponding stations of the project are searched for based on the module names in the CSV files. If a target station does not exist in the project or the module has a different name, the import of the particular CSV file will be ignored.

Restrictions for the import of data points

In the following situations the import of data points will be aborted:

- An attribute required by the module is missing in the CSV file to be imported.

Example: If a data point to be imported uses a time trigger, the import will be aborted if no time-of-day synchronization was configured for the module.

- The telecontrol protocol used by the module differs from that of the original module.


Modules with the same telecontrol protocol are compatible with each other:

Only when importing into several modules:

- The import is aborted when a module or CPU name is different from the data in the CSV file.

Assignment repair

If you have named the PLC tags in a station into which you want to import differently from the station from which the CSV file was exported, the assignment between data point and PLC tag is lost when you import.

You then have the option to either rename the existing PLC tags appropriately or add missing PLC tags. You can then repair the assignment between unassigned data points and PLC tags. This function is available either via the shortcut menu of the module (see above) or with the following icon to the upper left in the data point editor: 

If a PLC tag with a matching name is found for a data point by the repair function, the assignment is restored. However the data type of the tag is not checked.

After the assignment repair make sure that you check whether the newly assigned PLC tags are correct.

3.20.2 Datapoint types

During the configuration of the user data to be transferred, each data point is assigned to a data point type.

The table lists the supported data point types of the modules with the classifications of the protocol and the compatible S7 data types of the CPU.

Note

Effect of the change of arrays for data points

If an array is modified later, the data point must be recreated.

Data point types

Table 3- 4 Data point types, DNP3 object groups, variants and compatible S7 data types

Format (memory requirements)	Data point type	DNP3 object group [variation]	Direction	S7 data types		Operand area
				CP	TIM	
Bit	Binary Input	1 [1, 2]	in	Bool	Bool	I, Q, M, DB
	Binary Input Event	2 [1, 2]	in	Bool	Bool	I, Q, M, DB
	Binary Output ¹⁾	10 [2]	out	Bool	Bool	Q, M, DB
	Binary Output Event ¹⁾	11 [1, 2]	out	Bool	Bool	Q, M, DB
	Binary Command	12 [1]	out	Bool	Byte	Q, M, DB
Integer (16 bits)	Counter	20 [2]	in	UInt, Word	Word	I, Q, M, DB
	Frozen Counter ²⁾	21 [2, 6]	in	UInt, Word	Word	I, Q, M, DB
	Counter Event	22 [2, 6]	in	UInt, Word	Word	I, Q, M, DB
	Frozen Counter Event ³⁾	23 [2, 6]	in	UInt, Word	Word	I, Q, M, DB
	Analog Input	30 [2]	in	Int	Int	I, Q, M, DB
	Analog Input Event	32 [2]	in	Int	Int	I, Q, M, DB
	Analog Output Status ⁴⁾	40 [2]	out	Int	Int	Q, M, DB
	Analog Output	41 [2]	out	Int	Int	Q, M, DB
	Analog Output Event ⁴⁾	42 [2, 4]	out	Int	Int	Q, M, DB
Integer (32 bits)	Counter	20 [1]	in	DWord	DWord	I, Q, M, DB
	Frozen Counter ²⁾	21 [1, 5]	in	DWord	DWord	I, Q, M, DB
	Counter Event	22 [1, 5]	in	DWord	DWord	I, Q, M, DB
	Frozen Counter Event ³⁾	23 [1, 5]	in	DWord	DWord	I, Q, M, DB
	Analog Input	30 [1]	in	DInt	-	Q, M, DB
	Analog Input Event	32 [1]	in	DInt	-	Q, M, DB
	Analog Output Status ⁴⁾	40 [1, 3]	out	DInt	DWord	Q, M, DB
	Analog Output	41 [1]	out	DInt	DWord	Q, M, DB
	Analog Output Event ⁴⁾	42 [1]	out	DInt	DWord	Q, M, DB

Format (memory requirements)	Data point type	DNP3 object group [variation]	Direction	S7 data types		Operand area
				CP	TIM	
Floating-point number (32 bits)	Analog Input	30 [5]	in	Real	-	Q, M, DB
	Analog Input Event	32 [5, 7]	in	Real	-	Q, M, DB
	Analog Output Status ⁴⁾	40 [3]	out	Real	-	Q, M, DB
	Analog Output	41 [3]	out	Real	-	Q, M, DB
	Analog Output Event ⁴⁾	42 [5, 7]	out	Real	-	Q, M, DB
Floating-point number (64 bits)	Analog Input	30 [6]	in	LReal	-	Q, M, DB
	Analog Input Event	32 [6, 8]	in	LReal	-	Q, M, DB
	Analog Output	41 [4]	out	LReal	-	Q, M, DB
	Analog Output Event ⁴⁾	42 [6, 8]	out	LReal	-	Q, M, DB
Data block (1...64 bytes) ⁵⁾	Octet String / Octet String Output	110 [-]	in, out	⁵⁾	⁵⁾	DB
	Octet String Event ⁵⁾	111 [-]	in, out	⁵⁾	⁵⁾	DB

¹⁾ This object group can be configured in the data point editor of STEP 7 using the substitute object group 12.

²⁾ This object group can be configured in the Data point editor of STEP 7 using the substitute object group 20.

³⁾ This object group can be configured in the Data point editor of STEP 7 using the substitute object group 22.

⁴⁾ This object group can be configured in the Data point editor of STEP 7 using the substitute object group 41.

⁵⁾ With these data point types, contiguous memory areas up to a size of 64 bytes can be transferred. All S7 data types with a size between 1 and 64 bytes are compatible.

Explanation of the table footnotes ¹⁾, ²⁾, ³⁾, ⁴⁾: Configuring data points using substitute object groups

The initial data point types of the following object groups can be configured using the substitute object groups listed above:

- 10 [2]
- 11 [1, 2]
- 21 [1, 2, 5, 6]
- 23 [1, 2, 5, 6]
- 40 [1, 2, 3]
- 42 [1, 2, 4, 5, 6, 7, 8]

Use the specified substitute object group for the configuration.

Assign each data point on the master using the configurable data point index in STEP 7. The data point of the station module is then assigned to the corresponding data point on the master.

Example of configuring the data point Binary Output (10 [2])

The data point is configured as follows:

In the station module as Binary Command (12 [1])

On the master as Binary Output (10 [2])

With the data point types Binary Output Event (11) and Analog Output Event (42), you also need to enable mirroring; refer to the next paragraph.

Configuration of mirroring for output events (object groups 11 and 42)

You first create the data point types Binary Output Event (object group 11) and Analog Output Event (object group 42) as described above as data points of the object groups 12 or 41.

The local values of these two object groups can be monitored for changes and the changes transferred to the master. Changing a local value can, for example, be caused by manual operator input on site.

To allow the value resulting from local events or interventions to be transferred to the master, the data point in question requires a channel for mirroring back. You configure this mirroring back function using the "Value monitoring" option in data point configuration, "General" tab.

Remember that to use the mirror back function, you need to interconnect the local values in the controller with the relevant PLC tag of the data point.

Time stamp of the data with the DNP3 protocol in UTC format

Time stamps are transferred in UTC format (48 bits) and contain milliseconds.

3.20.3 "General" tab

General

You will also the most important parameters in the first tab of the data point editor in the data point table.

- **Data source**

- Name: Unique name of the data point
- For the assignment of the PLC tabs, see section Data point configuration (Page 103).
- For the data point type, see section Datapoint types (Page 109).
- For the data point index, see section Rules for configuring the data point index: (Page 113).

- **Master function**

- Option enabled

The values of the data point are sent as for a master:

- - Input data points are received.
- - Output data points are sent.

- Option disabled

The data point can be used for 'direct communication' between stations:

- Input data points can be received and sent.
- Output data points can be sent and received.

For direct communication, enable also the "Spontaneous" parameter in the DNP3 connection.

- **Value monitoring**

Only for commands and outputs of a station module

When this option is activated, the current value of the data point, which can be set by the master, is mirrored back from the station to the master. Furthermore, the trigger options of the data point can be enabled to configure the triggering of the transmission.

- **Type of transmission**

For the type of transmission, see section Process image, type of transmission, event classes (Page 113).

- **Read cycle**

Only for inputs

For the read cycle, see section Read cycle (Page 115).

- **Response to general request**

Enables a station data point for the response to general requests. If the function is disabled, the value of the data point is not sent to the communications partner following a general request.

3.20.4 Rules for configuring the data point index:

Configuration of the data point index

The following rules apply to configuring the data point index.

- Data point indexes must be unique within each of the following object groups:
 - Binary Input / Binary Input Event
 - Binary Output / Binary Command
 - Counter / Counter Event
 - Analog Input / Analog Input Event
 - Analog Output
 - Octet String / Octet String Event
- Indexes of two data points in different object groups can be identical.

3.20.5 Process image, type of transmission, event classes

Storage of values

As a rule the values of all data points are stored in the image memory of the module. Values in the image memory are transferred only after being called by master station TIM.

Events are also stored in the send buffer and can be transferred unsolicited.

The image memory, the process image of the module

The image memory is the process image of the TIM. All the current values of the configured data points are stored in the image memory. New values of a data point overwrite the last stored value in the image memory.

The values are sent only after a query by the communications partner - see below "Transfer after call" in the "Types of transmission" section - or along with a message from the send buffer that needs to be transferred immediately.

The send buffer

The send buffer of the TIM is the memory for the individual values of data points that are configured as an event. You will find the size of the send buffer in the manual of the relevant module.

The capacity of the send buffer is divided up equally for all enabled partners.

If the connection to a communications partner is interrupted, the individual values of the events are retained in the buffer. When the connection returns, the buffered values are sent. The frame memory operates chronologically; in other words, the oldest frames are sent first (FIFO principle).

If a frame was transferred to the communications partner, the transferred value is deleted from the send buffer.

If frames cannot be transferred for a longer period of time and the send buffer is threatening to overflow, the response is as follows:

- If the send buffer reaches a fill level of 80%, a warning message is output.
- If the fill level of the send buffer reaches 100%, no more values are saved until the fill level falls below 100% again.

Saving the data point values

As a rule, the values of data points are stored in the image memory of the module and transferred only when queried by the communications partner.

Events are also stored in the send buffer and can be transferred unsolicited.

Data points are configured as a static value or as an event using the "Type of transmission" parameter (see below):

- **Static value (no event)**

Static values are entered in the image memory (process image).

Static values correspond to the following type of transmission "Transfer after call (class 0)".

- **Event**

The values of data points configured as an event (triggered type of transmission) are also entered in the image memory of the module. The values are also entered in the send buffer.

Types of transmission and event classes

The following types of transmission are possible:

- **Transfer after call (class 0)**

The current value of the data point is entered in the image memory. New values of a data point overwrite the last stored value in the image memory.

After being called by the communications partner, the current value at this time is transferred.

- **Triggered**

Data points are configured as an event using a triggered type of transmission. The values of these data points are entered in the image memory and also in the send buffer.

The values of an event are saved as soon as the configured trigger conditions are met.

The following event classes are available:

- **Every value triggered**

Each value change is entered in the send buffer in chronological order.

- **Current value triggered**

Only the last, current value is entered in the send buffer. It overwrites the value stored there previously.

For information on the different trigger types, see section "Trigger" tab (Page 116).

3.20.6 Read cycle

Input data points are assigned to the read cycle of the CPU in the data point configuration in the "General > Read cycle" tab.

Structure of the CPU scan cycle

The cycle with which the transferring module (TIM) scans the memory area of the CPU is made up of the following phases:

- **High-priority read jobs**

- (Fast cycle)

For all data points with the assignment "Fast cycle" the PLC tags are read in every scan cycle.

As a rule, it is sufficient to assign only data to be acquired quickly, such as alarms and contact changeover messages as well as command, setpoint and parameter objects for the 1000 check, to the fast cycle.

For information on the 1000 check, see the Glossary.

- **Write jobs**

In every cycle, the values of a certain number of unsolicited write jobs are written to the CPU.

The number of tags written per cycle is specified for the transferring module in the "Communication with the CPU" parameter group with the "Max. number of write jobs" parameter. The tags whose number exceeds this value are then written in the next or one of the following cycles.

- **Low-priority read jobs - proportion**

(Normal cycle)

For data points with the assignment "Normal cycle", a proportion of the values of their PLC tags is read in every scan cycle.

The number of tags read per cycle is specified for the transferring module in the "Communication with the CPU" parameter group with the "Max. number of read jobs" parameter. The tags that exceed this value and can therefore not be read in one cycle are then read in the next or one of the following cycles.

- **Cycle idle time**

This waiting time between two scan cycles is used to reserve adequate time for other processes that access the CPU.

3.20.7 "Trigger" tab

Trigger

Data points are configured as a static value or as an event using the "Type of transmission" parameter:

Saving the value of a data point configured as an event

Saving the value of a data point configured as an event in the send buffer (message memory) can be triggered by various trigger types:

- **Threshold value trigger**

The value of the data point is saved when this reaches a certain threshold. The threshold is calculated as the difference compared with the last stored value, refer to the section Threshold value trigger (Page 117).

- **Time trigger**

The value of the data point is saved at configurable intervals or at a specific time of day.

- **Event trigger (Trigger tag)**

The value of the data point is saved when a configurable trigger signal is fired. For the trigger signal, the edge change (0 → 1) of a trigger tag is evaluated that is set by the user program. When necessary, a separate trigger tag can be configured for each data point.

Resetting the trigger tag in the bit memory area / DB:

If the memory area of a trigger tag is in the bit memory or in a data block, the module resets the trigger tag itself to 0 (zero) as soon as the value of the data point has been transferred. This can take up to 500 milliseconds.

Note**Fast setting of triggers**

Triggers must not be set faster than a minimum interval of 500 milliseconds. This also applies to hardware triggers (input area).

Note**Hardware trigger**

You need to reset hardware triggers via the user program

Transmission time

Whether the value of an event is transmitted to the communication partner immediately after activating the trigger or with a delay depends on whether spontaneous sending or asymmetric communication is possible in the network.

You set the spontaneous transfer of events in the "Network data" editor of the telecontrol connections for each connection segment using the "Spontaneous" parameter.

3.20.8 Threshold value trigger

Note**Threshold value trigger: Calculation only after "Analog value preprocessing"**

Note that the analog value preprocessing is performed before the check for a configured threshold value and before calculating the threshold value.

This affects the value that is configured for the threshold value trigger.

Note**No Threshold value trigger if Mean value generation is configured**

If mean value generation is configured, no threshold value trigger can be configured for the analog value event involved.

