SIEMENS

SIMATIC NET

Industrial Remote Communication -Telecontrol TIM DNP3

System Manual

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

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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 applies to the following modules:

• TIM 3V-IE DNP3

Hardware product version: 4

Firmware version V3.1

Article number: 6NH7803-3BA00-0AA0

• TIM 4R-IE DNP3

Hardware product version: 4

Firmware version V3.1

Article number: 6NH7803-4BA00-0AA0

Communications modules for the SIMATIC 300/400 for DNP3 communication via classic WAN networks (via serial interface) and IP-based LAN / WAN networks (via RJ-45 interface)

Product names and abbreviations

The following short forms of product names are often used in this manual:

- TIM
- DNP3 TIM

Simplified names of the two TIM modules named above if the property being described in the particular context applies equally to both modules.

Purpose of the manual

This manual supports you during the configuration, installation, commissioning and operation of the DNP3 modules in a DNP3 network.

New in this release

- New functions of the above firmware version of the TIM:
 - New data object "DNP_Cmd01X_R" for the function of the DNP3 Object Group 12 / Variation 1 in the station
 - Expansion of the DNP3 station address range to 65519
 - Expansion of the data objects "Dat12D_S / Dat12D_R" with the data type DWORD
 - Expansion of the data objects "Par12D_S / Par12D_R" to all data types except BOOL

For information on the new and expanded data objects refer to Objects of TD7onTIM (Page 177) and Data objects: Specific channel parameters (Page 206).

 Expansion of the Security functionality to protect against loading and deleting SDBs (system data) of the TIM from a PG/PC

See section "Options" tab (Page 130) for information on this.

- Adaptation of the SINAUT engineering software for configuration of the new functions
- Editorial revision

Replaced documentation

This manual replaces the manual release 06/2014.

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 under at the following address:

49109245 (https://support.industry.siemens.com/cs/ww/en/ps/15939/man)

46636298 (https://support.industry.siemens.com/cs/ww/en/ps/15940/man)

Compatibility with older firmware versions

The DNP3 TIM with the firmware version described here is downward compatible with a DNP3 TIM with firmware version 2.0.

Hardware and software requirements and compatibility

The hardware components and software versions required for configuration and operation of the DNP3 TIM modules can be found in the section Requirements for operation - necessary components and services (Page 31).

There, refer to the information on the compatibility of the SINAUT configuration tool.

Required experience

To be able to configure and operate the devices described in this document, you require experience of the following products and systems:

- SIMATIC S7-300 / S7-400
- SIMATIC STEP 7 V5
- DNP3 protocol

Further information on the Internet

You will find further information on the telecontrol products such as the latest information, manuals, FAQs or software updates on the Internet on the pages of Siemens Industry Online Support under the following address:

Link: (https://support.industry.siemens.com/cs/ww/en/ps/15939)

There select the required information under "Entry type" (for example "Updates", "Manuals", "FAQs" etc.).

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: (https://support.industry.siemens.com/cs/ww/en/view/50305045)

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Note

Open source software

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

You will find license conditions in the following documents on the supplied data medium:

- DOC_OSS-S7CMCP_74.pdf
- DOC_OSS-TIM-DNP3_76.pdf

Training, Service & Support

You will find information on Training, Service & Support in the multi--language document "DC_support_99.pdf" on the data medium supplied with the documentation.

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TIM 3V-IE DNP3, TIM 4R-IE DNP3, SINAUT, SCALANCE, MODEM MD720, Modem MD2 / MD3 / MD4, LTOP

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Uses and properties of the TIM

1.1 Application

DNP3 communication via WAN and Ethernet

The DNP3 TIM is a communications module for the SIMATIC® S7.

The TIM (Telecontrol Interface Module) is a communications module of the SIMATIC S7-300/400 and has an S7-300 housing. There are two variants available:

• TIM 3V-IE DNP3

Communications module for the SIMATIC S7-300

• TIM 4R-IE DNP3

Possible applications:

- Communications module for a SIMATIC S7-300
- Stand-alone device that can be connected to a SIMATIC S7-400 or S7-400H via Ethernet.

With the TIM modules, communication can be established between DNP3 master stations and SIMATIC S7 stations via a WAN (Wide Area Network) or Ethernet (TCP/IP).

Connecting the SIMATIC S7 to DNP3 master stations

S7 stations with a DNP3 TIM can be connected to DNP3 control systems from Siemens or other vendors.

A DNP3 master station can be a TIM or a control system.

In the SIMATIC world, PCS 7 (single or redundant) can be used as the central control center.

Output of process data to display devices

The process data in the process image of a master station TIM is output to the local CPU of the master station TIM. Via interfaces of the CPU or additional interfaces (CPs) of the SIMATIC station, process data can be output to other display devices, for example to Operator Panels.

1.1 Application

Classic WAN networks

In a classic WAN network, the following media can be used for data transfer with the TIM:

Dedicated line

Medium: Copper or fiber-optic cable

- Dial-up networks
 - Analog dial-up network
 - ISDN network

Star, bus (linear) and node structures can be implemented.

Ethernet

Communication is possible between the station and master station via an Ethernet network with the DNP3 protocol.

Redundant transmission paths

• Redundant paths with TIM 3V-IE DNP3

The classic WAN network can be combined with Ethernet networks. This allows redundant paths to be established with the two interfaces of the TIM 3V IE DNP3.

• Redundant paths with TIM 4R-IE DNP3

With the 4 interfaces of the TIM 4R IE DNP3, there are further options for establishing redundant transmission paths.

Interface combinations for redundant paths according to SIMATIC families:

• S7-300

In configurations with S7-300, two identical or different interfaces of the TIM can be used to create a redundant transmission path.

• S7-400 / S7-400H

In configurations with S7-400 / S7-400H, the following interfaces can be used to create a redundant transmission path:

- A serial interface and an RJ-45 interface
- Two serial RS-232/RS-485 interfaces

1.2 TIM 3V-IE DNP3 - Overview



Image 1-1 TIM 3V-IE DNP3

Overview of the Properties of the TIM 3V-IE DNP3

- TIM without integrated modem, single width
- For installation as a communications processor (CP) in an S7-300
- It has two interfaces:
 - RJ-45 interface for attachment to Ethernet

Allows DNP3 communication via IP-based networks (LAN or WAN).

- RS-232 interface

Allows the connection of a modem for DNP3 communication (classic WAN) or connection of a MODBUS slave.

Both interfaces can be used simultaneously.

1.2 TIM 3V-IE DNP3 - Overview

DNP3 communication

With a TIM 3V-IE DNP3, an S7-300 CPU or a C7 control system can handle DNP3 communication:

- Over an IP-based network (WAN or LAN) with DNP3 subscribers
- Via a classic WAN with DNP3 subscribers
- The TD7 software is integrated on the TIM (TD7onTIM)
- Message memory: 64 000 data points
- Module replacement without PG possible with the MMC of the CPU
- Can be combined with other TIMs in the rack: no
- Communication via MPI of the S7-300 CPU: no

Design of the TIM 3V-IE DNP3

The TIM 3V-IE DNP3 has all the advantages of the SIMATIC S7-300 system design:

- Compact design; single standard width of the SM modules of the SIMATIC S7-300
- 9-pin D-sub male connector with an RS-232 interface for connecting a modem
- RJ-45 jack for connection to Ethernet; industrial design with additional collar for inserting the IE FC RJ-45 Plug 180
- 2-pin plug-in terminal block for connecting the external supply voltage of 24 V DC
- Front LEDs for display of Ethernet and WAN communication
- Easy to mount; the TIM is mounted on the S7-300 rail and connected to adjacent modules by means of the bus module connectors. No slot rules apply.
- Can be operated in an expansion rack (ER) in conjunction with the IM 360/361. This allows the TIM to be combined with a C7 control system, with the newer C7 control systems it can also be combined using the supplied I/O expansion cable.
- Can be operated without a fan
- The device is operated without an additional back-up battery or memory module.

1.3 TIM 4R-IE DNP3 - Overview



Image 1-2 TIM 4R-IE DNP3

Overview of the Properties of the TIM 4R-IE DNP3

- TIM without integrated modem, double width
- Compact unit that can be used in a wide variety of situations:
 - As a communications processor (CP) in an S7-300
 - As a standalone device combined with an S7-400 or S7-400H via the Ethernet interface.
- It has four interfaces:
 - 2 x RJ-45 interface for attachment to Ethernet

Allows DNP3 communication via IP-based networks (LAN or WAN).

- 2 x combined RS-232/RS-485 interface

Allows DNP3 communication with a modem connected (classic WAN) or the connection of MODBUS slaves.

The interface standard (RS-232/RS-485) is specified in the interface configuration.

All four interfaces can be used at the same time for DNP3 communication. The four transmission paths can all be different and operated independently.

1.3 TIM 4R-IE DNP3 - Overview

• DNP3 communication

The SIMATIC devices named above can use DNP3 communication:

- Via any two WAN networks with DNP3 subscribers
- via two IP-based networks (WAN or LAN) with DNP3 subscribers

The four transmission paths can all be different and operated independently. All interfaces can be used for the establishment of redundant transmission paths.

- When installed as a CP in an S7-300, the following communication is also possible:
 - With the CPU
 - Via the MPI interface of a CPU 312 / 313 / 314 / 315-2 DP / 315F-2 DP with other CPUs and control center PCs connected to the MPI bus
- The TD7 software is integrated on the TIM (TD7onTIM). It can be used when the TIM is installed as a CP in an S7-300.
- Message memory: 200 000 data points
- Modules can be replaced without a PG:
 - In standalone mode using the optional C-PLUG
 - When installed as a CP in an S7-300 over the MMC of the CPU
- Optional: Battery for backup of the stored data messages and the hardware clock

Design of the TIM 4R-IE DNP3

The TIM 4R-IE DNP3 has all the advantages of the SIMATIC S7-300 system design:

- Compact design; double standard width of the SM modules of the SIMATIC S7-300
- Two 9-pin D-sub male connector with a combined RS-232/RS-485 interface for connecting a modem
- Two RJ-45 jacks for connection to Ethernet; industrial design with additional collar for inserting the IE FC RJ-45 Plug 180
- 2-pin plug-in terminal block for connecting the external supply voltage of 24 V DC
- Front LEDs for display of Ethernet and WAN communication
- Simple mounting; the TIM is installed on an S7-300 rail. If the TIM is installed in an S7-300 as a CP, it is connected to adjacent modules by means of the bus module connectors. No slot rules apply.
- Can be operated in an expansion rack (ER) in conjunction with the IM 360/361. This
 allows the TIM to be combined with a C7 control system, with the newer C7 control
 systems it can also be combined using the supplied I/O expansion cable.
- Can be operated without a fan
- A backup battery and a memory module (C-PLUG) can be installed as options.

1.4 Communications services of the TIM

DNP3 communication

The communication of the TIM is based on the DNP3 SPECIFICATION Version 2.x (2007/2009).

This handles the data traffic for the S7-CPU or for the control center PC with the aid of the DNP3 protocol via the relevant network.

DNP3 conformity level of the TIM

The DNP3 specification divides devices into classes according to their range of functions.

The DNP3 TIM supports the DNP3 implementation levels 1 - 4 according to the DNP3 specification (DNP3 Application Layer protocol Level).

Some communications objects of the TIM provide functions that go beyond the DNP3 specification, refer to the section Supported DNP3 object groups (Page 162). The DNP3 implementation level of these objects is designated "5".

To ensure that the communications functions are possible during operation, the implementation level of every DNP3 subscriber in the project is specified in the TD7onTIM configuration.

S7 communication

The TIM supports S7 communication and PG/OP communication with the following functions:

- PG functions
- Operator control and monitoring functions (HMI)
- PUT/GET (TIM 4R-IE only)

The TIM 4R-IE supports the PUT/GET services as client and server for data exchange with remote S7-300/400 stations.

Connecting MODBUS slaves

Devices that communicate using the MODBUS protocol can be connected as MODBUS slaves to a SIMATIC S7 station with a DNP3 TIM. The TIM of the S7 station operates as MODBUS master.

The communication is handled in the S7 station via the serial interface of a DNP3 TIM. The serial interface of the TIM is configured for this purpose in the SINAUT configuration tool for the MODBUS protocol.

You will find the number of MODBUS slaves that can be connected per station in the section Configuration limits (Page 28).

1.4 Communications services of the TIM

DNP3 subscriber types

The following subscriber types are specified in the DNP3 specification:

Master

Synonym: DNP3 master station

For the subscriber type "Master", the term "DNP3 master station" is used in this manual.

A master station is a higher-level controlling device.

When using DNP3 TIM modules, the following devices can operate as the DNP3 master station:

- DNP3 TIM
- Control center system

System supported by the DNP3 master function, for example an OPC client system.

Outstation

Synonym: DNP3 station

For the subscriber type "Outstation", the term "DNP3 station" is used in this manual.

As a lower-level system, the DNP3 station sends process data (measured values, statuses) to the DNP3 master station and receives switching or setpoint commands from the DNP3 master station.

DNP3 subscriber types supported by the TIM

The following DNP3 subscriber types are supported by the TIM modules:

DNP3 master station

Master in the sense of the DNP3 specification

The DNP3 master station is a DNP3 TIM in an S7-300/S7-400 station.

Due to the lower performance of the TIM 3V IE DNP3 (max. 8 possible connections), the TIM 4R IE DNP3 is recommended as the master station TIM.

In the case of the TIM 3V IE DNP3, the output device for the process data is the connected S7 CPU.

If a TIM 4R-IE DNP3 is used, the process data can be sent to control systems or other output devices via other interfaces of the module.

The polling of the stations is specified in the configuration of the TIM.

DNP3 station

Outstation in the sense of the DNP3 specification

TIM 3V-IE DNP3 or TIM 4R-IE DNP3 in an S7-300/S7-400 station

"Node station"

S7 station with a TIM 4R-IE DNP3, that connects two DNP3 networks. It has at least the following connections:

- Connection to the DNP3 master station via LAN or WAN
- Connection to hierarchically lower-level DNP3 stations via LAN or WAN

Setting the DNP3 subscriber type on the interface of the TIM

The DNP3 subscriber type is set in the configuration using the "Connection mode" of the Ethernet interfaces of the TIM.

• Master station function

The setting of the master station function on an interface has the effect that the TIM functions as a DNP3 master station on this interface.

• Station function

The setting of the station function on an interface has the effect that the TIM functions as a DNP3 station on this interface.

Node station function

The two interfaces with the "Node station" setting must therefore be connected once to the master station and once to the lower-level DNP3 network.

You make the settings for the DNP3 functions of the interfaces in the STEP 7 configuration of the TIM, refer to the section "Interfaces" tab (Page 119).

1.5 DNP3 device attributes of the TIM

Device attributes

The DNP3 protocol defines a series of device attributes that identify the functions of the devices of different manufacturers. A DNP3 master station can query and, if required, evaluate the attributes of the connected stations.

The DNP3 TIMs support the following device attributes:

Table 1-1 Device attributes of the TIM modules

Attribute	Meaning	Return value of the DNP3 TIM
211	Number of user-defined attributes	Not supported (negative acknowledgment)
212 - 215	Number of data set prototypes	In each case 0
216	Number of binary commands (object 12) in a mes- sage	10

1.5 DNP3 device attributes of the TIM

Attribute	Meaning	Return value of the DNP3 TIM
217	Accuracy of the TIM time stamp	10 ms
218	Time for which the time stamp accuracy can be maintained following synchronization.	600 s
219	Support of analog output events	Not supported (negative acknowledgment)
220	Max. index of the analog outputs	According to the configuration
221	Number of analog outputs	Max. index +1
222	Support of binary output events	Not supported (negative acknowledgment)
223	Max. index of the binary outputs	According to the configuration
224	Number of binary outputs	Max. index +1
225	Support of frozen counter events	Is supported
226	Support of frozen counters	Is supported
227	Support of counter events	Is supported
228	Max. index of the counters	According to the configuration
229	Number of counters	Max. index +1
230	Support of frozen analog inputs	Not supported (negative acknowledgment)
231	Support of analog inputs	Is supported
232	Max. index of the analog inputs	According to the configuration
233	Number of analog inputs	Max. index +1
234	Support of double bit inputs	Not supported (negative acknowledgment)
235	Max. index of double bit inputs	0
236	Number of double bit inputs	0
237	Support of event messages with binary inputs	Is supported
238	Max. index of the binary inputs	According to the configuration
239	Number of binary inputs	Max. index +1
240	Max. size of the application layer fragments in send direction (station \rightarrow master station)	2048 bytes
241	Max. size of the application layer fragments in receive direction (master station \rightarrow station)	2048 bytes
242	TIM software version	Software version
243	TIM hardware version	Hardware version
244	Not defined in the protocol specification	-
245	User-specified string (location)	Not supported (negative acknowledgment)
246	User-specified string (code)	MAC address as string
247	User-specified string (name)	Not supported (negative acknowledgment)
248	Serial number of the TIM	Not supported (negative acknowledgment)
249	DNP3 implementation level	Value of the configured conformity level of the DNP3 master station
250	Product name and model	Order number as string
252	Vendor	SIEMENS AG

Detailed information on DNP3 attributes in the DNP3 device profile

You will find a detailed overview of the attributes and properties specified in the DNP3 protocol and supported by the two DNP3 TIM modules in the DNP3 device profile.

You will find the DNP3 device profiles on the Internet pages of Siemens Automation Customer Support under the following entry IDs:

• TIM 3V-IE DNP3

Link: (https://support.industry.siemens.com/cs/ww/en/view/103655295)

• TIM 4R-IE DNP3

Link: (https://support.industry.siemens.com/cs/ww/en/view/103655863)

1.6 Other properties of the TIM

Compatible SIMATIC families

The following table shows the SIMATIC families in which the two TIM variants can be used.

	Can be used in SIMATIC family:	
	S7-300	S7-400
TIM 3V-IE DNP3	•	no
TIM 4R-IE DNP3	•	•

Interfaces

The table below shows the number of interfaces of the two TIM variants.

	Ethernet RJ-45 port	Serial interface for an exter- nal modem or for connecting MODBUS slaves
TIM 3V-IE DNP3	1	1 (RS232)
TIM 4R-IE DNP3	2	2 (RS232/RS485)

1.7 Transmission types and connection establishment

DNP3 communication between stations

Depending on the network type via which the DNP3 stations communicate, communication between the DNP3 stations is handled as follows:

• Direct communication

The DNP3 stations are connected via the following network types:

- Ethernet
- Dial-up network

A direct connection is established.

• Inter-station communication

The DNP3 stations are connected via the following network types:

DNP3 dedicated line

The connection is always via the CPU of the DNP3 master station or a higher-level node station.

Data received in the master station or node station from the transmitting source station is initially stored on the CPU of the master or node station. For this to be possible, receive objects must be configured on the TIM of the master or node station.

In a second step, the data must then be read out of the CPU by send objects and forwarded to the destination station.

Remote programming

Diagnostics and programming functions provided by SIMATIC and SIMATIC NET Telecontrol for station automation and telecontrol communication can be used via Ethernet while process data transmission is active.

You will find details in the section SINAUT diagnostics and service tool (Page 242).

1.7 Transmission types and connection establishment

Transmission types (prioritization)

The priority of the transfer of the process values from the station to the master station is configured in the parameter box "Send parameters" for sending communications objects:

The configuration of the send parameters is described in the following section: Data objects: Partner and send parameters (Page 194)

• No event class (static)

The data is read out of the image memory of the station TIM when it is polled by the DNP3 master station (class 0 poll).

1.7 Transmission types and connection establishment

• Event class 1, 2 or 3

The data is stored as an event in the send buffer and actively transferred to the DNP3 master station.