For the time sequence of the analog value preprocessing refer to the section Analog value preprocessing (Page 119).

Threshold value trigger

Function

If the process value deviates by the amount of the threshold value, the process value is saved.

Two methods are used to calculate the threshold value deviation:

- **Absolute method**

With binary and counter values as well as with analog values with configured mean value generation, the absolute method is used to calculate the threshold value deviation.

- **Integrative method**

With analog values without configured mean value generation, the integrating method is used to calculate the threshold value deviation.

In the integrating threshold value calculation, it is not the absolute value of the deviation of the process value from the last stored value that is evaluated, but rather the integrated deviation.

Absolute method

There is a check for each binary value to determine whether the current (possibly smoothed) value is outside the threshold value band. The current threshold value band results from the last saved value and the amount of the configured threshold value:

- Upper limit of the threshold value band: Last saved value + threshold value
- Lower limit of the threshold value band: Last saved value - threshold value

As soon as the process value reaches the upper or lower limit of the threshold value band, the value is saved. The newly saved value serves as the basis for calculating the new threshold value band.

Integrative method

The integration threshold value calculation works with a cyclic comparison of the integrated current value with the last stored value. The calculation cycle in which the two values are compared is 500 milliseconds.

(Note: The calculation cycle must not be confused with the scan cycle of the CPU memory areas).

The deviations of the current process value are totaled in each calculation cycle. The trigger is set only when the totaled value reaches the configured value of the threshold value trigger and a new process value is entered in the send buffer.

The method is explained based on the following example in which a threshold value of 2.0 is configured.

Table 3- 5 Example of the integration calculation of a threshold value configured with 2.0

Time [s] (calculation cycle)	Process value stored in the send buffer	Current process value	Absolute deviation from the stored value	Integrated deviation
0	20.0	20.0	0	0
0.5		20.3	+0.3	0.3
1.0		19.8	-0.2	0.1
1.5		20.2	+0.2	0.3
2.0		20.5	+0.5	0.8
2.5		20.3	+0.3	1.1
3.0		20.4	+0.4	1.5
3.5	20.5	20.5	+0.5	2.0
4.0		20.4	-0.1	-0.1
4.5		20.1	-0.4	-0.5
5.0		19.9	-0.6	-1.1
5.5		20.1	-0.4	-1.5
6.0	19.9	19.9	-0.6	-2.1

With the change in the process value shown in the example, the threshold value trigger configured with 2.0 is initiated twice:

- At the time 3.5 s: The value of the integrated deviation is at 2.0. The new process value stored in the send buffer is 20.5.
- At the time 6.0 s: The value of the integrated deviation is at 2.1. The new process value stored in the send buffer is 19.9.

In this example, if a deviation of the process value of approximately 0.5 should fire the trigger, then with the behavior of the process value shown here a threshold value of approximately 1.5 ... 2.5 would need to be configured.

3.20.9 Analog value preprocessing

The TIM supports analog value preprocessing. For analog value data points, some or all of the functions described below can be configured.

Requirements and restrictions

You will find the requirements for the configuration of the preprocessing options and restrictions in the section relating to the particular function.

Note

Restrictions due to configured triggers

The analog value preprocessing options "Error suppression time", "Limit value calculation" and "smoothing" are not performed if no threshold value trigger is configured for the relevant data point. In these cases, the read process value of the data point is entered in the image memory and transferred transparently before the preprocessing cycle of the threshold value calculation (500 ms) elapses.

Sequence of the analog value preprocessing options

The values of analog inputs configured as an event are processed on the TIM according to the following scheme:

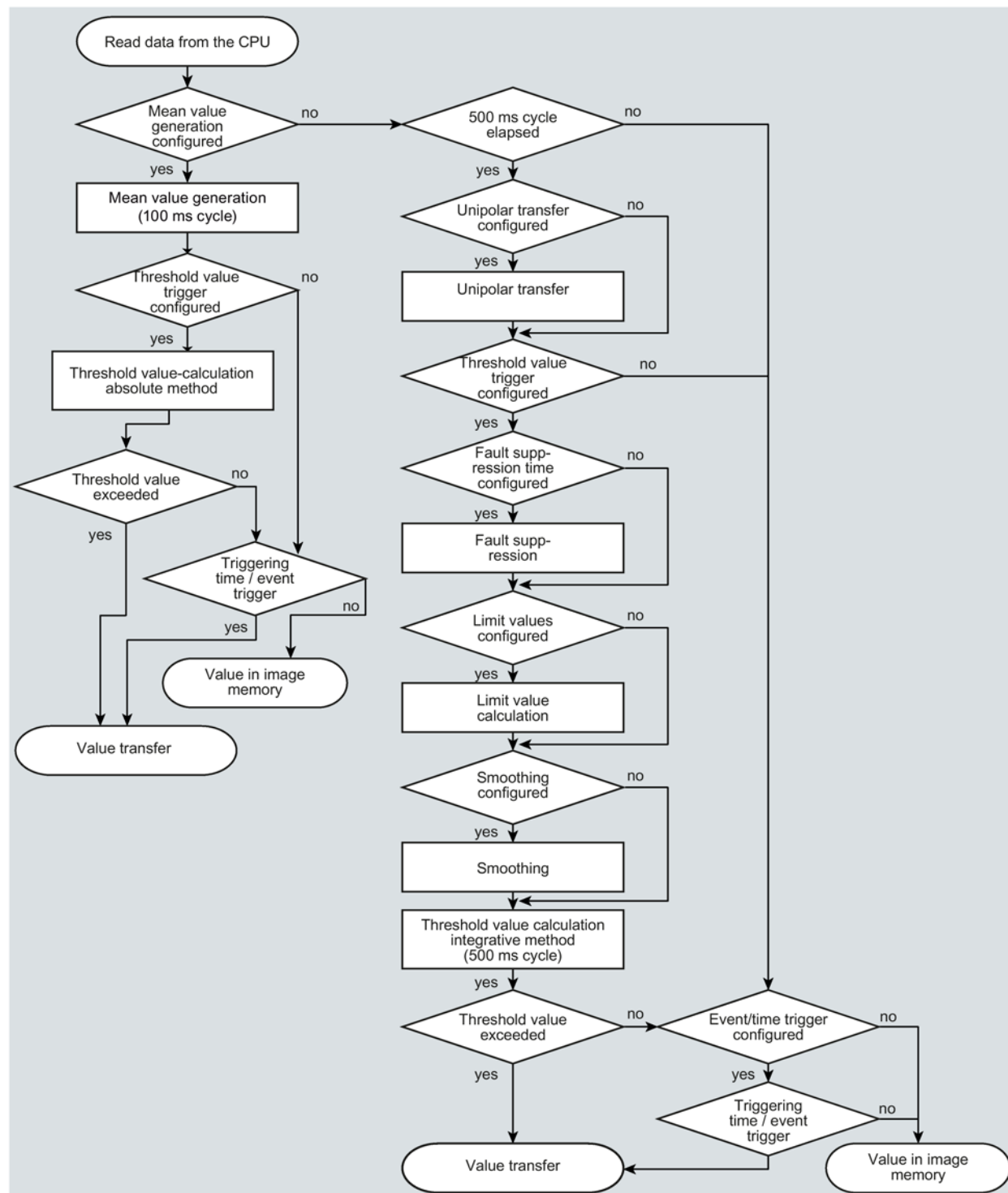


Figure 3-11 Sequence of the analog value preprocessing

The 500 millisecond cycle is started by the integrative threshold value calculation. In this cycle, the values are saved even when the following preprocessing options are enabled:

- Unipolar transfer
- Fault suppression time
- Limit value calculation
- Smoothing

Mean value generation

Note

Restricted preprocessing options if mean value generation is configured

If you configure mean value generation for an analog value event, the following preprocessing options are not available:

- Unipolar transfer
 - Fault suppression time
 - Smoothing
-

Function

With this parameter, acquired analog values are transferred as mean values.

If mean value generation is active, it makes sense to configure a time trigger..

The current values of an analog data point are read in a 100 millisecond cycle and totaled. The number of read values per time unit depends on the read cycle of the CPU and the CPU sampling cycle of the TIM.

The mean value is calculated from the accumulated values as soon as the transfer is triggered by a trigger. Following this, the accumulation starts again so that the next mean value can be calculated.

The mean value can also be calculated if the transmission of the analog value message is triggered by a request from the communications partner. The duration of the mean value calculation period is then the time from the last transmission (for example triggered by the trigger) to the time of the request. Once again, the accumulation restarts so that the next mean value can be calculated.

Input modules: Overflow range / underflow range

As soon as a value is acquired in the overflow or underflow range, mean value generation is stopped. The value 32767 / 7FFF_h or -32768 / 8000_h is saved as an invalid mean value for the current mean value calculation period and sent with the next message.

The calculation of a new mean value is then started. If the analog value remains in the overflow or underflow range, one of the two values named is again saved as an invalid mean value and sent when the next message is triggered.

Note

Fault suppression time > 0 configured

If you have configured an error suppression time and then enable mean value generation, the value of the error suppression time is grayed out but no longer used. If mean value generation is enabled, the error suppression time is set to 0 (zero) internally.

Unipolar transfer

Restrictions

Unipolar transfer cannot be configured at the same time as mean value generation. Enabling unipolar transfer has no effect when mean value generation is activated.

Function

With unipolar transfer, negative values are corrected to zero. This can be desirable if values from the underrange should not be transferred as real measured values.

Exception: With process data from input modules, the value -32768 / 8000_h for wire break of a live zero input is transferred.

With a software input, on the other hand, all values lower than zero are corrected to zero.

Fault suppression time

Requirements for the function

Configuration of the threshold trigger for this data point

Restrictions

The fault suppression time cannot be configured at the same time as mean value generation. A configured value has no effect when mean value generation is activated.

Function

A typical use case for this parameter is the suppression of peak current values when starting up powerful motors that would otherwise be signaled to the control center as a disruption.

The transmission of an analog value in the overflow (7FFF_h) or underflow range (8000_h) is suppressed for the specified time. The value 7FFF_H or 8000_H is only sent after the fault suppression time has elapsed, if it is still pending.

If the value returns to the measuring range before the fault suppression time elapses, the current value is transferred.

Input modules

The suppression is adjusted to analog values that are acquired directly by the S7 analog input modules as raw values. These modules return the specified values for the overflow or underflow range for all input ranges (also for live zero inputs).

An analog value in the overflow range (32767 / 7FFF_h) or underflow range (-32768 / 8000_h) is not transferred for the duration of the fault suppression time. This also applies to live zero inputs. The value in the overflow/underflow range is only sent after the fault suppression time has elapsed, if it is still pending.

Recommendation for finished values that were preprocessed by the CPU:

If the CPU makes preprocessed finished values available in bit memory or in a data block, suppression is only possible or useful if these finished values also adopt the values listed above 32767 / 7FFF_h or -32768 / 8000_h in the overflow or underflow range. If this is not the case, the parameter should not be configured for preprocessed values.

For finished values preprocess in the CPU, the limits for the overflow and underflow can be freely assigned.

Smoothing factor**Requirements for the function**

Configuration of the threshold trigger for this data point

Restrictions

The smoothing factor cannot be configured at the same time as mean value generation. A configured value has no effect when mean value generation is activated.

Function

Analog values that fluctuate quickly can be evened out using the smoothing function.

The smoothing factors are calculated according to the following formula as with S7 analog input modules.

$$y_n = \frac{x_n + (k - 1) y_{n-1}}{k}$$

where

y_n = smoothed value in the current cycle n

y_{n-1} = smoothed value in the previous cycle $n-1$

x_n = value acquired in the current cycle n

k = smoothing factor

The following values can be configured for the module as the smoothing factor.

- 1 = No smoothing
- 4 = Weak smoothing
- 32 = Medium smoothing
- 64 = Strong smoothing

Set limit value 'low' / Set limit value 'high'**Requirements for the function**

- Configuration of the threshold trigger for this data point
- PLC tag in the bit memory operand area or data area

The analog value data point must be linked to a PLC tag in the memory or data area (data block).

For PLC tags for analog input modules (input operand area) limit value configuration is not possible. With these analog values the limit values of the following table are used automatically.

The configuration of limit values is pointless for measured values that have already been preprocessed on the CPU.

Function

In these two input boxes, you can set a limit value in the direction of the start of the measuring range or in the direction of the end of the measuring range.

You can also evaluate the limit values, for example as the start or end of the measuring range.

Configuration of the limit value

The limit value is configured as a whole decimal number. The range of values is based on the range of values of the raw value of analog input modules.

Please note: The entry of the value 0 (zero) is interpreted as a deactivated limit value.

Range	Value of the 16-bit PLC variable *		Module output [mA]			Measuring range [%]
	Decimal	Hexadecimal	0 .. 20 (unipolar)	-20 .. +20 (bipolar)	4 .. 20 (life zero)	
Overflow	32767	7FFF	> 23.515	> 23.515	> 22.810	> 117.593
Overrange	32511	7EFF	23.515	23.515	22.810	117.593

	27649	6C01	20.001	20.001	20.001	100.004
Nominal range (unipolar / life zero)	27648	6C00	20		20	100

	0	0000	0		4	0
Nominal range (bipolar)	27648 ...	6C00 ...		20 ...		100 ...
	0	0000		0		0
	... -27648	... 9400		... -20		... -100
Underrange (unipolar / life zero)	-1	FFFF	-0.001		3.999	-0.004

	-4864	ED00	-3.518		1.185	-17.59
Underrange (bipolar)	-27649	93FF		-20.001		-100.004

	-32512	8100		-23.516		-117.593
Undershoot / wire break	-32768	8000	< -3.518		< 1.185	< -17.593

* The value ranges (underflow / overflow) in PLC variables with different data types are as follows:

- Int
 - -32768
 - 32767
- DInt
 - -2147483648
 - 2147483647
- Real
 - -3.4000E+038
 - 3.4000E+038
- LReal
 - -1.7000E+308
 - 1.7000E+308

Note**Evaluation of the value even when the option is disabled**

If you enable one or both options and configure a value and then disable the option later, the grayed out value is nevertheless evaluated.

To disable the two options, delete the previously configured values limit values from the input boxes and then disable the relevant option.

Recommendation for quickly fluctuating analog values:

If the analog value fluctuates quickly, it may be useful to smooth the analog value first if limit values are configured.

3.20.10 Command output

Output options of command outputs

The output options can be configured for the following data point types:

- Binary Command Output

The following output options can be used for command data points:

- **LATCH_ON/OFF**

The function is encoded by the master via the Control Code of the object.