You will find detailed information about the event classes in the section Classification of the data according to the type of transmission (Page 161).

Transfer of the data can be triggered by various criteria:

- Reaching a configured number of events in the send buffer of the TIM

The configuration is described in the following section: "DNP3 parameters" dialog (Page 123) > "DNP3 event parameters" tab

For dial-up networks, you will find further setting options in the following section: Configuring WAN network nodes (Page 99)

- Settable trigger conditions:
 - Change-driven transmission
 - Cyclic transmission
 - Time-driven transmission

The configuration is described in the following section: Data objects: Memory area and triggers of the channels (Page 200)

Connection establishment

Master station connections

The initiative for connection establishment depends on the transmission type configured for a data point:

- Static data points

The current values of all data points (including the events) are always transferred as the reply to polls by the DNP3 master station. The initiative for connection establishment comes from the DNP3 master (see above "Command direction" parameter).

- Data points configured as an event

The value of a data point configured as an event is transferred on the initiative of the station, see above (event classes).

Connections between stations

To allow a station to establish the connection to a partner station actively, the "Command direction" parameter must be enabled in the sending objects (TD7onTIM configuration > TIM with TD7onTIM > Object > Send parameter).

1.8 Message memory of the TIM for events

1.8 Message memory of the TIM for events

Message memory for events

Note

Reducing the size of the message memory

The overall size of the message memory can be configured and can be reduced. Since the transmission of several thousand events via connections with a low transmission speed (modem) takes a relatively long time, a reduction may be practical.

The TIM saves the data messages (including the time stamp) of data points that are configured as an event. This reduces the data loss if disturbances occur on the communications path or if a partner fails.

Size of the message memory:

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

If you use a backup battery in the TIM 4R-IE DNP3, events are retained even if there is a power outage. On return of power, the connected DNP3 master stations can read these events.

If there are several DNP3 master stations connected, the available message memory of a station is divided up according to the number of master stations.

1.9 Time synchronization

Options for time-of-day synchronization of DNP3 stations

The system time of the station TIM of a DNP3 station can be set in two ways as described below:

- Time-of-day synchronization using DNP3 mechanisms
- Time-of-day synchronization with NTP (Network Time Protocol)

(for TIM 4R-IE DNP3 only)

Note

Avoiding time-of-day inconsistencies

Note the following points relating to time-of-day synchronization:

- Make sure that only one subscriber ever operates as the time-of-day master in a DNP3 network.
- Make sure that only one of the methods of time-of-day synchronization listed below is used.

Time-of-day synchronization using DNP3 mechanisms

The system time of the station TIM can be set by a PC of the connected DNP3 master station.

If the TIM module has established a connection to the DNP3 master station, the TIM module requests time-of-day synchronization by the master station in the accompanying internal indication bit "IIN1.4 [NEED_TIME]".

If the master station supports this function, it sends time-of-day messages with the time of day to the TIM module. The TIM system time is set whenever a time-of-day message is received.

Remember that the time of day of DNP3 master stations in UTC format generally does not take into account daylight saving time or time zones.

To request a renewed time-of-day synchronization, the TIM sets the corresponding IIN1.4 bit after a configurable time has elapsed since the last time-of-day synchronization. The synchronization cycles are specified in the configuration.

Time-of-day synchronization with NTP

The time of day synchronization using NTP is only supported by the TIM 4R IE DNP3. It is intended for the TIM as DNP3 master station.

The following use of the two Ethernet interfaces of the TIM 4R IE DNP3 is a practical solution:

- One Ethernet interface for connecting the DNP3 network
- One Ethernet interface for connecting to one or two NTP servers

As a result, the two networks are separated from each other.

The TIM supports the following variants of NTP:

• NTP

time-of-day synchronization method without authentication

• NTP (secure)

The secure method NTP (secure) uses authentication with symmetrical keys according to the hash algorithms MD5 or SHA-1.

Configuration

You configure time-of-day synchronization in STEP 7, refer to the section Configuring timeof-day synchronization (Page 134). 1.10 Configuration limits

1.10 Configuration limits

Number of communications partners (connection resources) per TIM

The maximum number of communications partners is the maximum possible number of DNP3 connections (sessions) per TIM.

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.

TIM type	Subscriber type / interface configura- tion	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			
				Dial-up network	32			
			RS232 no. 2	Dedicated line	32			
				Dial-up network	32			
	Station 32	32	Ethernet 1	TCP	16			
			Ethernet 2	TCP	16			
			RS232 no. 1	Dedicated line	16			
				Dial-up network	16			
		RS232 no. 2	Dedicated line	16				
				Dial-up network	16			
TIM 3V-IE DNP3	Master station /	8	Ethernet	TCP	8			
	node station	node station R				RS232	Dedicated line	8
				Dial-up network	8			
	Station	8	Ethernet	TCP	8			
			RS23	RS232	Dedicated line	8		
				Dial-up network	8			

Table 1-2 Overview of the connection resources

* 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

1.11 Scope of delivery

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

1.11 Scope of delivery

In addition to the TIM module, the following components ship with the product:

Bus module connector

Both TIM modules are supplied with a bus module connector allowing the TIM to be installed in an S7-300 as a CP.

Adapter cable foe TIM 4R-IE DNP3

The adapter cable for the second RS-232/RS-485 interface ships with the TIM 4R-IE DNP3.

Documentation

The "SIMATIC NET Manual Collection" with documentation ships with both TIM modules. You will find the link to the current edition on the Internet in the preface of this manual.

1.12 Requirements for operation - necessary components and services

The TIM is based on the SIMATIC S7-300, S7-400 and S7-400H systems. It expands these systems with the components listed below that include both hardware and software.

1.12.1 Hardware and required services

Required hardware components and services

To use Internet and mobile wireless services, you require suitable network providers.

The following description of the devices relates only to the communications components. CPU, power supply and I/O modules as well as rails, enclosures, cabling and other accessories are not taken into account.

DNP3 master station

An S7 station with DNP3 TIM or a PC with SIMATIC PCS 7 TeleControl is required as the DNP3 master station.

For communication via the Internet, a router is required, for example SCALANCE M816.

Communication using mobile wireless

- With connection to the Ethernet interface of the TIM:

For communication using mobile wireless and via the Internet, your GSM network provider needs an access point (APN) to the Internet. The master station is connected to the Internet; the station is connected to the GSM network.

- With connection to the serial interface of the TIM:

For communication using only mobile wireless (without Internet), you require a MODEM MD720. Your GSM network provider must support the CSD service.

• DNP3 station

To set up DNP3 stations, SIMATIC stations are required consisting of CPU, I/O modules and possibly other modules.

The following is required in the SIMATIC station for DNP3 communication:

– TIM 3V-IE DNP3

or

- TIM 4R-IE DNP3

For communication via the Internet, a router is required, for example SCALANCE M812.

For communication using mobile wireless, a router or modem is required:

- With connection to Ethernet interface: Mobile wireless router, e.g. SCALANCE M87x
- Connection to Ethernet interface: MODEM MD720 (see below) in terminal mode (CSD)

For communication via classic WAN, the TIM requires a suitable modem:

- DNP3 dedicated line: Dedicated line modem MD2

Optional: LTOP overvoltage protection modules for the dedicated line attachment

- Analog dial-up network Analog dial-up modem MD3

Alternative: Third-party modem with RS-232 interface and support of AT commands and the duplex mode

- ISDN network: ISDN MD4 modem (is no longer available)

Alternative: Third-party ISDN modem with RS-232 interface and support of AT commands and the duplex mode

- GSM network: MODEM MD720

When connecting modems, you require a suitable cable.

For more information on routers, modems, connecting cables and optional components, refer to the section Accessories (Page 313).

1.12.2 Compatible SIMATIC CPUs

1.12.2.1 CPUs for installing the TIM 3V-IE DNP3 in an S7-300

Compatible CPU types in the S7-300

The TIM 3V-IE DNP3 can be used in an S7-300 as a communications processor (CP). In principle, all S7-300 standard and compact CPUs can be combined with this TIM. All the following standard and compact CPUs can be used without restrictions.

Standard CPU modules

CPU 312	ab 6ES7 312-1AE14-0AB0
CPU 314	ab 6ES7 314-1AG14-0AB0
CPU 315-2 DP	ab 6ES7 315-2AH14-0AB0
CPU 315-2 PN/DP	ab 6ES7 315-2EH14-0AB0
CPU 315T-2 DP	ab 6ES7 315-6TH13-0AB0
CPU 315F-2 DP	ab 6ES7 315-6FF04-0AB0
CPU 315F-2 PN/DP	ab 6ES7 315-2FJ14-0AB0
CPU 317-2 DP	ab 6ES7 317-2AJ10-0AB0
CPU 317-2 PN/DP	ab 6ES7 317-2EK14-0AB0
CPU 317T-2 DP	ab 6ES7 317-6TK13-0AB0
CPU 317F-2 DP	ab 6ES7 317-6FF03-0AB0
CPU 317F-2 PN/DP	ab 6ES7 317-2FK14-0AB0
CPU 319F-3 PN/DP	ab 6ES7 318-2FL01-0AB0
CPU 319-3 PN/DP	ab 6ES7 318-3EL01-0AB0

Compact CPU modules

CPU 312C	ab 6ES7 312-5BE03-0AB0
CPU 313C	ab 6ES7 313-5BF03-0AB0
CPU 313C-2 PtP	ab 6ES7 313-6BF03-0AB0
CPU 313C-2DP	ab 6ES7 313-6CF03-0AB0
CPU 314C-2 PtP	ab 6ES7 314-6BG03-0AB0
CPU 314C-2 DP	ab 6ES7 314-6CG03-0AB0

Instead of an S7-300 standard or compact CPU, one of the following C7 control systems can also be used.

C7 control systems

SIPLUS C7-613 ab 6ES7 613-1CA02-4AE3 SIPLUS C7-635 KEY ab 6ES7 635-2EC02-4AE3

1.12.2.2 CPUs for installing the TIM 4R-IE DNP3 in an S7-300

Introduction

The TIM 4R-IE DNP3 can be used in an S7-300 as a communications processor (CP). In principle, all S7-300 standard and compact CPUs can be combined with this TIM. All the following standard and compact CPUs can be used without restrictions.

Standard CPU modules

CPU 312	ab 6ES7 312-1AE14-0AB0
CPU 314	ab 6ES7 314-1AG14-0AB0
CPU 315-2 DP	ab 6ES7 315-2AH14-0AB0
CPU 315-2 PN/DP	ab 6ES7 315-2EH14-0AB0
CPU 315T-2 DP	ab 6ES7 315-6TH13-0AB0
CPU 315F-2 DP	ab 6ES7 315-6FF04-0AB0
CPU 315F-2 PN/DP	ab 6ES7 315-2FJ14-0AB0
CPU 317-2 DP	ab 6ES7 317-2AJ10-0AB0
CPU 317-2 PN/DP	ab 6ES7 317-2EK14-0AB0
CPU 317T-2 DP	ab 6ES7 317-6TK13-0AB0
CPU 317F-2 DP	ab 6ES7 317-6FF03-0AB0
CPU 317F-2 PN/DP	ab 6ES7 317-2FK14-0AB0
CPU 319F-3 PN/DP	ab 6ES7 318-2FL01-0AB0
CPU 319-3 PN/DP	ab 6ES7 318-3EL01-0AB0

Compact CPU modules

CPU 312C	ab 6ES7 312-5BE03-0AB0
CPU 313C	ab 6ES7 313-5BF03-0AB0
CPU 313C-2 PtP	ab 6ES7 313-6BF03-0AB0
CPU 313C-2DP	ab 6ES7 313-6CF03-0AB0
CPU 314C-2 PtP	ab 6ES7 314-6BG03-0AB0
CPU 314C-2 DP	ab 6ES7 314-6CG03-0AB0

Instead of an S7-300 standard or compact CPU, one of the following C7 control systems can also be used.

C7 control systems

SIPLUS C7-613	ab 6ES7 613-1CA02-4AE3
SIPLUS C7-635 KEY	ab 6ES7 635-2EC02-4AE3

1.12.2.3 CPUs for a standalone TIM 4R-IE DNP3 with S7-400 or S7-400H

Compatible CPU types for a standalone TIM 4R-IE DNP3

In standalone mode, in other words, without an S7-300-CPU, the TIM 4R-IE DNP3 is ideally suited as a communications processor for an S7-400 or S7-400H. They are then linked over one of the Ethernet ports of the TIM.

With an S7-400 or S7-400H, an Ethernet CP is used as the interface. The following S7-400-CPUs can be linked over an Ethernet CP:

S7-400

CPU 412-1	ab 6ES7 412-1XJ05-0AB0	(Version 02)
CPU 412-2	ab 6ES7 412-2XJ05-0AB0	(Version 01)
CPU 412-2 PN/DP	ab 6ES7 412-2EK06-0AB0	(Version 01)
CPU 414-2	ab 6ES7 414-2XK05-0AB0	(Version 01)
CPU 414-3	ab 6ES7 414-3XM05-0AB0	(Version 01)
CPU 414-3 PN/DP	ab 6ES7 414-3EM06-0AB0	(Version 01)
CPU 414F-3 PN/DP	ab 6ES7 414-3FM06-0AB0	(Version 01)
CPU 416-2	ab 6ES7 416-2XN05-0AB0	(Version 01)
CPU 416-3	ab 6ES7 416-3XR05-0AB0	(Version 01)
CPU 416-3 PN/DP	ab 6ES7 416-3ES06-0AB0	(Version 01)
CPU 416F-2	ab 6ES7 416-2FN05-0AB0	(Version 01)
CPU 416F-3 PN/DP	ab 6ES7 416-3FS06-0AB0	(Version 01)
CPU 417-4	ab 6ES7 417-4XT05-0AB0	(Version 01)
S7-400H		

CPU 412-3H 6ES7 412-3HJ14-0AB0 (Ver	sion 01)
	501101)
CPU 412-5H 6ES7 412-5HK06-0AB0 (Vers	sion 01)
CPU 414-4H 6ES7 414-4HM14-0AB0 (Vers	sion 01)
CPU 417-4H 6ES7 417-4HT14-0AB0 (Ver	sion 01)

1.12.3 Software

1.12.3.1 Required software components

Software components

- Configuration software
 - STEP 7 V5

STEP 7 is required for the basic configuration.

- SINAUT engineering software

The SINAUT configuration and diagnostics software from this software package is required for the PG.

• Control center software

SIMATIC PCS 7 TeleControl from the SIMATIC environment can be used as control center software.

You will find the required software versions in the section Software versions (Page 36).

1.12.3.2 Software versions

Required software

This manual applies to the following configuration software versions:

• SINAUT engineering software

Required version: V5.5 + SP1

Order number: 6NH7997-0CA54-0AA0

An already installed full version V5.x can upgraded to the current version with an upgrade package. You will find the upgrade package under the following article number: 6NH7997-0CA54-0GA0

Information on the upgrade package can be found on the Internet pages of Siemens Industry Online Support under the following entry ID: 87795994 (http://support.automation.siemens.com/WW/view/en/87795994)

You will find the STEP 7 version required for the SINAUT engineering software in the "STEP 7" bulleted point below.

Operating system for the SINAUT engineering software

For the the SINAUT engineering software you require a Windows operating system compatible with the installed version of STEP 7.
1.12 Requirements for operation - necessary components and services

• STEP 7

At least STEP 7 V5.4 Service Pack 4 is required.

As of STEP 7 V5.4 SP4 the following operating systems are supported:

- Windows XP Professional SP2
- Windows Server 2003 SP2

With STEP 7 V5.5 SP1, the following operating systems are supported:

- Windows 7 (32-bit or 64-bit)

The Windows XP mode in Windows 7 is not released.

- Windows Server 2008 (32-bit), without or with SP1
- Windows Server 2008 R2 (64-bit), without or with SP1

There is no guarantee that STEP 7 will run on other operating systems; any attempt to do so is the responsibility of the user. Refer to the readme of the relevant STEP 7 version for further details.

• SIMATIC PCS 7

The devices described in this manual are compatible with the following process control system versions:

- SIMATIC PCS 7 V7.1 SP2 (basic system for the DNP3 master station)
- SIMATIC PCS 7 TeleControl Server V7.1 SP2 (add-on for telecontrol functions)

1.12.3.3 The SINAUT engineering software

Components of the SINAUT engineering software and how it is supplied

The SINAUT ST7 Engineering Software is made up of two parts:

• The SINAUT configuration and diagnostics software

The software is installed on the programming device or on the engineering station.

• The SINAUT TD7 block library for the CPU (not necessary)

The TD7 library contains software blocks for telecontrol communication. It is not required for DNP3 TIMs.

The the TD7 software is integrated in DNP3 TIMs as TD7onTIM. It is configured with the SINAUT configuration software.

How the SINAUT engineering software is supplied

The SINAUT engineering software is supplied on a CD-ROM.

The CD-ROM also contains the following manuals in electronic form (German/English):

- DNP3-TIM System manual
- SINAUT ST7 System Manual (volume 1, volume 2)

1.12 Requirements for operation - necessary components and services

Licensing

The software package is a working package that can be used for any number of projects without licensing.

Components of the SINAUT configuration and diagnostics software

The SINAUT configuration and diagnostics software includes the following components:

• Expanded functions for STEP 7 V5

When you install the SINAUT configuration and diagnostics software, additional software functions are integrated in the STEP 7 installation:

- Enhancement in STEP 7 NetPro

With the enhanced functions, WANs and network nodes can be displayed and assigned parameters in NetPro.

- Enhancement in STEP 7 HW Config

With the enhanced functions, the TIM modules can be displayed and assigned parameters in HW Config.

• The SINAUT Configuration Tool

This is used for project-wide functions such as connection configuration and subscriber management.

The SINAUT diagnostics and service tool.

Apart from the diagnostics functions of STEP 7, the diagnostics and service tool can be used, for example, to load new firmware on a TIM.

Expansions in STEP 7 HW Config

The catalog in STEP 7 HW Config is expanded by the SINAUT folder in the SIMATIC 300 directory. This lists all available TIM modules.

You can select the required TIM module from the SINAUT folder and install it in the S7 rack.

The relevant properties dialogs are available for assigning parameters to the TIM modules, telecontrol networks and network nodes. They can also be called from NetPro.

Expansions in STEP 7 NetPro

The catalog in STEP 7 NetPro is expanded by the telecontrol networks in the Subnets directory. You can select the telecontrol networks you require from this directory and install them in the STEP 7 network window.

The TIM modules are interconnected with the networks in the STEP 7 network window using the mouse. Errors in the interconnections are rejected immediately.

The relevant properties dialogs are available for assigning parameters to the TIM modules, telecontrol networks and network nodes. They can also be called from HW Config.

The SINAUT Configuration Tool

The SINAUT configuration tool is a separate configuration tool embedded in the STEP 7 environment. This allows you to perform the remaining tasks required for telecontrol networks. It consists of the following:

- Connection configuration
- Subscriber administration
- SINAUT ST1 Configuration Overview (not necessary)

Connection configuration

The first step is to use the connection configuration function to specify the subscribers between which a connection is necessary. The tool provides you with a selection of all theoretically possible connections in the right-hand pane of the split window. These are identified automatically by the tool based on the network configured with NetPro. You then select the actually required connections and copy them to the left-hand pane using the shortcut menu.

Subscriber administration

Among other things, the subscriber administration provides a list with all subscribers. Where necessary, you can make subscriber-specific adaptations, for example, changing the SINAUT subscriber number of the individual devices.

The TD7 software is also configured in the subscriber administration (TD7onTIM); in other words, the configuration of the data messages to be sent and received. Based on the configuration data, the software generates the system data blocks (SDBs) for the CPU and TIM modules.