- Control Code, Operation Type field (OP Type) - Volume 6, Part 2, Objects

The master permanently latches a command output to the value 0 or 1.

The station processes the command according to the Complementary Latch Model.

Note:

The latched value is only canceled by a new command. Alternatively, the command can be reset by the user program.

- **PULSE_ON**

The function is encoded by the master via the Control Code of the object.

- Control Code, Operation Type field (OP Type) - Volume 6, Part 2, Objects

The master sends the information "Trip-Close Count", "On-time", "Off-time" and "Pulse count" with the command frame to the station.

The station data point evaluates the information and checks it for consistency with the parameters "Max. pulse duration", "Pulse duration replacement time" and "Max. number of pulses".

The TIM 1531 IRC processes the command according to the Activation Model.

- **Select and Operate / Direct Operate**

"Command execution mode" according to the following function codes:

- "Direct Operate" is realized via the function codes 05 and 06.
- "Select and Operate" is realized via the function codes 03 and 04.

Control Code - LATCH_ON/OFF / PULSE_ON

The station data point evaluates the coding of the control code according to the following table.

The "Clear" field (CR) is not supported.

Table 3- 6 Decoding of the control code by the command data point of the station

Received control code			Reaction of the station data point	
Control Code	Trip-Close Code	Operation Type Field	Option enabled: PULSE_ON	Option enabled: LATCH_ON / OFF
0x01	NUL	PULSE_ON	The output is set to 1 for the duration of "On-time".	The command is rejected.
0x03	NUL	LATCH_ON	<ul style="list-style-type: none"> • CP The command is rejected. <ul style="list-style-type: none"> • TIM 1531 IRC The output is set to 1 for the duration of "On-time".	The output is set to 1.
0x04	NUL	LATCH_OFF	<ul style="list-style-type: none"> • CP The command is rejected. <ul style="list-style-type: none"> • TIM 1531 IRC The output is set to 1 for the duration of "On-time".	The output is set to 0.
0x41	CLOSE	PULSE_ON	<ul style="list-style-type: none"> • CP The command is rejected. <ul style="list-style-type: none"> • TIM 1531 IRC The output is set to 1 for the duration of "On-time".	<ul style="list-style-type: none"> • CP The command is rejected. <ul style="list-style-type: none"> • TIM 1531 IRC The output is set to 1.
0x81	TRIP	PULSE_ON	<ul style="list-style-type: none"> • CP The command is rejected. <ul style="list-style-type: none"> • TIM 1531 IRC The output is set to 1 for the duration of "On-time".	<ul style="list-style-type: none"> • CP The command is rejected. <ul style="list-style-type: none"> • TIM 1531 IRC The output is set to 0.

Note**Mirroring**

If you want the station data point to mirror the current value back to the master, enable the "Value monitoring" option in the "General" tab of the data point.

Selection of the control code

Name: **Control Code**

Range of values:

- PULSE_ON
- LATCH_ON/OFF

Explanation: Output option of the command output. See above for the meaning.

Select the desired output option.

No specific parameters are available for the output option LATCH_ON/OFF. The station module evaluates the control codes of the master station according to the table above.

PULSE_ON parameters

Master

Name: **Number of pulses**

Range of values: 1 ... 255

Default: 1

Explanation: Number of pulses that the data point of the master sends to the corresponding data point of the station.

Name: **Puls-Steuerung**

Range of values:

- NUL
- CLOSE
- TRIP

Explanation: Trip-Close Code for Control Code "PULSE_ON". The data point sends the configured code to the corresponding data point of the station. See above for the meaning.

Name: **Pulse ON duration**

Range of values: 0 ... 4294967295

Default: 10

Explanation: Duration (milliseconds) for "On-time". The data point sends the configured time to the corresponding data point of the station.

Name: **Pulse OFF duration**

Range of values: 0 ... 4294967295

Default: 0

Explanation: Duration (milliseconds) for "Off-time". The data point sends the configured time to the corresponding data point of the station.

Station

Name: **Max. number of pulses**

Range of values: 0 ... 255

Default: 1

Explanation: Monitors the number of pulses sent by the master (Count). If the number of pulses received from the master exceeds the value configured here, the command is discarded.

If you enter 0 (zero), the monitoring is disabled.

Name: **Max. pulse duration (s)**

Range of values: 0 ... 65535

Default: 0

Explanation: Monitors the pulse duration transmitted by the master in the command frame (On-time).

If the pulse duration exceeds the value configured here, the command is rejected by the station module, provided no "Pulse duration replacement time" is configured.

When the "Max. pulse duration" is exceeded and "Pulse duration replacement time" is configured or when the received pulse duration is 0, the "Pulse duration replacement time" is used.

Name: **Pulse duration replacement time (s)**

Range of values: 0 ... 65535

Default: 0

Explanation: Replacement value for the pulse duration

The replacement value is used in the following cases:

- The pulse duration received from the master exceeds the value configured under "Max. pulse duration".
- The received pulse duration is 0.

If the value is 0 (zero), no replacement value is used. The command is discarded.

If the "Max. pulse duration" and "Pulse duration replacement time" are both configured with zero, every command is discarded.

Select and Operate / Direct Operate

Name: **Command execution mode**

Range of values:

- Execute directly (Direct Operate)
- Select and operate (Select and Operate)

Default: Execute directly

Explanation:

- Execute directly

The command is immediately transmitted to the CPU of the station for execution.

- Select and operate

Procedure:

- The command is triggered in the master module

The "select" frame is sent from the master station to the communication module of the station.

- The station acknowledges receipt.
- The master data point sends the execution frame after receiving the acknowledgment from the station.
- The station only forwards the command to the CPU when it receives the "Operate" frame from the master within the configured "Max. time between Select and Operate".

The station must not receive any other data frame between Select and Operate.

Note: "Max. time between Select and Operate" is configured in the transmission settings of the respective interface.

3.20.11 Partner stations

Activating the partners of the data point

All partners with which a telecontrol connection has been configured are shown in the table.

Enable the partner or partners with which the selected data point is to exchange data using the check box: ☒

3.21 Configuring messages

3.21.1 Messages

Calling the editor

You configure the messages in STEP 7 in the data point and message configuration. You can find this using the project tree:

Project > directory of the relevant station > Local modules > Module

For the view in STEP 7, refer to the section Data point configuration (Page 103).

Alternatively, you can get to the editor via the shortcut menu when the module is selected in the network view.

E-mails

If important events occur, the module can send e-mails. The recipient can be a PC with an Internet connection or an S7Station.

Triggering sending of messages

The sending of the message is triggered by an event that is configured in the "Trigger" tab (see below).

Requirements and necessary information

Consider the following requirements in the configuration for the transfer of e-mails:

- Enabling telecontrol communication ("Communication types") parameter group
- Activating security functions
- Configuring the "E-mail configuration" parameter group

To do this, you require the following information:

- Access data of the SMTP server: Address, port number, user name, password
- E-mail address of the recipient
- When using STARTTLS or SSL/TLS: Certificate of the e-mail service provider

"Message parameter"

Here you configure the recipient, the subject and the text of the message.

"Trigger"

In the "Trigger" parameter group you configure triggering for sending the message and other parameters.

- **E-mail trigger**

Specifies the event for which the sending of the message is triggered:

- Use PLC tag

For the trigger signal to send the message, the edge change (0 → 1) of the trigger bit "PLC tag for trigger" that is set by the user program is evaluated. When necessary, a separate trigger bit can be configured for each e-mail. For information on the trigger bit, see below.

- CPU changes to STOP
- CPU changes to RUN
- Connection to a partner interrupted

Triggers the sending of the message when the connection to a partner is interrupted.

- Connection to a partner established

Triggers the sending of the message when the connection returns.

- **PLC tag for trigger**

PLC tag for the message trigger "Use PLC tag"

If the memory area of the trigger bit is in the bit memory or in a data block, the trigger bit is reset to zero when the message is sent.

- **Enable identifier for processing status**

If the option is enabled, every attempt to send returns a status with information about the processing status of the sent message.

The status is written to the "PLC tag for processing status". If there are problems delivering messages, you can determine the status via the Web server (diagnostics status) or read it out from the PLC tag.

For the significance of the status output in hexadecimal, refer to the section Processing status of the messages (e-mail) (Page 153).

- **PLC tag for processing status**

PLC tag of the type DWORD for the processing status

- **Include value**

If you enable the option, the CP sends a value for the placeholder \$\$ from the memory area of the CPU in the message. To do this enter "\$\$" as a placeholder for the value to be sent in the message text.

Select a PLC tag whose value will be integrated in the message. The value is entered in the message text instead of the placeholder \$\$.

\$\$ can be a placeholder for data point types with a simple data type up to a size of 32 bits.

Note that the number of characters increases with the value:

E-mail: Max. 256 ASCII characters including the value sent at the same time

- **PLC tag for value**

PLC tag in which the value to be sent is written.

3.21.2 Character set for messages

Character set for message texts

The following ASCII character set (hexadecimal value and character name) is supported for the texts:

- 0x0A
LF (line feed)
- 0x0D
CR (carriage return)
- 0x20
Space
- 0x21 ... 0x5A
! " # \$ % & ' () * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @ A B C D E F G H I J K L M N O P
Q R S T U V W X Y Z
- 0x5F
£
- 0x61 ... 0x7A
a b c d e f g h i j k l m n o p q r s t u v w x y z

Diagnostics

4.1 Diagnostics options

The following diagnostic options are available with most modules. Some functions are limited to specific data types or protocols.

LEDs of the module

You can find information on the LED displays in the manual for the respective module.

STEP 7: The "Diagnostics" tab in the Inspector window

If your engineering station is connected to a module via Ethernet, you will receive the following information about the selected module here:

- Connection status of the engineering station with the module

STEP 7: Diagnostics functions in the "Online > Online and diagnostics" menu

Using the online functions, you can read various diagnostic information from the relevant module from an engineering station on which the STEP 7 project is stored and perform maintenance functions.

You will find additional information on the diagnostics functions of STEP 7 in the STEP 7 information system.

Online access

This is where you establish the online connection to the module.

For the procedure, refer to the section Online functions (Page 135).

Diagnostics

Here, you can obtain the following static information on the selected module:

- **General**
General information on the module
- **Diagnostic status > Device-specific events**
Here you will find the diagnostics buffer entries of the module and an overview of the sent messages (SMS messages / e-mails).
- **Diagnostics buffer**
This is where you can find entries in the diagnostics buffer of the TIM.
- **Ethernet interface[X1/2/3]**
Address and statistical information

- **Industrial Remote Communication**

Here, you obtain WAN-specific information on the TIM module:

- **Partner**

Here you will find address and configuration data of the partners, connection statistics and additional diagnostics information. Click on a subscriber to display additional information.

You will also find information on the partners in the WBM, see below.

- **Data point list**

Information on the data points such as configuration data, value, connection status etc.

- **Protocol diagnostics**

With this function, you can enable the logging of frames of the module and evaluate it using the SINAUT engineering software.

With the function "Enable protocol trace", the frames received and sent by the module are copied for several seconds.

With the function "Disable protocol trace", the logging is stopped and the data is written to a logging file.

With the function "Save", you can save the log file on the engineering station.

To evaluate the file, you need to rename it to the format "*.7dt". You can decode and analyze the renamed file using the TIM frame monitor of the SINAUT diagnostics tool.

- **Time**

Specification of the current time in the module and the time source. Possibility to set the time in the module.

Functions

You can run the following functions here:

- **Firmware update**
- **Assign IP address**
- **Assign PROFINET device name**
- **Reset to factory settings**

For information on the functions, refer to the section Maintenance (Page 155).

- **SINAUT special diagnostics**

For a description, see section SINAUT special diagnostics (Page 137).

Web server (WBM) of the TIM 1531 IRC

From a PC you can use HTTP/HTTPS to access the Web pages (WBM) of the TIM. The WBM returns a variety of information.

For access to the content, refer to the section WBM of the TIM 1531 IRC (Page 167).

Partner status and connection status in the WBM

You will see the configured partners and the status of the connections to the local and remote communications partners of the TIM on the page "Telecontrol" > "Partner information" of the WBM. For details, see section Connection overview (Page 180).

Partner and connection information to the CPU

The TIM can signal the status of the connection and the connection paths to the communications partner to its local CPU via a PLC tag. For information on the configuration, refer to the section Communication with the CPU (Page 62).

SNMP

For information on the functions, refer to the section SNMP (Page 136).

4.2 Online security diagnostics via port 8448 (CP)

Security diagnostics without opening port 102

If you want to perform security diagnostics without opening port 102, follow the steps below:

1. Select the CP in STEP 7.
2. Open the "Online & diagnostics" shortcut menu.
3. In the parameter group "Security" click the "Connect online" button.

In this way you perform the security diagnostics via port 8448.


4.3 Online functions

Online functions

Along with STEP 7 on the engineering station (ES) the TIM provides various diagnostics and maintenance functions. The requirement is that the ES and the TIM are located in the same subnet.

Connection establishment to use the online functions via Ethernet**Procedure:**

1. Connect the ES to the network.
2. Open the relevant STEP 7 project on the ES.
3. Select the TIM that you want to update with new firmware.
4. Enable the online functions using the "Connect online" icon.

5. In the "Connect online" dialog, go to the Choose the entry "TeleService via telecontrol" in the "Type of PG/PC interface" drop-down list.
6. In the "PG/PC interface" drop-down list select the entry "TeleService board".
7. In the table select the TIM if it is not already selected.
The path both via the TIM or also via the CPU is possible.
8. Click on the  icon next to the "PG/PC interface" drop-down list.
The "Establish remote connection via telecontrol" dialog box opens.
9. Make the necessary entries in this dialog (see below) and click on "Connect".

Terminate online connection

On completion of the online session, terminate the online connection again using the "Disconnect" button.

4.4 SNMP

SNMP (Simple Network Management Protocol)

SNMP is a protocol for management and diagnostics of networks and nodes in the network. To transmit data, SNMP uses the connectionless UDP protocol.

The information on the properties of SNMP-compliant devices is entered in MIB files (MIB = Management Information Base).

Scope of performance of the module as SNMP agent

Not all functions described below are available with every module. Refer to the manual of the respective module for information on the functional scope.

The communication modules support data queries in the following SNMP versions:

- SNMPv1 (standard)
- SNMPv3 (Security)

They return the contents of MIB objects of the standard MIB II according to RFC1213 and the Siemens Automation MIB.

- **MIB II**

The MIB supports the following groups of MIB objects:

- System
- Interfaces

The "Interfaces" MIB object provides status information about the module interfaces.

- IP
- ICMP

- TCP
- UDP
- SNMP

The following groups of the MIB II standard are not supported:

- Address Translation (AT)
- EGP
- Transmission

- **Siemens Automation MIB**

Write access is permitted only for the following MIB objects of the system group:

- sysContact
- sysLocation
- sysName

A set sysName is sent as the host name using DHCP option 12 to the DHCP server to register with a DNS server.

For all other MIB objects / MIB object groups, only read access is possible for security reasons.

The modules do not support traps.

For more detailed information about the MIB files and SNMP, refer to the manual /10/ (Page 189).

Configuration

For information on the configuration, refer to the section SNMP (Page 74).

4.5 SINAUT special diagnostics

4.5.1 SINAUT-Spezial-Diagnose - Gültigkeit

The SINAUT special diagnostics is available for the following modules:

- TIM 3V-IE DNP3
- TIM 4R-IE DNP3

4.5.2 TIM diagnostics

4.5.2.1 TIM Diagnostics - functions

Description of the functions

TIM Diagnostics provides various diagnostic data of a TIM module. This is displayed in the following tabs:

- "Memory" tab:
Information on memory and disk configuration
- "Message" buffer tab:
Information on the buffer areas of an Ethernet TIM for messages
- "Communication" tab:
Displays the installed communication drivers on the various interfaces of the TIM
- "Time synchronization" tab:
Status of the time-of-day synchronization on the interfaces of the TIM
- "Time" tab:
Information on the system clock of the TIM
- "Filesystem" tab:
Displays all the files in the flash file system or (if installed) on the RAM disk of the TIM
- "IP Parameters" tab (TIM 4R-IE only):
Displays the current IP parameters and settings of the Ethernet ports
- "Statistics" tab (TIM 4R-IE only):
Displays the transmission statistics for the Ethernet ports
- "MSC Communication" tab
Information on communication with the MSC protocol

4.5.2.2 TIM Diagnostics - Memory tab

Memory tab

The Memory tab displays current diagnostic data of the memory configuration on the TIM:

- In the Memory configuration box:
 - Static flash EPROM
 - Dynamic flash EPROM
 - RAM
 - Available RAM: Size of the free storage space available to the drivers on the TIM for dynamic data.
 - Memory overflow: If the free RAM is no longer sufficient, a check mark appears in the Memory overflow check box.
 - Message memory: Size of the memory for data messages that can be stored
 - Size of a memory block that is reserved for a data message.
 - Number of possible message entries calculated based on the size of the message memory and the size of a memory block
- In the Disc configuration box:
 - Storage space, used and free storage capacity of the flash or RAM disk.

4.5.2.3 TIM Diagnostics - Message buffer tab

Message buffer tab

The Message buffer tab is available only for TD7onTIM-capable TIM modules (for example TIM 3V-IE). The tab displays the current diagnostic data on the size and utilization of the buffer areas for messages on the selected TIM module.

With TD7onTIM-compliant TIM modules, the message buffer is divided into various buffer areas:

- Buffer areas for data messages sorted according to destination subscribers (destination subscriber buffers)
- Buffer areas for messages in TIM - TIM communication (TIM buffers)
- Buffer area for local communication of the CPU or an ST7cc/sc

The message buffer diagnostics function analyzes the buffer areas of the destination subscribers in which the data frames are stored. These are of particular interest to the user.

"Total" box

The Total box provides the following information:

- Size (blocks):

Total size of the frame buffer. The value indicates the total number of message memory blocks. This is calculated from the total size of the message memory set for the TIM and

the byte size of a memory block. The parameter assignment is performed in the network configuration in NetPro in the Properties dialog, Options tab, Global frame memory field.

- Free (blocks):
Free area of the frame buffer. The value indicates the number of free memory blocks.
- Free (%):
Free area of the frame buffer as a percentage
- Image blocks:
Number of blocks occupied in the frame memory of the TIM for data frames transmitted using the image memory principle.

"Buffers" box

The Buffers box lists the frame buffers for various communication partners with the following information:

- From:
Subscriber number of the source subscriber
- To:
Subscriber number of the destination subscriber
- No. of frames:
Total number of stored frames for the relevant source and destination subscriber

If a frame buffer is selected on the left with the mouse in the Buffers box, the following detailed information is displayed in the Buffer info list:

- From:
Subscriber number of the source subscriber
- To:
Subscriber number of the destination subscriber
- Type:
 - = 2: Buffer for organizational messages, hand-shake messages or messages transmitted from one TIM to another TIM.
 - = 4: Buffer for messages to a remote subscriber (CPU or ST7cc).
 - = 8: Buffer for messages to a local subscriber (CPU or ST7cc).
- No. of frames:
Total number of stored frames for the source and destination subscriber named above
- No. of uncond. frames:
Number of stored frames to be sent unconditionally and spontaneously (only relevant in dial-up networks)
- No of prio. frames:
Number of stored frames to be sent with high priority.
- Status:
The status is a hexadecimal value that codes the buffer information following it into binary.
- Forced image mode:
1 = forced image mode

To avoid overflow of the frame memory, all data frames are treated as image frames; in other words, even send buffer frames are treated as image frames and overwritten.

- **Data brake:**
The sending of frames to the remote partner is currently disabled, either because the remote partner is unavailable or there is a lack of memory on the remote partner.
- **Blocked:**
Reserved for future functions. Nothing is currently displayed.
- **Overflow warning:**
Reserved for future functions. Nothing is currently displayed.
- **XGA:**
Reserved for future functions. Nothing is currently displayed.
- **Uncond. frames:**
Reserved for future functions. Nothing is currently displayed.
- **Est. dial-up conn.**
Reserved for future functions. Nothing is currently displayed.

4.5.2.4 TIM Diagnostics - Communication tab

Communication tab

The Communication tab displays information on the status of communication of the TIM with information on interfaces, drivers (available/not available) and baud rate. The data is displayed in the lower part of the dialog when you select one of the communication interfaces.

4.5.2.5 TIM Diagnostics - Time Synchronization tab

Time synchronization tab

The Time synchronization tab displays information on the time synchronization on the various interfaces of the TIM with information on the interface, synchronization and status of time synchronization. The information is displayed in the lower part of the dialog when you select one of the communication interfaces.

4.5.2.6 TIM Diagnostics - Time tab

Time tab

The Time tab displays the date and current module time of the TIM on the left in the Current time field. Information on the validity of the time, daylight saving/standard time and the changeover from daylight saving to standard time is displayed on the right in the Time-of-day status field.

4.5.2.7 TIM Diagnostics - Filesystem tab

File system tab

The File system tab displays all the system data blocks and files of the individual firmware components installed on the flash file system.

If a RAM disk is configured on the TIM, this will also be displayed with the files located there.

4.5.2.8 TIM diagnostics - IP Parameters tab

IP parameters tab

This tab is available only for the TIM 4R-IE.

The IP parameters tab displays the current IP parameters and settings of the Ethernet ports:

- IP address: Configured IP address of the module.
- Subnet mask: Configured subnet mask of the module.
- Default router: If a default router was specified during configuration, the IP address of the default router is displayed here.
- MAC address: MAC address of the module.
- IP settings: Indicates where the module obtained the IP parameters from.
- Link status: Indicates whether or not a physical connection to Ethernet exists.
- Link settings: Shows the setting for detecting network settings, here: "automatic" (autosensing)
- Mode: Indicates the transmission speed and direction dependency on Ethernet.

4.5.2.9 TIM diagnostics - IP statistics tab

Statistics tab

This tab is available only for the TIM 4R-IE.

The tab contains transmission statistics for the Ethernet interfaces. The number of transferred data packets with and without errors since the last reset or restart of the module is displayed for the send and receive directions.

4.5.2.10 TIM diagnostics - MSC Communication tab

MSC communication tab

This tab exists only for a TIM 4R-IE as MSC master station.

SINAUT Diagnostics - TIM 4R-IE ONLINE

Path:

Memory | Message buffer | Communication | Time Synchronization | Time

Filesystem | IP parameter | IP statistics | MSC Communication

Transmission Information

Sub-No.	Station	Signal	Active month sent	Active month received
1010	Station 10	no GPRS	-	-
1020	Station 20	no GPRS	-	-
1060	Station 60	19	28237460	48259477
1250	Station 250	23	28496726	54124208
1400	Station 400	25	22059244	37210532

Information Details

Device name: Quality of signal:

Firmware version: Local area code:

Protocol version: Cell ID:

Data Volume

	Active count	Count at begin of month
Amount of data sent [bytes]:	<input type="text" value="28237460"/>	<input type="text" value="0"/>
Amount data received [bytes]:	<input type="text" value="48259477"/>	<input type="text" value="0"/>


Close | Update | Print ... | Save ... | Help

Figure 4-1 SINAUT diagnostics dialog, MSC communication tab

The "Transmission Information" list shows all MSC stations along with the following detailed information stored on the MSC master station when the dialog is opened.

- Globe icon


The globe icon in this dialog has a the following meaning depending on its color (from the perspective of the master station):

- Black and white ()

The station can be reached online but the displayed data is not up to date. The reason for this may be that the response to a query was not received, for example due to a timeout: *)

- Green ()

All the required properties of the network provider are configured. The network provider can be reached online.

- Blue and red ()

The network provider cannot be reached.

*) When the "MSC Communication" tab is opened, the icons of all stations are gray. The change to green or blue and red takes place only after the data has been updated (see below).

- Subscriber number
- Station
- Signal quality
see below → "Quality of the received signal"
- Sent current month / Received current month

Sent/received volume of data since the last change of month

Difference between "current count - count previous month" (see below)

- When the TIM of a DSL station is restarted, the counter is set to 0.
- When the MD720 of a GPRS station is restarted, the counter is set to 0.

The fields below this show more details of the MSC station selected in the list:

- Device name
Device name of the TIM
- Firmware version
TIM firmware version
- Protocol version
MSC protocol version

The following information is only supplied by GPRS stations with MD720:

- Signal quality
Relative receive quality
Range: 0..99

0 = error-free signal
99 = loss of synchronization

- Local area code
Location of area in the mobile wireless network
- Cell ID
Identification number of the active GSM cell
- Data sent [bytes] / Data received [bytes]
Volumes of data in bytes at the following times:
 - Current count
Current counter reading: Volume of data since the first station TIM startup to the present time
 - Count in previous month
Volume of data at the last change of month (1st day of the month)

Buttons in the *MSC Communication* tab

- Update
The "Update" button updates the data of the following stations:
 - No station selected: The data of all stations is updated.
 - One station selected: The data of the selected station is updated.The requested data can take up to 1/2 a minute.
- Print...
Opens a follow-on dialog from which you can print the displayed information.
- Save...
Opens a follow-on dialog from which you can save the displayed information in a text file.

4.5.3 TIM subscriber diagnostics

4.5.3.1 TIM Subscriber Diagnostics - functions

Description of the functions

The TIM subscriber diagnostics function displays the diagnostic data of the known SINAUT subscribers of the connected TIM module. The following detailed information is available:




- Selection list of the known subscribers (on the left):
The selection list of the known subscribers is used to select individual subscribers known to the connected TIM module allowing the information to be displayed in the tabs on the

right. The known subscribers are listed with their subscriber number and subscriber type, if accessed over a STEP 7 project the name and station is also displayed.

- **Status tab:**
Information on the reachability of the partners, connections or connection disruptions and information on data communication and the operation of the send buffer
- **Partner tab:**
Displays the known partners:
 - With CPU modules: Display in the known partners tab of the CPU selected in the list of known subscribers on the left of the dialog
- **Dialing list external tab (optional):**
Dial-up service and command of the connected TIM module
- **Polling list tab (optional):**
Data of the station call of the partners of the connected TIM module connected over a dedicated line with the option of disabling or enabling a connected partner

The colored symbols in the selection list of known subscribers indicate the reachability of the individual subscribers and have the following meaning:

Table 4- 1 Symbols indicating subscriber reachability in subscriber diagnostics

Symbol	Status
	Subscriber is reachable, all connections are OK
	Subscriber is reachable, at least one connection is disrupted
	Subscriber is not reachable

4.5.3.2 TIM Subscriber Diagnostics - Status tab

Status tab

The Status tab displays the following information on the subscriber selected on the left in the list of known subscribers from the perspective of the connected TIM module:

- In the General field:
 - Reachability of the known subscriber. Entries indicating problems are highlighted in color.
 - Any connection disruptions
 - Information on gateways to the known subscriber (subscriber local/remote)
- In the Connection field:
 - Interface of the connection
 - Type of connection
 - Connection enable
 - Information on calling
 - Status of data communication
- In the Special field:
 - Information on the operation of the send buffer of the known subscriber

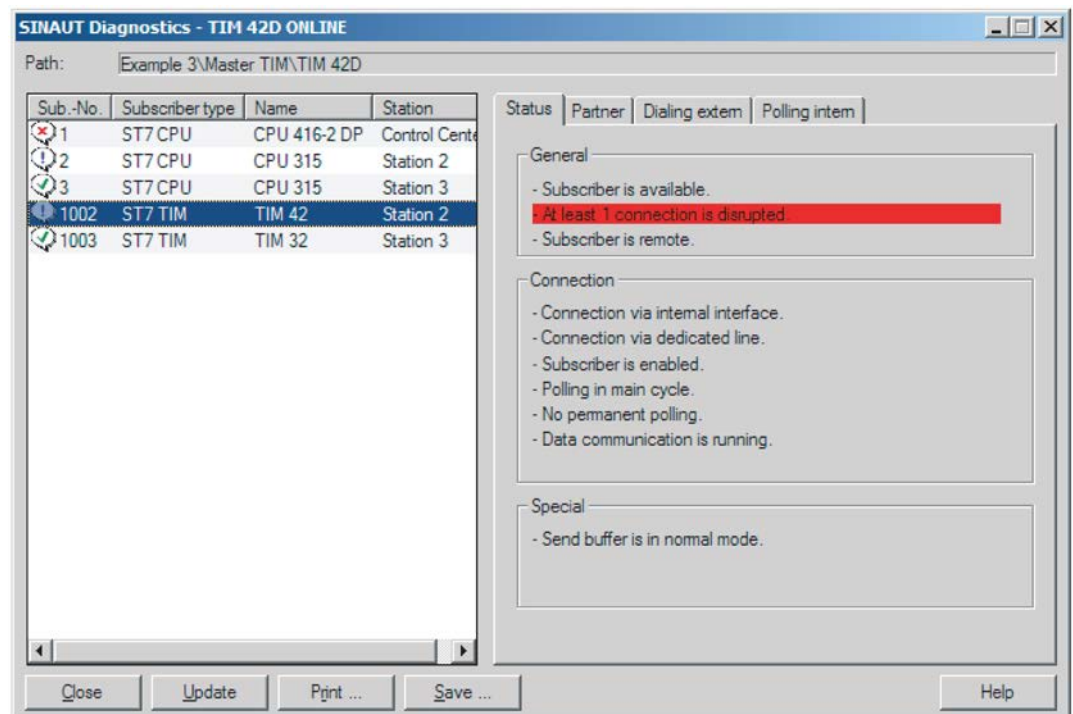


Figure 4-2 TIM subscriber diagnostics dialog, Status tab

4.5.3.3 TIM Subscriber Diagnostics - Partner tab

Partner tab

The Partner tab displays the following known partners with their subscriber number, name and station in the List of communication partners box:

- With CPU modules: Display of the communication partners of the CPU selected in the list on the left of the dialog
- With TIM modules: Display of the communication partners of the connected TIM module selected in the subscriber list prior to opening the dialog.
If different subscribers are selected on the left in the dialog, the same subscribers are always displayed in the list of communication partners.