The SINAUT diagnostics and service tool

In addition to the diagnostics functions familiar from STEP 7, you also have access here to TIM-specific diagnostic information.

Using the service tool, new software can also be loaded on a TIM.

1.12.3.4 Compatibility of the versions of the SINAUT configuration tool

Use of the SINAUT configuration tool in existing projects

If you want to edit existing projects created with older versions of the SINAUT configuration tool with the software version described here, remember the following:

Note

Editing with the current version of the SINAUT configuration tool

If you edit an existing project with the version of the SINAUT configuration tool described here, do not edit it again with the older version of the configuration tool. This can lead to inconsistencies.

1.12 Requirements for operation - necessary components and services

Network structures and configurations

2.1 Overview of the possible network types

With the DNP3 TIM, hierarchical networks consisting of control center and stations and if required node stations can be set up via a WAN.

IP-based WAN

DNP3 communication is possible between station and control center via IP-based WANs:

- Via Ethernet (copper cable)
- Over fiber-optic cable
 - For example by using SCALANCE X switches with optical ports; this allows distances of up to 120 km to be covered.

or also

- In conjunction with transmission systems such as PCM30 or OTN

Classic WAN

Dedicated lines

Dedicated lines, private or leased copper cable or fiber-optic cable can be used as classic WANs for the data transmission. A suitable dedicated line modem is required for data transmission, for example the dedicated line modem MD2.

• Dial-up networks

The following networks can be used for data transmission:

- Private wireless networks
- Analog telephone network
- Digital ISDN network
- Mobile wireless network (GSM)

2.2 Communication relations between DNP3 subscribers

Possible communications relations

- A DNP3 master station can communicate with several DNP3 stations.
- A DNP3 station can communicate with several master stations.

2.3 Communication with MODBUS slaves

• A node station with DNP3 TIMs can communicate with a higher-level DNP3 master station and with DNP3 stations of a lower-level DNP3 network.

This means that DNP3 communication via several lower-level hierarchical networks is not possible.

• Communication between station and station is also not supported.

Details on the attachment options can be found in the section Technical specifications (Page 299).

The initiative for communication generally comes from the DNP3 master station that sends commands to and polls the lower-level devices. The DNP3 station reacts with a corresponding response.

Stations can also send spontaneous (unsolicited) messages relating to events to the master station.

Communication relations that are not supported

• Communication between master station and master station is not supported.

2.3 Communication with MODBUS slaves

Connecting MODBUS slaves

Devices that communicate using the MODBUS RTU protocol can be connected as MODBUS slaves to a SIMATIC S7 station with a DNP3 TIM. The S7 station operates as MODBUS master. The communication is handled in the S7 station via the serial interface of a DNP3 TIM.

In the DNP3 network, the S7 station to which the MODBUS slave or slaves are connected operates as a DNP3 station.

2.4 Configuration options with the DNP3 TIMs

2.4.1 Configurations with S7-300

Possible configurations

The following configuration options are possible with DNP3 TIMs in the S7-300. You will find the numbering of the station connectors in the following figure.

- 1. Single connection of a station via 1 Ethernet network
- 2. Single connection of a station via 1 classic WAN network, alternatively:
 - DNP3 dedicated line network
 - DNP3 dial-up network

2.4 Configuration options with the DNP3 TIMs

- Redundant connection of a station via 1 DNP3 dedicated line or dial-up network and 1 Ethernet network
- Redundant connection of a station via 2 classic WAN networks (DNP3 dedicated line or dial-up network)
- 5. Redundant connection of a station via 2 Ethernet networks



Image 2-1 Configurations with S7-300

2.4.2 Configurations with S7-400

Possible configurations

The following configuration options are possible with DNP3 TIMs in the S7-400. You will find the numbering of the station connectors in the following figure.

- 1. Single connection of a station via 1 Ethernet network
- 2. Single connection of a station via 1 DNP3 dedicated line or dial-up network
- Redundant connection of a station via 1 DNP3 dedicated line or dial-up network and 1 Ethernet network

2.4 Configuration options with the DNP3 TIMs

- Redundant connection of a station via 2 DNP3 dedicated line or dial-up networks (or mixed)
- 5. Connections between the stations themselves via a local Ethernet network are not DNP3 connections. The connections are configured as S7 connections.

Access to the CPU data of the DNP3 station is configured using the TD7onTIM objects of the TIM. Data is exchanged using the PUT/GET services.

The connection mode of the Ethernet interface of the TIM in DNP3 station 3 must be set to "Neutral".

Note

Max. 1 CPU connected to stand-alone TIM

A maximum of one CPU can be connected to a stand-alone TIM (in the example Ethernet network 5).



Image 2-2 Configurations with S7-400

2.4.3 Configurations with S7-400H

Possible configurations

The following configuration options are possible with DNP3 TIMs in the S7-400H. You will find the numbering of the station connectors in the following figure.

- 1. Single connection of a station via 1 Ethernet network
- 2. Single connection of a station via 1 DNP3 dedicated line or dial-up network
- Redundant connection of a station via 1 DNP3 dedicated line or dial-up network and 1 Ethernet network
- Redundant connection of a station via 2 DNP3 dedicated line or dial-up networks (or mixed)
- 5. Connections between the stations themselves via a local Ethernet network are not DNP3 connections. The connections are configured as S7 connections.

Access to the CPU data of the DNP3 station is configured using the TD7onTIM objects of the TIM. Data is exchanged using the PUT/GET services.

The connection mode of the Ethernet interface of the TIM in DNP3 station 3 must be set to "Neutral".

Note

Max. 1 CPU connected to stand-alone TIM

A maximum of one CPU can be connected to a stand-alone TIM (in the example Ethernet network 5).

An H-CPU counts as 1 CPU.

Device redundancy with 2 TIM modules on an S7-400H is not supported.

2.5 Configuration variants with IP-based WAN



Image 2-3 Configurations with S7-400H

2.5 Configuration variants with IP-based WAN

Hierarchical networks with node stations

The two following examples illustrate configurations in a star or ring topology.

You will find hierarchical network structures with node stations in the following section Configuration variants with classic and IP-based WAN (Page 48). The hierarchical setup with node stations shown there also applies to IP-based networks.

2.5 Configuration variants with IP-based WAN



IP-based optical network, linking via switches in a ring topology

Image 2-4 IP-based network, linking via switches

IP-based communication via DSL



Image 2-5 IP-based communication via DSL

2.6 Configuration variants with classic and IP-based WAN

2.6 Configuration variants with classic and IP-based WAN

Dedicated line configurations



Image 2-6 Examples of dedicated line configurations

2.6 Configuration variants with classic and IP-based WAN

Dial-up network configurations



Image 2-7 Examples of dial-up network configurations

2.6 Configuration variants with classic and IP-based WAN

Various redundant configurations



Image 2-8 Examples of redundant configurations

LEDs and connectors

3.1 TIM 3V-IE DNP3

3.1.1 Display elements, connectors and buttons







Image 3-2 Front view of a TIM 3V-IE DNP3 with front panel removed

For information on the function of the RESET button, refer to "Default startup" in the section Startup activities of the TIM 3V-IE DNP3 (Page 70).

3.1.2 LEDs of the TIM 3V-IE DNP3

The following table summarizes the meaning of the nine LEDs during normal operation. The display during startup is explained in the section "Startup activities of the TIM 3V-IE DNP3 (Page 70)".

Table 3-1 Meaning of the LEDs on the front panel of the TIM 3V-IE DNP3

LED no.	Labeling	Relevant TIM port	Description
1	SF	All	Group error Indicates missing or bad parameter settings and RAM errors.
2	None	-	-

LED no.	Labeling	Relevant TIM port	Description
3	LINK	Ethernet	Connection to Ethernet
			LED is lit when there is a physical connection to Ethernet.
			LED is off when there is no physical connection to Ethernet.
4	RX/TX	Ethernet	Data flow over Ethernet
			The display changes with each packet received or sent over Ether- net.
5	RUN	-	Module in RUN
			LED is lit when the module completes startup without error or is switched to RUN mode by the PG.
			LED is off when the module is switched to STOP mode by the PG.
6	STOP	-	Module in STOP
			LED is lit when the module is switched to STOP mode by the PG.
			LED is off when the module is switched to RUN mode by the PG

Table 3-2 Meaning of the LEDs behind the front panel of the TIM 3V-IE DNP3

LED no.	Labeling	Relevant TIM port	Type of WAN driver	Description
7	KBus	MPI / K bus	-	Data flow over MPI / backplane bus
				The display state changes with each message received or sent over MPI / backplane bus.
8	TxD	RS-232 interface	Dedicated line	Transmit data LED is lit constantly and is off while a message is being sent (TXD).
9	RxD	RS-232 interface	Dedicated line	Receive data As long as receive level (DCD) is detected, the LED is lit and goes off while a message is being received (RXD).

3.1 TIM 3V-IE DNP3

3.1.3 Pinout of the ports

RS-232 interface

The connector for the RS-232 port is designed as a 9-pin D-sub miniature connector (male). The pinout is shown in the following table. As an RS-232 port, the pinout corresponds to that of a standardized PC connector.

Illustration	Pin no.	Signal name	Signal direction	Remark
	1	DCD	Input	
	2	RXD	Input	
	3	TXD	Output	
\frown	4	DTR	Output	
	5	GND		
•	6	-		
• • •	7	RTS	Output	
<u>о</u> σ	8	CTS	Input	
	9	-		

Table 3-3 Pinout of the RS-232 port connector for connecting an external modem

Ethernet interface

The connector of the Ethernet port is designed as an 8-pin RJ-45 Western jack. The pinout is shown in the following table.