With TIM modules, partners are only displayed if the TIM is installed in the master station and is connected to partners over a dedicated line.

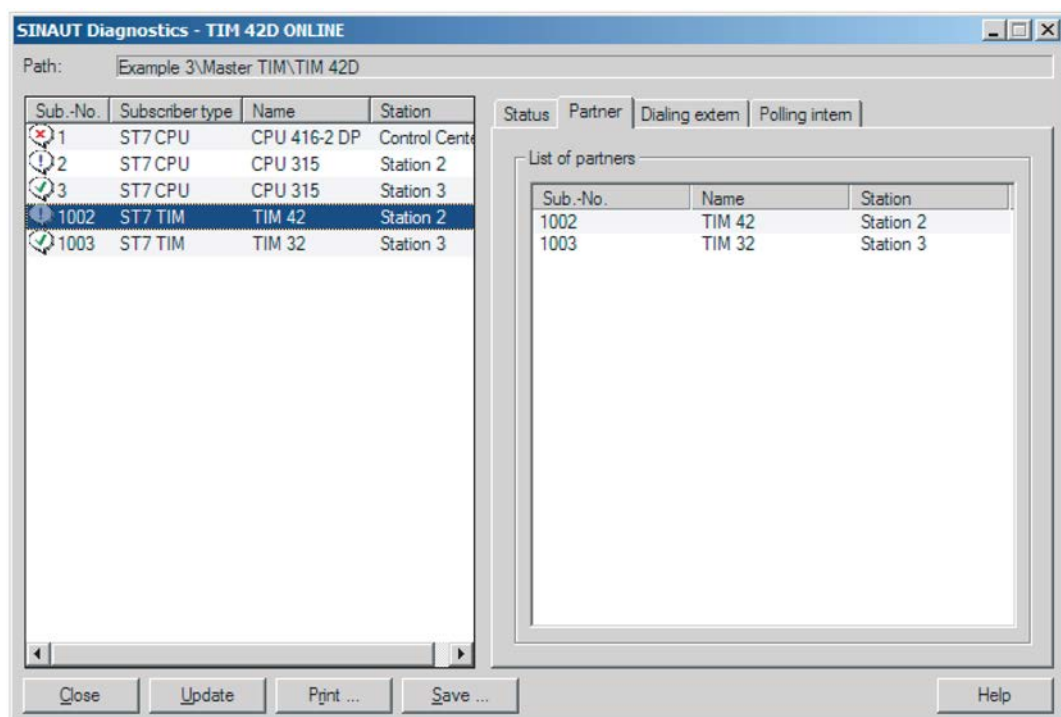


Figure 4-3 TIM subscriber diagnostics dialog, Partner tab

4.5.3.4 TIM Subscriber Diagnostics - Dialing extern tab

Dialing list external tab

If a TIM with a central function is selected before opening the dialog, then special services and the telephone number list (dial command) of the dial-up network driver of the connected TIM modules are displayed in the Dialing list external tab.

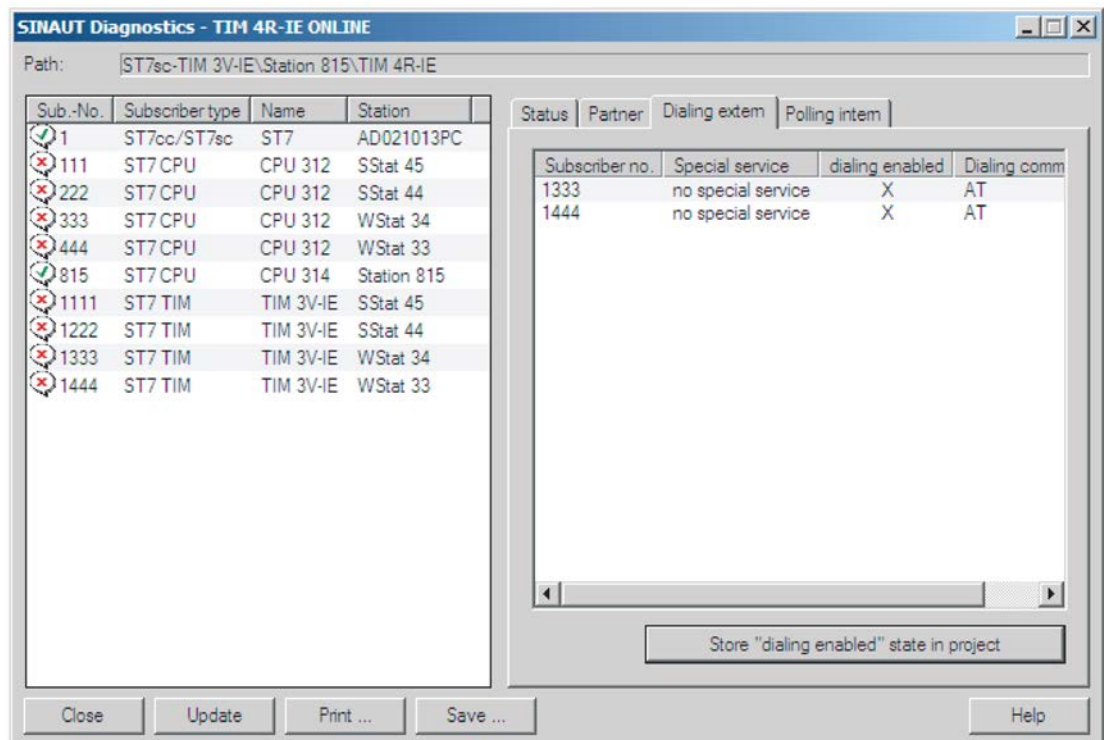


Figure 4-4 TIM subscriber diagnostics dialog, Dialing list external tab

The Subscriber no., Special service, Dialing enabled and Dialing command parameters are displayed for the listed TIM modules.

An "X" in the Dialing enabled column indicates that the connection is enabled.

The following functions are available only for the TIM 4R-IE:

- By double-clicking on a subscriber in the dialing list, the Disable/Enable subscribers dialog opens in which the configured and current enable status of the selected subscriber is displayed from the perspective of the master TIM. The current enable status can be switched.
- The settings for enabling subscribers are stored permanently.
- Using the button below the list, you save the current enable state in the STEP 7 project of the connected PG/PC.

4.5.3.5 TIM Subscriber Diagnostics - Polling intern

Polling list internal tab

If a TIM with master function is selected before opening the dialog, the Polling list internal tab displays the data of the station for the known subscribers connected to the connected TIM over a dedicated line.

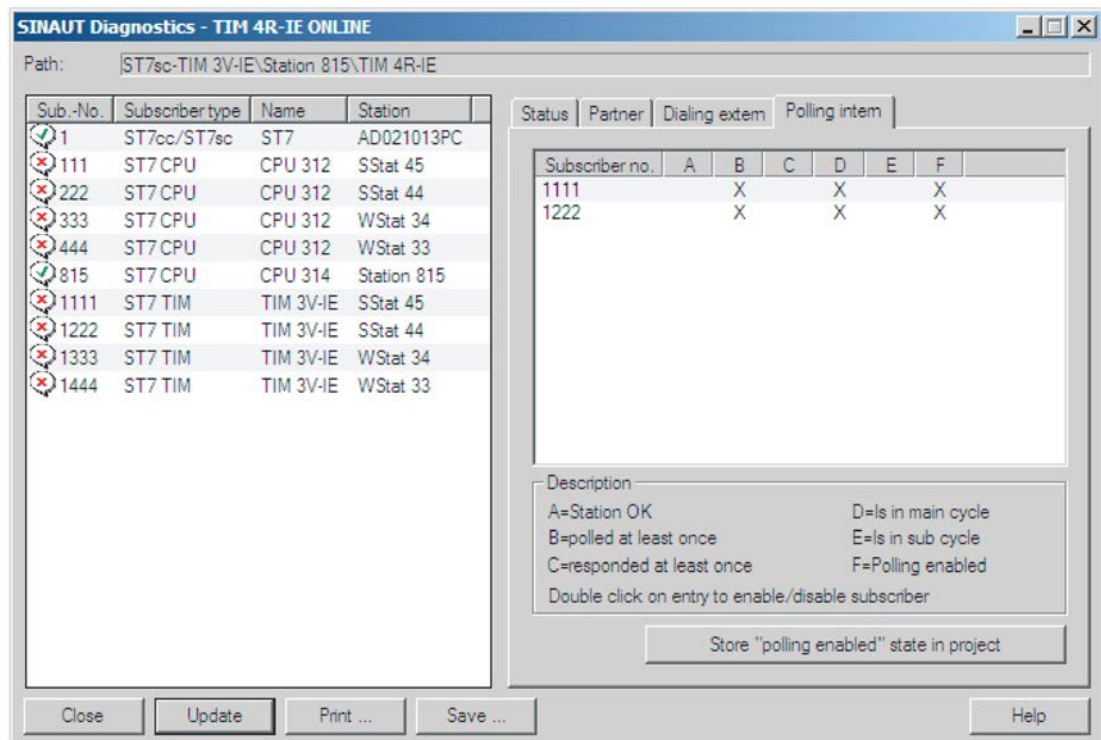


Figure 4-5 TIM subscriber diagnostics dialog, Polling list internal tab

By double-clicking on a subscriber in the polling list, the Disable/Enable subscribers dialog opens in which the configured and current enable status of the selected subscriber is displayed from the perspective of the master TIM. The current enable status can be changed.

If you change the state to Disable in this dialog, the configured state is adopted again next time the master TIM is reset.

The following functions are available only for the TIM 4R-IE:

- The settings for enabling subscribers are stored permanently.
- Using the button below the list, you save the current enable state in the STEP 7 project of the connected PG/PC.

4.5.4 TD7onTIM diagnostics

4.5.4.1 TD7onTIM Diagnostics - functions

Description of the functions

Note

The TD7onTIM diagnostics function is available only for TD7onTIM-capable TIM modules on which parameters were set for the TD7onTIM software (for example TIM 3V-IE).

TD7onTIM diagnostics provides information on the status of the data transmission of the TD7onTIM software package of the TIM module selected in the SINAUT subscriber list.

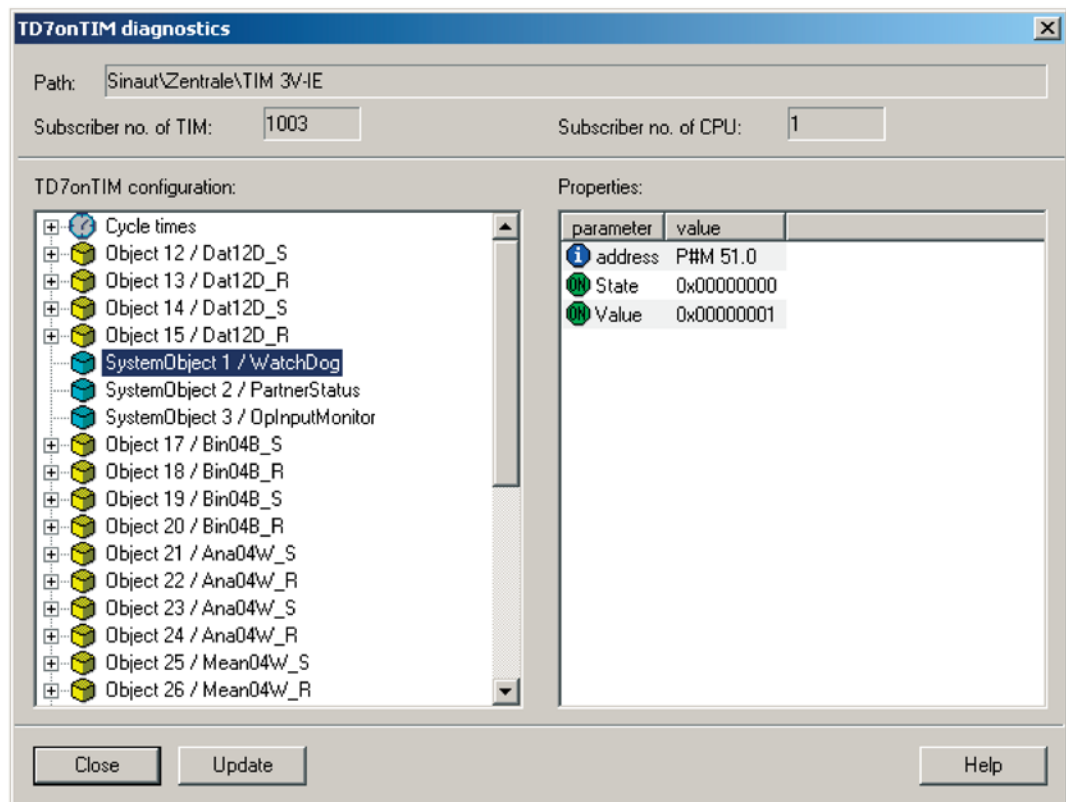


Figure 4-6 TD7onTIM diagnostics dialog with system object parameters based on the example of WatchDog

In keeping with the parameter assignment of the TD7onTIM, the diagnostic functions are displayed for the following objects:

- Status of system objects
- Status of data objects
- Status of the input and output channels

The dialog displays the following information for the station of the selected TIM module:

- The path of the TIM in the project
- The subscriber no. of the TIM
- The subscriber no. of the CPU

The lower part of the dialog displays the SINAUT objects and channels with their parameters:

- TD7onTIM configuration:
This box lists the following directories of the selected TIM as they are successively expanded:
 - System objects (blue symbols)
 - Data objects (yellow symbols)
 - The cycle time
 - Send and receive channels
- Properties:
This box displays the following properties of an object selected in the directory tree:
 - Parameter name
 - Value
 - Comment

The Parameter name column lists the individual parameters with colored symbols indicating the following status:

- Blue symbols: Configured data
- Red symbols: Online data

The cycle time is displayed in the TD7onTIM configuration box below the last data object. This is the current time of a sampling cycle in which TD7onTIM samples the work memory of its local CPU. If you click on the cycle time, the corresponding value is displayed in the Properties box.

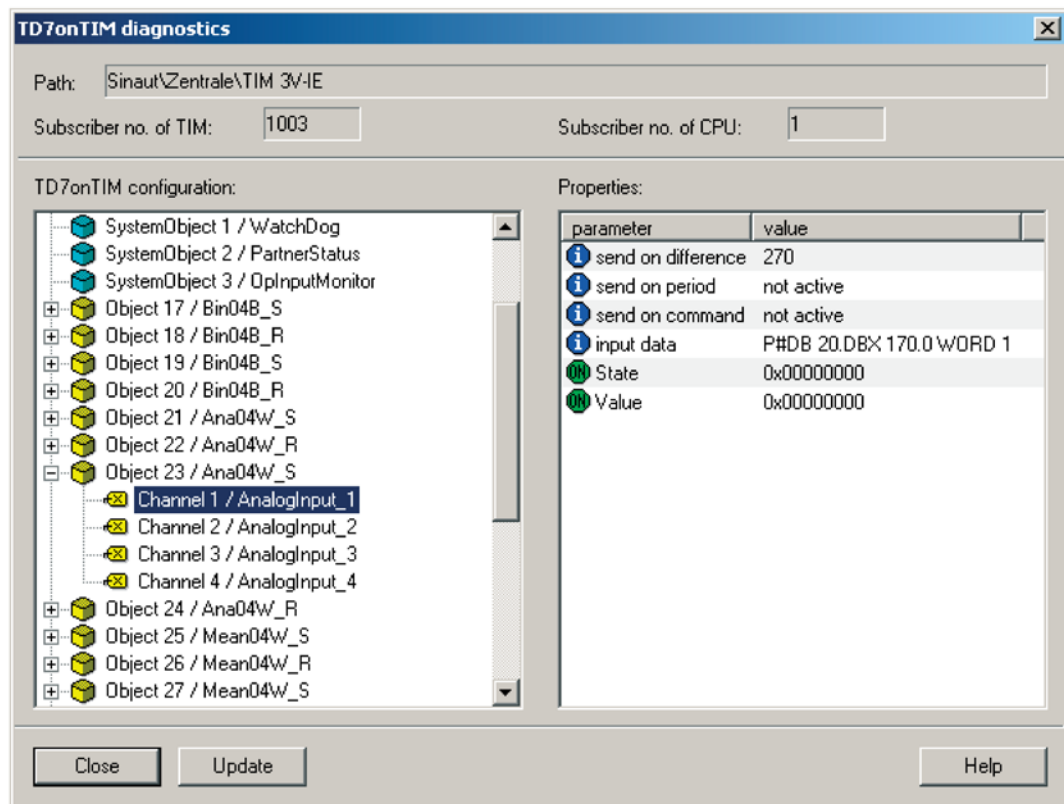


Figure 4-7 TD7onTIM diagnostics dialog with channel parameters based on the example of the Send analog value channel

4.6 Processing status of the messages (e-mail)

Processing status of messages

If this option is enabled in the "Trigger" tab of the message configuration of STEP 7, a status is output on the CP that provides information about the processing status of the sent message. The status is written to a PLC tag of the type DWORD. Select this tag via the "PLC tag for processing status" box.

Processing status of the telecontrol e-mails

The meaning of the statuses is as follows:

Table 4- 2 SMS: Meaning of the status ID output in hexadecimal format

Status	Meaning
0000	Transfer completed free of errors
0001	Error in the transfer, possible causes: <ul style="list-style-type: none"> • SIM card invalid • No network • Wrong destination phone number (number not reachable)

Table 4- 3 E-mail: Meaning of the status ID output in hexadecimal format

Status	Meaning
0000	Transfer completed free of errors
82xx	Other error message from the e-mail server Apart from the leading "8", the message corresponds to the three-digit error number of the SMTP protocol.
8401	No channel available. Possible cause: There is already an e-mail connection via the module. A second connection cannot be set up at the same time.
8403	No TCP/IP connection could be established to the SMTP server.
8405	The SMTP server has denied the login request.
8406	An internal SSL error or a problem with the structure of the certificate was detected by the SMTP client.
8407	Request to use SSL was denied.
8408	The client could not obtain a socket for creating a TCP/IP connection to the mail server.
8409	It is not possible to write via the connection. Possible cause: The communications partner reset the connection or the connection aborted.
8410	It is not possible to read via the connection. Possible cause: The communications partner terminated the connection or the connection was aborted.
8411	Sending the e-mail failed. Cause: There was not enough memory space for sending.
8412	The configured DNS server could not resolve specified domain name.
8413	Due to an internal error in the DNS subsystem, the domain name could not be resolved.
8414	An empty character string was specified as the domain name.
8415	An internal error occurred in the cURL module. Execution was aborted.
8416	An internal error occurred in the SMTP module. Execution was aborted.
8417	Requests to SMTP on a channel already being used or invalid channel ID. Execution was aborted.
8418	Sending the e-mail was aborted. Possible cause: Execution time exceeded.
8419	The channel was interrupted and cannot be used before the connection is terminated.
8420	Certificate chain from the server could not be verified with the root certificate of the module.
8421	Internal error occurred. Execution was stopped.
8450	Action not executed: Mailbox not available / unreachable. Try again later.

Status	Meaning
84xx	Other error message from the e-mail server Apart from the leading "8", the message corresponds to the three-digit error number of the SMTP protocol.
8500	Syntax error: Command unknown. This also includes the error of having a command chain that is too long. The cause may be that the e-mail server does not support the LOGIN authentication method. Try sending e-mails without authentication (no user name).
8501	Syntax error. Check the following configuration data: Alarm configuration > E-mail data (Content): <ul style="list-style-type: none"> • Recipient address ("To" or "Cc").
8502	Syntax error. Check the following configuration data: Alarm configuration > E-mail data (Content): <ul style="list-style-type: none"> • Email address (sender)
8535	SMTP authentication incomplete. Check the "User name" and "Password" parameters in the configuration.
8550	SMTP server cannot be reached. You have no access rights. Check the following configuration data: <ul style="list-style-type: none"> • Module configuration > E-mail configuration: <ul style="list-style-type: none"> – User name – Password – Email address (sender) • Alarm configuration > E-mail data (Content): <ul style="list-style-type: none"> – Recipient address ("To" or "Cc").
8554	Transfer failed
85xx	Other error message from the e-mail server Apart from the leading "8", the message corresponds to the three-digit error number of the SMTP protocol.

4.7 Maintenance

Maintenance functions

You can find a description of the following maintenance functions in the manual of the respective module, see Bibliography (Page 187).

- Firmware update
- Reset
- Module replacement

See also

WBM of the TIM 1531 IRC (Page 167)

OUC program blocks (CP)

A.1 Validity

The functions described below are supported by the following modules:

- CP 1243-1
- CP 1243-8 IRC
- CP 1542SP-1 IRC

A.2 Program blocks for OUC

Using the program blocks for Open User Communication (OUC)

You can use the instructions (program blocks) listed below for direct communication between S7 stations.

In contrast to telecontrol communication, Open User Communication does not need to be enabled in the configuration because the corresponding program blocks need to be created for this. You will find details on the program blocks in the information system of STEP 7.

Note

Different program block versions

Note that in STEP 7 you cannot use different versions of a program block in a station.

Supported program blocks for OUC

The following instructions in the specified minimum version are available for programming Open User Communication:

- **TSEND_C V3.0 / TRCV_C V3.0**

Compact blocks for:

- Connection establishment / termination and sending data
- Connection establishment / termination and reception of data

Use as an alternative:

- **TCON V4.0 / TDISCON V2.1**

Connection establishment / connection termination

- **TUSEND V4.0 / TURCV V4.0**

Sending and receiving data via UDP

- **TSEND V4.0 / TRCV V4.0**

Sending and receiving data via TCP or ISOonTCP

- **TMAIL_C V4.0**

Sending e-mails

To transfer encrypted e-mails with this block, the precise time of day is required on the module. Configure the time-of-day synchronization.

To change the configuration data of the module during runtime:

- **T_CONFIG V1.0**

Program-controlled configuration of the IP parameters

Refer to the information on T_CONFIG and on the SDTs "IF_CONF_..." in the section Changing the IP address during runtime (Page 159).

You can find the program blocks in STEP 7 in the "Instructions > Communication > Open User Communication" task card.

Connection descriptions in system data types (SDTs)

The blocks listed above use the CONNECT parameter for the relevant connection description. TMAIL_C uses the parameter MAIL_ADDR_PARAM.

The connection description is stored in a data block whose structure is specified by the system data type (SDT).

Creating an SDT for the data blocks

Create the SDT required for every connection description as a data block (global DB).

The SDT type is generated by entering the name in the declaration table of the block manually not by selecting an entry from the "Data type" drop-down list but by entering it in the "Data type" box for example "TCON_IP_V4".

The corresponding SDT is then created with its parameters.

Using the SDT

- **TCON_IP_V4**

For transferring frames via TCP or UDP

- **TADDR_Param**

For transferring frames via UDP

- **TCON_IP_RFC**

For transferring frames via ISO-on-TCP (direct communication between two S7 stations)

- **TMail_V4**

For transferring e-mails addressing the e-mail server using an IPv4 address

- **TMail_V6**

For transferring e-mails addressing the e-mail server using an IPv6 address

- **TMail_FQDN**

For transferring e-mails addressing the e-mail server using its name (FQDN)

- **TMail_V4_SEC**

For secure transfer of e-mails addressing the e-mail server using an IPv4 address

- **TMail_V6_SEC**

For secure transfer of e-mails addressing the e-mail server using an IPv6 address

- **TMail_QDN_SEC**

For secure transfer of e-mails addressing the e-mail server using the host name

You will find the description of the SDTs with their parameters in the STEP 7 information system under the relevant name.

Connection establishment and termination

Connections are established using the program block TCON. Note that a separate program block TCON must be called for each connection.

A separate connection must be established for each communications partner even if identical blocks of data are being sent.

After a successful transfer of the data, a connection can be terminated. A connection is also terminated by calling TDISCON.

Note

Connection abort

If an existing connection is aborted by the communications partner or due to disturbances on the network, the connection must also be terminated by calling TDISCON. Make sure that you take this into account in your programming.

A.3 Changing the IP address during runtime

Changing the IP address during runtime

You can change the following address parameters of the CP at runtime controlled by the program:

- IP address
- Subnet mask
- Router address

Apart from the address parameters of the CP, with T_CONFIG the address parameters of DNS servers (IF_CONF_DNS) and NTP servers (IF_CONF_NTP) can also be changed program controlled.

Note

Changing the IP parameters with a dynamic IP address

Note the effects of program-controlled changes to the IP parameters if the CP obtains a dynamic IP address from the Internet service provider: In this case, the CP can no longer be reached by communications partners.

Requirements - Configuration

To be able to change the IP parameters program controlled, the option "IP address is set directly at the device" must be enabled in the configuration of the IP address of the Ethernet interface of the CP.

Requirements - STEP 7 version

- STEP 7 ≥ V14

Requirements - Firmware versions

- **CP 1243-1**
 - CP firmware ≥ V2.1.7x
 - CPU firmware ≥ V4.2
- **CP 1542SP-1 IRC**
 - CP firmware ≥ V1
 - CPU firmware ≥ V2.0 (CPU 151xSP)

Program blocks

Program-controlled changing of the IP parameters is supported by program blocks. The program blocks access address data stored in a suitable system data type (SDT).

The following program blocks and system data types can be used:

- **T_CONFIG**

Along with:

- IF_CONF_V4
- IF_CONF_NTP
- IF_CONF_V6
- IF_CONF_DNS

The address parameters can only be configured with temporary validity in the CP. In the respective "IF_CONF_..." SDT, the "Mode" = 2 parameter must be set.

Note

No feedback from the CP

"T_CONFIG" does not support feedback from the CP to the CPU. Errors in the block call or in setting the address parameter are not reported. The block outputs "BUSY" or "DONE" regardless of whether the address parameter was set.

You can find detailed information on parameter assignment of the blocks and SDTs in the STEP 7 information system.

SINEMA Remote Connect (CP)

B.1 Validity

The functions described below are supported by the following modules:

- CP 1243-1
- CP 1243-8 IRC
- CP 1542SP-1 IRC

B.2 Connection to SINEMA RC

Requirement

Required firmware and software versions:

- CP 1243-1
 - As of firmware \geq V3.1
- CP 1243-8 IRC
 - As of firmware \geq V3.1
- CP 1542SP-1 IRC
 - As of firmware \geq V2.0
- SINEMA Remote Connect
 - As of software version \geq V1.3

Communication via SINEMA Remote Connect (SINEMA RC)

The "SINEMA RC Server" application provides end-to-end connection management of distributed networks via the Internet. This also includes secure remote access to lower-level stations. Communication between SINEMA RC Server and the remote devices takes place via a VPN tunnel with consideration of the stored access rights.

SINEMA RC uses OpenVPN for encryption of the data. The center of the communication is SINEMA RC Server via which communication runs between the subscribers and that manages the configuration of the communications system.

SCALANCE M routers, which you can use for the connection, also support OpenVPN and connection to SINEMA Remote Connect.

The CP can also handle telecontrol communication via the SINEMA RC server.

Parameter groups

You configure communication via SINEMA RC and telecontrol communication via SINEMA RC in two parameter groups:

- Communication via SINEMA RC:
 - > "Security > VPN"
- Telecontrol communication via SINEMA RC:
 - > "Communication types"

For information on the supported protocols and configuration, see section Telecontrol via SINEMA RC (Page 163).

Applications

The following application options of the CP result from the combination of the parameters for telecontrol communication and SINEMA RC:

- (1) No telecontrol and no SINEMA RC (CP for network separation only)
- (2) CP only for remote maintenance via SINEMA RC
- (3) CP for telecontrol communication only
- (4) CP uses telecontrol communication, but SINEMA RC only for remote maintenance.
- (5) CP uses SINEMA RC for telecontrol communication and remote maintenance.

The table provides an overview of the applications with the respective parameter settings.