Table 3-4 Pinout of the RJ-45 Western jack for the Ethernet port

Illustration	Pin no.	Signal name	Signal direction	Remark
	1	TXD+	Output	
8	2	TXD-	Output	
	3	RXD+	Input	
5	4	-		
	5	-		
2	6	RXD-	Input	
	7	-		
	8	-		

3.2 TIM 4R-IE DNP3

3.2.1 Display elements, connectors and buttons



Image 3-3 Front view of the TIM 4R-IE DNP3 with closed front panel

For information on the RESET button, refer to "Default startup" in the section Startup activities of the TIM 4R-IE DNP3 (Page 73).

3.2 TIM 4R-IE DNP3



Image 3-4 Front view of the TIM 4R-IE DNP3 with front panel removed

On the rear of the housing, there is an opening for the optional C-PLUG. The configuration data of the TIM 4R-IE DNP3 can be stored on the C-PLUG. If service is required, a standalone TIM can be replaced without needing a PG.

3.2.2 LEDs of the TIM 4R-IE DNP3

The following table summarizes the meaning of the LEDs during normal operation. The display during startup is explained in the section "Startup activities of the TIM 4R-IE DNP3 (Page 73)".

LED no.	Labeling	Relevant TIM port	Type of WAN driver	Description
1	BATF	All	-	If there is a functioning battery installed, the LED is off.
				The LED lights up red if the battery is not inserted in the battery compartment or if the battery voltage is too low.
2	KBus	K bus	-	Data flow over the backplane bus
				The display state changes with each message re- ceived or sent over the backplane bus.
3	TXD1	RS-232 interface 1	Dedicated line	Transmit data
				LED is lit constantly and is off while a message is being sent (TXD).
4	RXD1	RS-232 interface 1	Dedicated line	Receive data
				As long as receive level (DCD) is detected, the LED is lit and goes off while a message is being received (RXD).
5	TXD2	RS-232 interface 2	Dedicated line	Transmit data
				LED is lit constantly and is off while a message is being sent (TXD).
6	RXD2	RS-232 interface 2	Dedicated line	Receive data
				As long as receive level (DCD) is detected, the LED is lit and goes off while a message is being received (RXD).

Table 3- 5	Meaning of the LEDs on the left of the front panel of the TIM 4R-IE	DNP3
Table 3- 3		

Table 3- 6	Meaning of the LEDs on the right of the front panel of the TIM 4R-IE DNP3	
	meaning of the LEDS of the right of the nont parter of the rim 410-1E DN 5	

LED no.	Labeling	Relevant TIM port	Description
7	SF	All	Group error
			Indicates missing or bad parameter settings and RAM errors.
8	-	-	-
9	P 1	Ethernet	Connection to Ethernet (interface 1)
			LED lights up yellow if there is a physical connection to Ethernet. Green flashing LED indicates data flow.
			LED is off when there is no physical connection to Ethernet.
10	P 2	Ethernet	Connection to Ethernet (interface 2)
			LED lights up yellow if there is a physical connection to Ethernet. Green flashing LED indicates data flow.
			LED is off when there is no physical connection to Ethernet.
11	RUN	-	Module in RUN
			LED is lit when the module completes startup without error or is switched to RUN mode by the PG.
			LED is off when the module is switched to STOP mode by the PG.
12	STOP	-	Module in STOP
			LED is lit when the module is switched to STOP mode by the PG.
			LED is off when the module is switched to RUN mode by the PG.

3.2 TIM 4R-IE DNP3

3.2.3 Pinout of the ports

RS-232/RS-485 interfaces

The plugs for the two serial ports are designed as a 9-pin D-sub miniature connectors (male). The pinout of the two connectors is identical and is shown in the following table. As an RS-232 port, the pinout corresponds to that of a standardized PC connector.

This is a combined RS-232/RS-485 port. As default, the ports are set to RS-232. The switchover to RS-485 is set in the STEP 7 configuration and is therefore part of the configuration data of the TIM 4R-IE DNP3.

Illustration	Pin no.	Signal name	Signal direction	Remark
	1	DCD	Input	
	2	RXD	Input	Switching over to RS-485 in the configuration
	3	TXD	Output	Switching over to RS-485 in the configuration
00	4	DTR	Output	
	5	GND		
φ ο ση	6	-		
	7	RTS	Output	
	8	CTS	Input	
	9	-		

Table 3-7 Pinout of the connector of the combined RS-232/RS-485 port

Ethernet ports

The two Ethernet ports are designed as 8-pin RJ-45 Western jacks. The pinout is shown in the following table.

Table 3-8 Pinout of the RJ-45 Western jack for the Ethernet port

Illustration	Pin no.	Signal name	Signal direction	Remark
	1	TXD+	Output	
8	2	TXD-	Output	
	3	RXD+	Input	
	4	-		
	5	-		
2	6	RXD-	Input	
	7	-		
	8	-		

Installation and commissioning

4.1 Installation guide

4.1.1 Installation of a DNP3 TIM in an S7-300

Installation in a rack

With standard and compact CPU modules, the TIM can be inserted into any of the racks 0 to 3 but only in expansion racks 1 to 3 if these racks are connected to the CPU over the IM 360/IM 361 interface modules.

With the C7 control systems, the TIM can be inserted in any of the expansion racks 1 to 3. These are connected to the C7 device over IM 360/IM 361 interface modules (the IM 360 is already integrated in the C7 device). With the C7-635 and C7-636 devices, this is also possible without the IM 361 if no more than four modules including the TIM are connected externally.

For all S7-300 racks the following applies: All slots designed for SM, FM or CP can also be used for the TIM.

A bus module connector ships with every TIM. The TIM is connected to the module to its left by the bus module connector.

Note

In all of the sample configurations of the S7-300, it is assumed that a 24 V power supply is available for the CPU, the TIMs and the other modules.

Note

Direct connection of a TIM 3V-IE DNP3 to the PROFINET interface of an S7-300-CPU is not possible!

4.1.2 Configuration of an S7-300 with a DNP3 TIM

Note

A maximum of one TIM can be installed in an S7-300.

4.1 Installation guide

S7-300 with modem connection for access to the WAN

To implement classic WAN access for an S7-300, you can use a TIM 3V-IE DNP3 or TIM 4R-IE DNP3. The following figure shows such a configuration.



Image 4-1 SIMATIC S7-300 with TIM 3V-IE DNP3 with 1 connection to classic WAN via an external MDx modem

Other modems with an RS-232 interface can be used, for example wireless devices.

S7-300 with attachment to Ethernet





A module is required on the Ethernet interface (RJ-45) of the TIM to link the TIM to an IPbased WAN. The following are, for example, possible:

- SCALANCE X switches for twisted-pair or FO cable
- SCALANCE W wireless devices for data transmission over IWLAN
- · Other wireless devices optimized for Ethernet
- 3G/UMTS router SCALANCE M875 for data transfer via mobile wireless with GPRS
- ADSL router SCALANCE M812 for data transfer via the Internet
- Backbone transmission systems such as OTN, PCM30

Two examples are illustrated below.



Image 4-3 SIMATIC S7-300 with TIM 3V-IE DNP3 connected to a fiber-optic cable via a SCALANCE X-200





4.1.3 Installation of a stand-alone TIM 4R-IE DNP3

Installation

When installed separately, the TIM is normally installed on a separate S7-300 standard rail, when necessary along with a power supply module to supply the TIM with 24 V. The bus module connector that ships with each TIM is not required here, because the TIM and modem are only connected together via a 6NH7701-xxx connecting cable.

4.1 Installation guide

4.1.4 Connection of a stand-alone TIM 4R-IE DNP3 to S7-400 / S7-400H

TIM 4R-IE DNP3 with SIMATIC S7-400 or SIMATIC S7-400H

The TIM 4R-IE DNP3 is connected to a SIMATIC S7-400 or SIMATIC S7-400H via one of the Ethernet interfaces of the TIM. With the S7-400 / S7-400H, an Ethernet CP is used as the interface.



Image 4-5 SIMATIC S7-400 with TIM 4R-IE DNP3 connected over Ethernet, 1 connection to IP-based WAN or LAN,

2 connections to classic WAN, for example via MDx modems

Instead of the MDx modem, other modems with an RS-232 or RS-485 interface can also be used, for example wireless devices.

A 3G/UMTS router SCALANCE M875 for IP-based communication via a GSM network can, for example, be connected to the second Ethernet interface of the TIM.

Per TIM, one (1) S7-400 or S7-400H cab be connected. An H-CPU counts as 1 CPU. With an S7-400, one (1) connection resource is required per TIM.

4.1.5 Dimensions for installation

Introduction

This section contains information on the dimensions for installing DNP3 components. You will require this information when planning the mechanical layout of the system.

Dimensions for installation of the components

Table 4-1 Dimensions for installation of the SINAUT DNP3 components	
---	--

Module	Module width	Module height	Max. depth	Installation on
Communications module TIM 3V-IE DNP3	40 mm	125 mm	120 mm or 150 mm with open front panel	S7 rail
Communications module TIM 4R-IE DNP3	80 mm	125 mm	120 mm or 180 mm with open front panel	S7 rail

4.1.6 Permitted ambient temperatures with horizontal and vertical installation

Horizontal and vertical installation

You can operate the DNP3 components both in horizontally and in vertically installed racks.

Permitted ambient temperature

The DNP3 components can be operated in the same temperature range specified for the S7-300.

Installation position	Permitted ambient temperature (operation)
TIM TIM Horizontally installed rack	0 to 60 °C
	0 to 40 °C
Vertically installed rack	

Table 4-2 Permitted ambient temperatures for the SINAUT TIM modules

4.2 Mounting and connecting up a TIM

4.2.1 Important notes on using the device

Safety notices on the use of the device

Note the following safety notices when setting up and operating the device and during all associated work such as installation, connecting up or replacing the device.

Safety requirements for installation

The devices are "open equipment" according to the standard IEC 61010-2-201or UL 508 / CSA C22.2 No. 142. To fulfill requirements for safe operation with regard to mechanical stability, flame retardation, stability, and protection against contact, the following alternative types of installation are specified:

- Installation in a suitable cabinet.
- Installation in a suitable enclosure.
- Installation in a suitably equipped, enclosed control room.