- "On" means that the parameter is activated.
- "Off" means that the parameter is deactivated.

Table B- 1 Use cases and parameters to be activated

Use case	Parameter settings (Parameters abbreviated) *		
	SRC	TC	TC-SRC
(1)	Off	Off	Off
(2)	On	Off	Off
(3)	Off	On	Off
(4)	On	On	Off
(5)	On	On	On

* Explanation of the parameter abbreviations:

SRC - Security > VPN (activated) > "VPN connection type":

"Automatic OpenVPN configuration via SINEMA Remote Connect Server"

TC - Communication types > Telecontrol communication enabled

TC-SRC - Communication types >

"Activate telecontrol communication via SINEMA Remote Connect"

B.3 Telecontrol via SINEMA RC

For information on possible applications of communication via SINEMA Remote Connect, see section Connection to SINEMA RC (Page 161).

Requirements

Configure the SINEMA Remote Connect - Server before configuring the CP (not in STEP 7). The CP and the communication partner of the CP must be configured in the SINEMA RC Server.

Supported telecontrol protocols

The following protocols support communication via SINEMA Remote Connect:

- TeleControl Basic
- DNP3
- IEC 60870-5-104

Configuration of the telecontrol communication via SINEMA Remote Connect

Follow the steps below when configuring the CP for use of telecontrol communication via SINEMA RC:

1. In the "Communication types" parameter group activate telecontrol communication and select the protocol.
The option for communication via SINEMA RC is not yet visible.
2. Change to the "Security" parameter group and enable the security functions.
(In the "Communication types" parameter group the SINEMA RC option appears disabled and grayed out)
3. Open the "Security > VPN" parameter group and enable VPN.
4. For the parameter "VPN connection type" select the option "Automatic OpenVPN configuration via SINEMA Remote Connect Server" if this is not preset.
(In the "Communication types" parameter group the SINEMA RC option becomes usable.)
5. Change to the "Communication types" parameter group and enable the option "Telecontrol communication via SINEMA Remote Connect".
6. Create the remaining configuration of the SINEMA RC connection of the CP under "Security > VPN".

For information on the configuration, see section Security > VPN > SINEMA Remote Connect (Page 164).

B.4 Security > VPN > SINEMA Remote Connect

Remote maintenance with SINEMA Remote Connect (SINEMA RC)

The application "SINEMA Remote Connect" (SINEMA RC) is available for remote maintenance purposes.

SINEMA RC uses OpenVPN for encryption of the data. The center of the communication is SINEMA RC Server via which communication runs between the subscribers and that manages the configuration of the communications system.

Preparatory steps

Execute the following steps before start configuring the SINEMA RC connection of the module in STEP 7. They are the prerequisite for a consistent STEP 7 project.

- Configuration of SINEMA Remote Connect - Server

Configure SINEMA RC - Server as necessary (not in STEP 7). The communication module and its communication partners must be configured in the SINEMA RC Server.

- Exporting the CA certificate (optional)

If you want to use the server certificate as authentication method of the communication module during connection establishment, export the CA certificate from SINEMA RC - Server. Then import the CA certificate from SINEMA RC - Server to the engineering station.

Alternatively, you can use the fingerprint of the server certificate as authentication method of the communication module.

Note

Recommended authentication method:

The recommended authentication method is the one using the CA certificate. The certificate is valid for 10 years.

The fingerprint, on the other hand, is derived from the server certificate. Its validity may be significantly shorter.

Configuration of SINEMA Remote Connect

Importing your own certificate

1. Navigate to the parameter group "Security > Certificate manager".
2. Open the certificate selection dialog with a double-click on the first free table row of the local certificate manager.
3. Select the CA certificate of SINEMA RC - Server.

Then navigate to the parameter group "Security > VPN".

VPN > General

1. Activate VPN
2. As "VPN connection type", select the option "Automatic OpenVPN configuration via SINEMA Remote Connect Server" if you wish to use communication via SINEMA Remote Connect.

If you select "Internet Key Exchange (IKE) ...", you can use communication via IPsec tunnels.

SINEMA Remote Connect Server

Enter the address and port number of the server.

Server Verification

Here you select the authentication method of the communication module during connection establishment.

- CA Certificate

Under "CA certificate" select the CA certificate from SINEMA RC - Server that was previously imported and activated in the local certificate manager.

The module generally checks the CA certificate of the server and its validity period. The two options cannot be changed.

- Fingerprint

When you select this authentication method, you enter the fingerprint of the server certificate of SINEMA RC - Server.

Authentication

- Device ID

Enter the device ID generated for the module in SINEMA RC.

- Device password

Enter the device password of the module configured in SINEMA RC.

Max. number of characters: 127

Optional settings

The connection establishment is configured in the "Security > VPN > Optional settings" parameter group with the parameter "Connection type".

- **Update interval**

With this parameter you set the interval at which the CP queries the configuration on the SINEMA RC Server.

Note that with the setting 0 (zero) changes to the configuration of the SINEMA RC Server may result in the CP no longer being capable of establishing a connection to the SINEMA RC Server.

- **"Connection type"**

The two options of the parameter have the following effect on the connection establishment:

- Auto

The module establishes a connection to the SINEMA RCServer. The OpenVPN connection is retained until the connection parameters are changed by the SINEMA Remote Connect Server. If the connection is interrupted, the CP automatically re-establishes the connection.

If the connection parameters are changed by the SINEMA Remote Connect Server, the CP requests the new connection data after the update interval configured above has elapsed.

- PLC trigger

The option is intended for sporadic communication of the module via the SINEMA RC Server.

You can use this option when you want to establish temporary connections between the module and a PC. The temporary connections are established via a PLC tag and can be used in servicing situations, for example.

- **PLC tag for connection establishment**

If the option "PLC trigger" is selected, the module establishes a connection when the PLC tag (Bool) changes to the value 1. During operation the PLC tag can be set when necessary, for example using an HMI panel.

When the PLC tag is reset to 0, the connection is terminated again.

WBM of the TIM 1531 IRC

C.1 Supported Web browsers

Web browser

For secure access to the Web server of the TIM the following Web browsers are suitable:

- Internet Explorer (version 11)
- Google Chrome (version 68)
- Firefox (version 62)

You will find the specified Web browsers, information and any necessary addons on the Internet.

C.2 Establishing a connection to the WBM of the TIM

Possible connections

You can establish a connection between a PC and the TIM using the HTTP/HTTPS protocol:

- LAN connection

With a local connection from the PC to the TIM you can connect directly.

- Connection via WAN (Internet/mobile wireless)

The TIM must be reachable via a fixed IP address.

With connections via the Internet / mobile wireless network you need to use the security protocol "HTTPS".

Requirements

Requirements for access to the TIM:

- The TIM must be reachable via an IPv4 address.
- The PC must be in the same subnet as the TIM.
- The TIM must be reachable.

Connection to the Web server of the TIM

Follow the steps below to connect the PC to the Web server of the TIM:

1. Open the Web browser.
2. Enter the address (IP address / host name) of the TIM (or the router) in the address line of the Web browser either via the HTTP or HTTPS protocol:
 - http://<Address>
 - https://<Address>

When selecting the protocol, make sure that it is released in the configuration of the TIM ("Web server" tab).

With HTTPS connections via the Internet when you log in the first time, a warning can appear that the Web page is not secure or that the certificate is not trustworthy. If you are sure that you have entered the correct address, ignore the message. If necessary add the connection to the exceptions (depending on the Web browser).

The logon window of the TIM opens.

3. In the "User name" input box, enter the name of a user or administrator configured in STEP 7.

The rights assigned in "Global security settings" of the STEP 7 project apply.

4. Enter the corresponding password in the "Password" input box.
5. Click the "Log in" button.

The Web server opens with the start page:

C.3 General functions of the WBM

You set the WBM language with the setting of the browser being used.




The following languages are supported:

- German
- English

Displays and symbols in the title bar

The displays and symbols in the WBM title bar have the following meaning:

Symbol	Function
User: 1	Name of the currently logged in user
Log out	User logout
Number of active sessions: 1	Number of connections to a PC
2015-01-28 14:30:37	Date and time of the last page update of the WBM in local time of the TIM (yyyy-mm-dd hh:mm:ss)

Symbol	Function
	The automatic update of the WBM display is enabled. The data is fetched at the interval configured under "System > Web server".
	The automatic update of the WBM display is disabled.
Turn on	Switches on the automatic update of the WBM display.
Turn off	Switches off the automatic update of the WBM display.
	Prints out the current WBM page

C.4 Start page

After logging in to the WBM, the start page appears.

On the left you will find the navigation area with the main levels of the WBM.

Navigation in the WBM

By clicking on an entry in the navigation area on the left open the WBM page you want for further information or on which you want to configure or program.

The WBM opens the first tab of the entry.

On other pages with several tabs change to the relevant tab by clicking on the tab name.

Start page

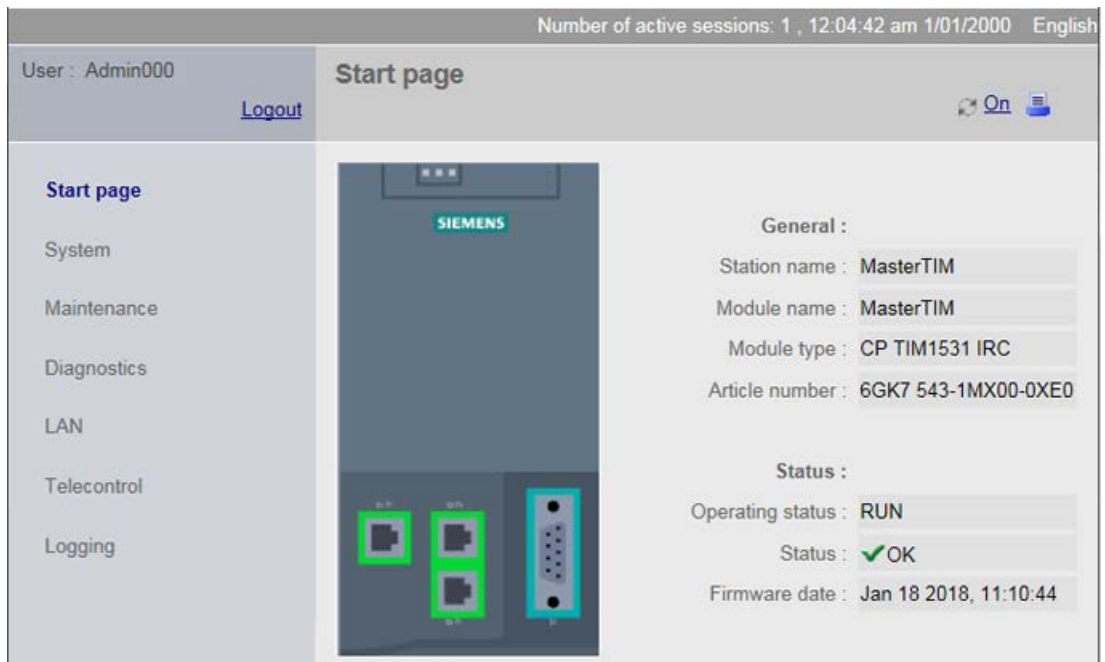


Figure C-1 Start page of the WBM

The page shows general data of the module.

General

- **Station name**
Parameter configured in STEP 7
- **Module name**
Parameter configured in STEP 7
- **Module type**
- **Article number**

Status

- **Operating status**
Current operating status of the TIM
- **Status**
Status of the firmware startup of the TIM:
 - TIM started up free of errors
 - Startup aborted with error
- **Firmware date**
Date the firmware currently being used was generated
Format: MMM DD YYYY, hh:mm:ss

C.5 System

C.5.1 Device info

Module

- Short designation
Parameter configured in STEP 7
- Article number
- Hardware product version
- Firmware version
- Rack
- Slot

Module information

- Module name
Parameter configured in STEP 7

Vendor information

- Vendor
- Serial number
Serial number of the device

C.5.2 SD card

SD card

SD card

- **SD card inserted**
yes / no
- **Free memory space / total**
Display of the free memory space still available and the total usable memory capacity
- **Content**
Display of the messages and files saved on the SD card

C.5.3 System time

System time

The current system time of the TIM is displayed in the title bar of the WBM.

- **Input box for time**

Format: YYYY-MM-DD hh:mm:ss

In the input box, you can manually enter the time and transfer it to the TIM.

When making your entry, keep to the specified format.

Month, day, and hour can also be entered as single digits. Example: March is accepted as "03" or as "3".

- **Apply time of day**

When you click this button, you transfer the time entered above to the TIM.

- **Adopt PC time**

When you click this button, the TIM adopts the time of day from the connected PC.

C.5.4 NTP

NTP

- **NTP server list**

Shows the addresses of the configured NTP servers.

C.5.5 Web server

Web server

- **Disable Web server**

Disables the Web server of the TIM. The setting is adopted in the configuration data of the TIM.

Note

No HTTP/HTTPS connection to the TIM

If you disable the Web server of the TIM, you lose the possibility to access the TIM via HTTP/HTTPS.

Access is only possible again after loading the configuration data (with enabled Web server access).

- **Automatic update**

Enable the option if the contents of the Web pages are to be updated automatically.

If the option is disabled, the pages are updated at the interval you configured in STEP 7.

- **Update interval (s)**

Here, the update interval configured in STEP 7 is displayed
in seconds.

If the option is enabled (above) you can enter the desired update interval manually.

- **Save**

Applies the update interval entered manually.

C.5.6 DNS configuration

DNS server list

- **List of configured DNS servers**

Servers configured in STEP 7

C.6 Maintenance

C.6.1 Firmware

Firmware

This page displays the most important version data of the firmware currently being used.

If a new firmware version is available for the TIM, you will find this on the Internet pages of Siemens Industry Online Support:

Link: (<https://support.industry.siemens.com/cs/ww/en/ps/21764/dl>)

If a new firmware version is available, you can download the firmware file from the PC to the TIM via this WBM page.

Note**Digitally signed and encrypted firmware prevents manipulation by third parties**

To be able to check the authenticity of the firmware, the firmware is digitally signed by Siemens. This allows manipulation by third parties to be detected and prevented.

Note

Do not operate during the update

During the update of the firmware until the TIM restarts, the WBM is not blocked.

Do not perform any operations during this time (e.g. no restart).

Note

Do not switch off the power supply

During activation of the firmware do not switch off the power supply. This avoids the occurrence of inconsistent statuses.

Firmware

The following information is shown:

- **Firmware version**

Version of the firmware currently being used by the TIM.

- **Date**

Date the firmware was generated

Firmware update

Download the firmware file to the file system of your connected PC.

- **File**

After selecting a firmware file stored on the PC using the "Browse" button, the file name is displayed here.

- **Browse**

Searches the file system of the PC for a firmware file saved there that is intended to be loaded on the TIM.

- **Load on device**

By clicking the button, download the selected firmware file to the TIM.

Note that updating the firmware can take a while. You can recognize the current status of the firmware download based on the LED pattern.

After updating the firmware the TIM starts up again automatically.

C.6.2 Operating status

Operating statuses

Apart from using this WBM page, you can also execute the functions described below using the switch of the TIM.

The buttons have the following functions:

- **Run a restart**

When restarting, existing telecontrol connections are interrupted and cyclic processing stops. The TIM restarts.

- **Reset to factory settings**

Note

Data loss: Note the effects of a reset

Before you reset, note the effects.

Resets the TIM to the factory settings. During this all parameters are reset to the initial statuses as shipped and the TIM restarts.

If you use an SD card and you want to reset the TIM to the factory settings, you must pull the SD card (while disconnected from the power) before resetting. If the SD card remains inserted, the TIM starts up again with the configuration data on the SD card.

Resetting to factory settings: Effect

Note

Configuration data is deleted

Resetting to factory settings deletes all configuration data in the TIM.

- **Deleted data**

The following data is deleted by resetting to factory settings:

- Configured IP addresses of the LAN interfaces X1, X2 and X3
- All other configuration data in the work memory of the TIM

- **Data not deleted**

The following data is not deleted by resetting to factory settings:

- MAC addresses of the LAN interfaces

C.7 Diagnostics

C.7.1 Events

Diagnostics messages

Table

The table lists the last diagnostics events to occur on the TIM with the following information:

- **Number**
Consecutive number
- **Time**
Time of the diagnostics event
- **Date**
Date of the diagnostics event
- **Event type**
The diagnostics messages are classified as follows:
 - INFO
Information about a special event
 - WARNING
Warning of a possibly unwanted event
 - ERROR
Internal error. The TIM starts up.
 - FATAL
Serious error that impairs or interrupts the operation of the TIM.
- **Event**
Plain text of the diagnostics event

Copy of the diagnostics buffer

Using the button, you save the content of the diagnostics buffer on the PC.

The diagnostics buffer

The diagnostics buffer receives diagnostics messages for internal events and errors. It can hold a maximum of 200 entries. When the maximum number is exceeded, the oldest entries are overwritten.

The entries in the diagnostics buffer contain a consecutive number, a classification, a time stamp and the message text.

Below you will find several examples of events that are entered in the diagnostics buffer:

- TIM startup
- Change to the configuration
- Establishment/abort of the communications connection
- Time-of-day synchronization
- Power failure

C.7.2 Notifications

Messages

Table

The table lists the last messages of the TIM with the following information:

- **Number**
Consecutive number
- **Time**
Time of sending
- **Trigger**
Trigger that fired generation of the message.
- **Recipient**
Configured recipient of the message
- **Message**
Message text
- **Processing status**
Status of the sending of the message

You will find an overview of the possible statuses in the section Processing status of the messages (e-mail) (Page 153).
- **Type**
Type of the message

C.8 LAN

C.8.1 Ethernet interface [Xn]

- The three Ethernet interfaces of the TIM are selected via the upper tabs.
 - X1 ... X3
- The parameters of the selected interface are shown in the lower series of tabs:
 - IPv4 parameters
 - IPv6 parameters
 - Statistics

IPv4 parameters

Network attachment

- **MAC address**

IP parameters

- **IP address**

Current IP address

- **Subnet mask**

Default or last configured subnet mask.

- **Default router**

Configured default router

- **Address assignment**

Shows how obtaining the IP address is configured in STEP 7:

- Set IP address in the project
- IP address from DHCP server
- Set IP address on the device

The IP address obtained using other services outside the configuration

Ports

- **Port number**

Port of the interface

- **Connection status**

- OK: Existing connection to the network
- Not OK: No connection

- **Settings**

Behavior of the network setting:

- Automatic
- Manual setting for transmission speed and direction dependency

- **Mode**

Used transmission speed and direction dependency (duplex/half duplex)

- **Connection medium**

Connected medium (copper / optical)

IPv6 parameters

- **IPv6 address**

Currently used IPv6 address

- **Gateway**

Display of IPv6 addresses of up to two gateways

Statistics

Statistics

The following statistical data of the interface since the TIM last started up is displayed.

- **Bytes received**

- **Received frames discarded**

Number of messages that were discarded on receipt due to address, protocol or data errors.

- **Error on receipt**

Number of internal errors on receipt

- **Frames with unknown protocol**

Number of messages with the wrong protocol

- **Bytes sent**

- **Sent unicast frames**

- **Dropped frames**

Number of frames that were discarded due to errors when sending.

- **Error sending**

Number of internal errors when sending

- **Frames in the send mailbox**

Number of unsent frames waiting for transfer.

C.9 Telecontrol

C.9.1 Partner information

C.9.1.1 Connection overview

The tab shows you information on the communications partners and the connection status of the TIM.

Table

The column headers have the following meaning:

- **Connection status**

The status of the connections to the assigned CPU and to the remote partners is shown as follows:

- **Green: Connected**
All connections are established.
- **Yellow: Connected**
Some of the possible connections are established.
- **Red: Disconnected**
None of the possible connections is established

- **Partner**

Possible partner types:

- Local CPU
The CPU assigned to the TIM in the configuration.
- Application
(e.g. WinCC)
- TIM
TIM of the remote station
- Partner CPU
CPU of the remote station
- CP ...
CP of the remote station (CP 1243-8 IRC / CP 1542SP-1 IRC)

- **Subscriber number**

Subscriber number of the partner

When you click on the '±' icon in a table row, the relevant parameters are displayed.

The following information is available on each subscriber:

- Information on the subscriber
- Information on the transmission path

Information on the subscriber

Local CPU

- **Status**

Operating status of the local CPU

- **Number of connections**

Number of connections between the TIM and local CPU

Remote partner

- **Partner type**

- Application (e.g. WinCC)
- CPU
CPU of the remote station
- TIM
- CP ...

- **Subscriber number**

Subscriber number of the partner

- **Time master**

Display of the option configured on the partner:

Yes / No

- **Security options**

Display of the active access level (protection):

ON / OFF

- **Connection status**

- Connected
- Not connected

For the meaning of the colors, see above (Connection overview).

- **Frame memory status**

State of the send buffer, only relevant for a communications module:

- **Normal operation**

The send buffer is working normally. The memory space allocation is between 10 and 80 %.

- **80% limit reached**

When the ST7 protocol is used, the TIM switches to the forced image mode at 80 % occupation of the send buffer.

- **Overflow**

100% occupation of the send buffer

Transmission path

Information on the transmission path

Local CPU

- **Interface ID**

Ethernet interface of the TIM for connection with the local CPU

X1 (ETH1) / X2 (ETH2) / X3 (ETH3)

- **CPU type**

Type of the local CPU

- **Connection status**

- Connected
- Not connected

- **CFB reference**

Local ID (decimal) of the S7 connection

- **Local TSAP**

Local TSAP of the S7 connection

- **Remote TSAP**

Remote TSAP of the S7 connection

- **IP address**

IP address of the CPU

Remote partner

- **Address**

IP address or WAN address of the interface of the TIM

- **Interface**

Ethernet interface of the TIM for connection with the remote partner

X1 (ETH1) / X2 (ETH2) / X3 (ETH3)

- **CFB reference**

Local ID (decimal) of the S7 connection

- **Connection type**

Display of several of the following connection properties:

- PBK connection
Configured S7 connection
- ST7
ST7 connection via classic WAN
- DNP3
DNP3 connection via classic WAN network
- IEC
IEC 60870-5-101 connection via a classic WAN network
- MSC connection
Only ST7: Connection of the MSC protocol for which no S7 connection is required.
- CR connection
Read/write connection to the local CPU that does not require an S7 connection.
- X connection
Unconfigured S7 connection that uses the SFCs "X_SEND" and "X_RCV".
- Permanent / temporary
Permanent or temporary telecontrol connection
- GPRS / no GPRS
GPRS connection or no GPRS connection
- local / remote
Connection to a local or remote partner

- **Connection status**

- Connected
- Disconnected

C.9.1.2 Send buffer

The tab provides information on the send buffer (frame memory) of the local or remote TIM.

Information on the send buffer

Information on the send buffer of the TIM:

- **Size (memory spaces)**

Configured size of the send buffer as number of memory spaces

One memory space is reserved per frame.

- **Free (memory spaces)**
Memory currently free as number of memory spaces
- **Free (%)**
Currently free memory space in percent
In brackets: Number of configured events / Max. number of events

Table

The column headers have the following meaning:

- **Source subscriber**
Subscriber number of source subscriber from which the connection is established.
- **Destination subscriber**
Subscriber number of destination subscriber to which the connection is established.
- **Number of events**
Number of configured events of the source subscriber

Parameters

When you click on the '±' icon in a table row, the relevant parameters are displayed.

- **Unconditional spontaneous**
Number of stored frames to be sent unconditionally and spontaneously (only relevant in dial-up networks).
- **Prioritized**
Number of stored frames to be sent with high priority.
- **Identification**
Hexadecimal value that codes the information below.
 - Unconditional spontaneous (9)
Number of frames with the transmission mode "Spontaneous (unsolicited - direct transfer)"
 - XGA (10)
Only ST7: Pending general request
 - Overflow (11)
Send buffer overflow prewarning
 - Transmission stop (12)
Sending data to the remote partner is temporarily blocked because the partner cannot be reached or a memory bottleneck has occurred at the partner.

- Forced image mode (14)

Only ST7: When the send buffer is 80% full, the TIM switches to the forced image mode.

To prevent a send buffer overflow, all data frames are treated as image frames. Send buffer frames are also treated as image frames; the data is overwritten by newer data.

- Locked (15)

The send buffer is locked.

C.9.2 Data points

The tab shows you information on the configured data points of the TIM.

Data points

- **Data point number**
Consecutive number
- **Name & type**
Name and type of the data point
When you hold the cursor over the column entries, additional properties of the data points are displayed in tooltips.
- **Type identifier**
Type of the data point
- **Object number**
Object number of the ST7 data point
- **Object group**
Object group (DNP3 / IEC 60870-5)
- **Data point index**
Index of the DNP3/IEC data point
- **Status**
Occasion of transfer/status of TIM
- **Current value**
Currently saved value
- **Historical value**
Previous value
- **Time stamp**
Time stamp of the currently saved value

C.10 Logging

Functions of logging

On this page, you can log the data traffic of the TIM using PCAP functionality for diagnostics purposes.

If an error occurs or if the TIM behaves in an unwanted manner, the communication behavior of the TIM can be recorded. The frame traffic of the TIM is recorded for a defined time or for a configurable number of frames.

The log files are stored as PCAP files on the connected PC and can be evaluated with the Wireshark program, for example.

Options:

- **Ethernet Interface X1 / X2 / X3**

Enable the interfaces for which you want to record data.

- **Data volume (kB)**

Via the input box, you specify the overall size of the logging file.

Maximum file size: 10000 kB

- **Recording acc. to time**

If the option is enabled, the recording is made for a configurable time.

Via the input box, you specify the recording time in seconds.

Max. recording duration: 600 s

- **Recording acc. to frames**

If the option is enabled, the recording is made for a configurable number of frames.

Via the input box, you specify the number of frames.

Max. number of frames: 500 s

- **Start**

With this button you start the logging.

- **Stop**

With this button you stop the logging.

Bibliography

Where to find Siemens documentation

- Article numbers

You will find the article numbers for the Siemens products of relevance here in the following catalogs:

- SIMATIC NET - Industrial Communication / Industrial Identification, catalog IK PI
- SIMATIC - Products for Totally Integrated Automation and Micro Automation, catalog ST 70

You can request the catalogs and additional information from your Siemens representative. You will also find the product information in the Siemens Industry Mall at the following address:

Link: (<https://mall.industry.siemens.com>)

- Manuals on the Internet

You will find SIMATIC NET manuals on the Internet pages of Siemens Industry Online Support:

Link: (<https://support.industry.siemens.com/cs/ww/en/ps/15247/man>)

Go to the required product in the product tree and make the following settings:

Entry type "Manuals"

- Manuals on the data medium

You will find manuals of SIMATIC NET products on the data medium that ships with many of the SIMATIC NET products.

You can find additional references in the bibliographies of the individual manuals.

/1/

SIMATIC NET - TeleControl

Configuration manuals for the protocols:

- SINAUT ST7

- DNP3

- IEC 60870-5

Siemens AG

Link: (<https://support.industry.siemens.com/cs/ww/en/ps/21764/man>)

/2/

SIMATIC NET
TIM 1531 IRC
Operating instructions
Siemens AG
Link: (<https://support.industry.siemens.com/cs/ww/en/ps/24710/man>)

/3/

SIMATIC NET
CP 1243-1
Operating Instructions
Siemens AG
Link: (<https://support.industry.siemens.com/cs/ww/en/view/103948898>)

/4/

SIMATIC NET
CP 1243-8 IRC
Operating Instructions
Siemens AG
Link: (<https://support.industry.siemens.com/cs/ww/en/ps/21162/man>)

/5/

SIMATIC
CP 1542SP-1, CP 1542SP-1 IRC, CP 1543SP-1
Operating instructions
Siemens AG
Link: (<https://support.industry.siemens.com/cs/ww/en/ps/22144/man>)
Link: (<https://support.industry.siemens.com/cs/ww/en/ps/22143/man>)

/6/

SIMATIC NET
TIM DNP3
System manual
Siemens AG
Link: (<https://support.industry.siemens.com/cs/ww/en/ps/15940/man>)

/7/

SIMATIC
S7-1200 Automation System
system manual
Siemens AG
Link: (<http://support.automation.siemens.com/WW/view/en/34612486>)

/8/

SIMATIC
ET 200SP - Distributed I/O System
system manual
Siemens AG
Link: (<http://support.automation.siemens.com/WW/view/en/58649293>)

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SIMATIC NET
Industrial Ethernet / PROFINET
System manual
Siemens AG

- Industrial Ethernet
Link: (<https://support.industry.siemens.com/cs/ww/en/view/27069465>)
- Passive network components
Link: (<https://support.industry.siemens.com/cs/ww/en/view/84922825>)

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SIMATIC NET
Diagnostics and configuration with SNMP
Diagnostics manual
Siemens AG
Link: (<https://support.industry.siemens.com/cs/ww/en/ps/15392/man>)

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