4.2.1.1 Notices on use in hazardous areas

The device may only be operated in an environment with pollution degree 1 or 2 (see IEC 60664-1).

EXPLOSION HAZARD

The device must not be opened.

Power supply

The equipment is designed for operation with Safety Extra-Low Voltage (SELV) by a Limited Power Source (LPS).

This means that only SELV / LPS complying with IEC 60950-1 / EN 60950-1 / VDE 0805-1 must be connected to the power supply terminals. The power supply unit for the equipment power supply must comply with NEC Class 2, as described by the National Electrical Code (r) (ANSI / NFPA 70).

EXPLOSION HAZARD

DO NOT CONNECT OR DISCONNECT EQUIPMENT WHEN A FLAMMABLE OR COMBUSTIBLE ATMOSPHERE IS PRESENT.

EXPLOSION HAZARD

SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2 OR ZONE 2.

When used in hazardous environments corresponding to Class I, Division 2 or Class I, Zone 2, the device must be installed in a cabinet or a suitable enclosure.

4.2.1.2 Notices on use in hazardous areas according to ATEX / IECEx

Requirements for the cabinet

To comply with EC Directive 94/9 (ATEX95) or the conditions of IECEx, this enclosure or cabinet must meet the requirements of at least IP54 in compliance with EN 60529.

If the cable or conduit entry point exceeds 70 °C or the branching point of conductors exceeds 80 °C, special precautions must be taken. If the equipment is operated in an air ambient in excess of 50 °C, only use cables with admitted maximum operating temperature of at least 80 °C.

Take measures to prevent transient voltage surges of more than 40% of the rated voltage. This is the case if you only operate devices with SELV (safety extra-low voltage).

4.2.1.3 Notices on use in hazardous areas according to UL HazLoc

EXPLOSION HAZARD

DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D or non-hazardous locations only.

This equipment is suitable for use in Class I, Zone 2, Group IIC or non-hazardous locations only.

4.2.2 Installing the TIM modules

Both DNP3 TIM types can be installed as a CP in an S7-300 device.



Only 1 DNP3 TIM can be installed per S7 station.

The TIM 4R-IE DNP3 can also be mounted as a standalone device on an S7-300 rail and then communicates via Ethernet with S7-400, S7-400H or S7-300 CPU modules and/or a PC control center.

The following sections describe how to mount the devices as a CP or standalone device.

4.2.3 Installing a TIM module as CP

Order of installation

Note

Only 1 DNP3 TIM module may be installed in an S7-300. This means that TIM modules of other types cannot be added either.

Install a TIM as a CP in an S7-300 rack by following the steps in the order shown below:

- 1. Turn off the power supply to the CPU.
- 2. A bus module connector ships with the TIM. Insert this in the backplane connector of the module to the left of the TIM.
- 3. If you want to install further modules to the right of the TIM, insert the bus module connector of the next module into the right backplane connector of the TIM.
- 4. Place the TIM on the standard rail and push it in towards the bottom.
- 5. Screw the TIM securely into position.
- 6. Connect the TIM to the same power supply as the CPU.
- If you are connecting the TIM to an external modem, the insert the 9-pin D-sub connector of the modem connecting cable into the X1 (or X2) connector of the TIM and screw it tight.
- 8. Turn on the power supply.

The TIM starts up. The LEDs indicate the current start-up activities (see separate section *Start-up activities*).

Once it has started up, the TIM can be supplied with its parameters (SDBs) using the SINAUT diagnostics and service tool.

With the TIM 3V-IE DNP3 and the TIM 4R-IE DNP3, the SDBs can also be loaded on the memory card of the S7-300 CPU, with the TIM 4R-IE DNP3, you can also use the optional C-PLUG of this module for storage. The TIM receives then its configuration data from the CPU during startup or takes it from the inserted C-PLUG.

4.2.4 Installing a TIM 4R-IE DNP3 as a standalone device

Order of installation

To install the TIM 4R-IE DNP3 as a standalone device on an S7-300 rail, follow the steps below in the order shown:

- 1. Place the TIM on the standard rail and push it in towards the bottom.
- 2. Screw the TIM securely into position.
- Connect the TIM to the power supply. Since this is a separate TIM rack, this does not need to be the power supply of the CPU with which the TIM is connected via Ethernet.

- If you are connecting the TIM to an external modem, the insert the 9-pin D-sub connector of the modem connecting cable into the X1 or X2 connector of the TIM 4R-IE DNP3 and screw it tight.
- Connect the TIM to the S7-CPU(s) or the PC of the control center. With a TIM 4R-IE DNP3, this is via Ethernet.
- 6. Once the wiring is completed, the power supply can be turned on.

The TIMs start up. The LEDs on each TIM indicate the current start-up activities, refer to the section Commissioning the TIM (Page 70).

7. Once it has started up, the TIM can be supplied with its parameters (SDBs) using the SINAUT diagnostics and service tool.

With the TIM 3V-IE DNP3 and the TIM 4R-IE DNP3, the SDBs can also be loaded on the memory card of the S7-300 CPU, with the TIM 4R-IE DNP3, you can also use the optional C-PLUG of this module for storage. The TIM receives then its configuration data from the CPU during startup or takes it from the inserted C-PLUG.

4.2.5 Connecting the TIM to the power supply

Connecting up only with power off

Connecting the TIM module to a live power supply can damage the module. Connect the module to the power supply only when the power supply is off.

SELV

The power for the device (24 V DC) must be generated as a safe extra low voltage. This means it must be a SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage) according to DIN VDE 0100 Part 410 (IEC 60364-4-41).

Cables

To wire the power supply, use flexible cables with a cable cross-section of 0.25 ...0.75 mm².

If you wire only one cable per connection, no wire-end ferrule is necessary.

Wiring

To wire up the power supply module with a TIM, follow the steps below:

- 1. Open the front panels of the power supply module and the TIM.
- 2. Connect the power cables from the power supply module to the TIM: M and L+
- 3. Close the front panels.

Note

To avoid ground loops, do not connect the shielding of the TIM.

Wiring diagram

The following figure shows how to connect up the TIM 3V-IE DNP3 and the TIM 4R-IE DNP3.



Image 4-6 Connecting the TIM 3V-IE DNP3 and the TIM 4R-IE DNP3 to the power supply

If one or more TIMs are installed as a CP in an S7-300 device, the CPU and TIMs must be connected to the same power supply. This ensures that the CPU and TIMs start up at the same time when the power supply is turned on.

4.3 Commissioning the TIM

4.3 Commissioning the TIM

4.3.1 Steps in commissioning

Requirements for commissioning

The following requirements must be met for the full commissioning of the TIM:

- Installation and wiring
 Installation and wiring is described in the preceding sections.
- Full configuration
 The configuration of the TIM is described in the following sections:
 Configuration in STEP 7 (Page 77)
 The SINAUT Configuration Tool (Page 139)

Steps in commissioning

Commissioning involves the following steps:

- Turn on the common power supply of the fully wired S7 station.
 The LED display during startup is described in the two following sections.
- Download the configuration data to the station.
 Downloading the configuration data is described in the following section: Downloading (Page 239)

4.3.2 Startup activities of the TIM 3V-IE DNP3

Introduction

During startup, the LEDs on the front panel of the TIM 3V-IE DNP3 have a different significance compared with normal operation. They are optical indicators of the various startup phases and provide detailed information about any errors detected during startup. The only exceptions are the LINK and RX/TX LEDs that have no significance during the startup of the TIM 3V-IE DNP3.

LED displays during startup

The following table summarizes the startup phases.

Table 1 2	I CD activity on the TIM 21	-IE DNP3 during the various startup phases
1 able 4- 5	LED activity on the Thy Sy	-IE DINPS during the various startup phases

Phase	Activity	SF	RUN	STOP	KBus	TxD	RxD
1	Power ON followed by hardware initialization	On	On	On	On	On	On
2	Loading the operating system from flash memory	Off	On	On	On	On	On
3	Starting VxWorks operating system	Off	Off	On	On	On	On
4	Loading and starting TIM firmware	Off	Off	Off	On	On	On
5	Initializing flash file system and starting the start manager	Off	Flashes	On	Off	Off	Off
6	Loading and starting P bus driver	Off	Flashes	On	On	Off	Off
7	Loading and starting subscriber man- agement (SubA)	Off	Flashes	On	Off	On	Off
8	Loading and starting LAN-COM	Off	Flashes	On	On	On	Off
9	Loading and starting subscriber man- agement (MesA)	Off	Flashes	On	Off	Off	On
10	Loading and starting time-of-day driver	Off	Flashes	On	On	Off	On
11	Loading and starting the TD7 software of the TIM (TD7onTIM) on the TIM	Off	Flashes	On	Off	On	On
12	Loading and starting WAN driver	Off	Flashes	On	On	On	On
13a	Startup completed without error	Off	On	Off	X ¹⁾	X ¹⁾	X ¹⁾
13b	Startup completed with error	On	Off	On	X ²⁾	X ²⁾	X ²⁾
13c	Startup aborted - user parameter assign- ment missing. Module expects user pa- rameter assignment	Off	Off	On	Flashes	Flashes	On
13d	Startup aborted - No firmware loaded	Off	Off	On	On	Flashes	Flashes
13e	Startup aborted - No SDBs and no firm- ware loaded	Off	Off	On	Flashes	Flashes	Flashes
13f	Default startup completed	Off	Flashes	Flashes	On	On	On
13g	Startup aborted due to incorrect firmware (firmware does not match module type)	On	Flashes	Flashes	Flashes	Flashes	Flashes

1) The LEDs KBus, TxD and RxD now operate in normal mode

2) The LEDs KBus, TxD and RxD remain in the phase in which the error occurred

4.3 Commissioning the TIM

Group error LED

If a problem occurs during startup, the red group error LED (SF) lights up and a diagnostic interrupt is sent to the CPU. A message to this effect is also entered in the diagnostic buffer of the TIM. In the section on the SINAUT diagnostics and service tool, you will find a table with a summary of all the errors that can cause the group error LED to light up, as well as a detailed description of each error message.

Note

After transferring the SDBs to the TIM, the group error LED flashes for approximately 10 seconds. This indicates that the TIM has registered the transfer and will automatically start a reset after a further 10 seconds and the parameter assignment from the newly transferred SDBs will be adopted. The TIM then behaves the same as following power "ON".

Default startup

If the situation arises that the TIM 3V-IE DNP3 can no longer be addressed via the MPI interface of the CPU or its own Ethernet interface following startup due to a bad parameter assignment, the TIM can be returned to a defined state using the default startup. Following the default startup, the TIM can have new parameters set both over the MPI interface of the CPU and over its own Ethernet interface.

To force a default startup, follow the steps outlined below:

- 1. Turn off the power for the TIM.
- 2. Press the reset button accessible from the front, turn on the power while holding down the reset button.
- 3. During hardware initialization (LED phase 1), the SF LED is turned off briefly and then turned on again. Release the reset button at the moment when the RUN LED stops flashing and the SF LED is turned on again.
- 4. Wait until the startup of the TIM is completed and the default startup is signaled by the LEDs.
- 5. The TIM can then be supplied with its parameters over the MPI interface of the CPU or its own Ethernet interface.

Note

With the CPU types CPU 312, CPU 312-C, CPU 313-C, CPU 314, CPU 314-C, CPU 315-2 DP and CPU 315F-2 DP, the TIM is assigned MPI address 3 following a default startup. If another subscriber on the MPI bus already has MPI address 3, a conflict will arise. You will then have to disconnect one of the two modules temporarily from the MPI bus to be able to transfer the parameters (including the correct MPI address) to the TIM.

6. Restart the TIM on completion of the parameter assignment.
4.3.3 Startup activities of the TIM 4R-IE DNP3

Introduction

During startup, the LEDs on the front panel of the TIM 4R-IE DNP3 have a different significance compared with normal operation. They are optical indicators of the various startup phases and provide detailed information about any errors detected during startup. During startup on the TIM 4R-IE DNP3, the "BATF", "P1" and "P2" LEDs have no significance.

LED displays during startup

The following table summarizes the startup phases.

Phase	Activity	SF	RUN	STOP	KBUS	TxD1	RxD1	TxD2	RxD2
1	Power ON, followed by hardware initialization	On	On	On	On	On	On	On	On
2	Loading the operating system from flash memory	Off	On	On	On	On	On	On	On
3	Starting VxWorks operating sys- tem	Off	Off	On	On	On	On	On	On
4	Loading and starting TIM firmware	Off	Off	Off	On	On	On	On	On
5	Initializing flash file system and starting the start manager	Off	Flash- es	On	Off	Off	Off	Off	Off
6	Loading and starting P bus driver	Off	Flash- es	On	On	Off	Off	Off	Off
7	Loading and starting subscriber management (SubA)	Off	Flash- es	On	Off	On	Off	Off	Off
8	Loading and starting LAN-COM	Off	Flash- es	On	On	On	Off	Off	Off
9	Loading and starting subscriber management (MesA)	Off	Flash- es	On	Off	Off	On	Off	Off
10	Loading and starting time-of-day driver	Off	Flash- es	On	On	Off	On	Off	Off
11	Loading and starting the TD7 soft- ware of the TIM (TD7onTIM) on the TIM	Off	Flash- es	On	Off	On	On	Off	Off
12	Loading and starting WAN driver	Off	Flash- es	On	On	On	On	Off	Off
13	Startup completed or aborted								
13a	Startup completed without error	Off	On	Off	X ¹⁾				
13b	Startup completed with error	On	Off	On	X ²⁾				
13c	Startup aborted - user parameter assignment missing. Module ex- pects parameter SDBs	Off	Off	On	On	Flashes	On	Flashes	On

Table 4-4 LED activity on the TIM 4R-IE DNP3 during the various startup phases

Installation and commissioning

4.3 Commissioning the TIM

Phase	Activity	SF	RUN	STOP	KBUS	TxD1	RxD1	TxD2	RxD2
13d	Startup aborted - No firmware loaded	Off	Off	On	Flashes	On	Flashes	On	Flashes
13e	Startup aborted - No SDBs and no firmware loaded	Off	Off	On	Flashes	Flashes	Flashes	Flashes	Flashes
13f	Default startup completed (see below)	Off	Flash- es	Flashes	On	On	On	On	On
13g	Startup aborted due to incorrect firmware (firmware does not match module type)	On	Flash- es	Flashes	Flashes	Flashes	Flashes	Flashes	Flashes

¹⁾ The LEDs operate in normal mode

²⁾ The LEDs stop in the phase in which the error occurred.

Group error LED

If an error occurs during startup, the red group error LED (SF) lights up and, if the TIM is installed as a CP in an S7-300, a diagnostic interrupt is sent to the CPU. A message to this effect is also entered in the diagnostic buffer of the TIM. In the section on the SINAUT diagnostics and service tool, you will find a table with a summary of all the errors that can cause the group error LED to light up, as well as a detailed description of each error message.

Note

After transferring the SDBs to the TIM, the group error LED flashes for approximately 10 seconds. This indicates that the TIM has registered the transfer and will automatically start a reset after a further 10 seconds and the parameter assignment from the newly transferred SDBs will be adopted. The TIM then behaves the same as following power "ON".

Default startup

If the situation arises that the TIM 4R-IE DNP3 can no longer be addressed over the MPI (over the CPU) or Ethernet bus following startup due to a bad parameter assignment, the TIM can be returned to a defined state using the default startup. Following the default startup, the TIM can be assigned new parameter settings over the MPI interface.

To force a default startup, follow the steps outlined below:

- 1. Turn off the power for the TIM.
- Press the reset button accessible from the front, turn on the power while holding down the reset button.
- 3. During hardware initialization (LED phase 1), the SF LED is turned off briefly and then turned on again. Release the reset button at the moment when the RUN LED stops flashing and the SF LED is turned on again.
- 4. Wait until the startup of the TIM is completed and the default startup is signaled by the LEDs.
- 5. The TIM can then be supplied with its parameters over the MPI interface of the CPU or its own Ethernet interface.

Note

If the TIM 4R-IE DNP3 is installed as a CP in an S7-300 and the CPU is of the type CPU 312, CPU 312-C, CPU 313-C, CPU 314, CPU 314-C, CPU 315-2 DP or CPU 315F-2 DP, the TIM is assigned the MPI address 3 following a default startup. If another subscriber on the MPI bus already has MPI address 3, a conflict will arise. You will then have to disconnect one of the two modules temporarily from the MPI bus to be able to transfer the parameters (including the correct MPI address) to the TIM.

6. Restart the TIM on completion of the parameter assignment.

4.4 Battery of the TIM 4R-IE DNP3

A back-up battery can be ordered as an option for the TIM 4R-IE DNP3 that prevents loss of messages stored on the TIM in the event of a power outage. You will find the order number of the backup battery in the catalog.

Storage

Batteries can ignite or explode. There is serious risk of burns if the batteries are heated or damaged.

Store the battery in a dry and cool location (below 30 °C) and not in the vicinity of heating appliances. Protect the device with a battery inserted from direct sunlight.

Replacing the battery

NOTICE

Installation of non-approved or damaged batteries may result in damage to the device or its surroundings. Only use batteries approved by the manufacturer. Before inserting a battery, make sure that it is not damaged.

Note

If the ambient temperature is too high or too low, this will restrict the performance of the battery

A low ambient temperature causes a voltage drop in the battery possibly to a point that the device can no longer be operated.

A high ambient temperature causes a reduction in the capacity of the battery due to self discharge.

4.4 Battery of the TIM 4R-IE DNP3

To replace the battery, follow the steps below:

1. Open the battery compartment with a screwdriver as shown in the figure.



- 2. Remove the old battery.
- 3. Insert a new battery.
- 4. Close the battery compartment.

Disposal

Note

Environmental protection

The used battery contains lithium. The internal components of the battery must not be allowed to pollute the environment.

- Do not dispose of the battery in the domestic refuse.
- Make sure that you observe the waste disposal regulations in your country.

Please ask your regional contact concerning the procedure for exchanging old batteries. You will find additional information in the Internet at: Partner http://www.automation.siemens.com/partner

Procedure for returning devices with batteries

Remove the battery before returning the device

Remove the battery before returning the device. Batteries must not be returned.

Configuration in STEP 7

5.1 Overview

5.1.1 The SINAUT configuration software in the SIMATIC world

The SINAUT configuration software is used to configure and assign parameters for the specific properties of telecontrol systems. With this software, the user can implement and set the parameters for the telecontrol components in a STEP 7 project.

The following figure shows where the SINAUT configuration software fits into the overall system of the SIMATIC world. The areas with the "cloud" behind them are covered by the SINAUT configuration software.



Image 5-1 The SINAUT configuration software within the overall system

The STEP 7 package provides the tools for configuring LANs.

The SINAUT software also allows the configuration of the following objects:

- WAN networks and WAN network nodes
- TIM modules
- WAN connections
- Objects (for example system and data objects)

5.1.2 Sequence of configuration of a telecontrol system

The configuration of a telecontrol system is shown below step-by-step. The dialogs of the SINAUT configuration tool are also explained.



Image 5-2 Sequence of configuration of a telecontrol system

When configuring a telecontrol system, the SINAUT configuration tool must be started after the network has been configured to allow configuration of the communications module, connections and then the data of the subscribers.

Following each step, the configured data must be saved.

As the second to last step, the subscriber information, the system data blocks (SDBs) are generated for TIM and CPU modules.

Finally, the SDBs are downloaded to the relevant modules.

5.1.3 Configuration of a TIM - overview

Introduction

The next sections provide you with a brief summary of configuration and parameter assignment and explain which data generated during commissioning needs to be loaded on the TIM to make it operational.

The individual steps are described in detail in the sections that follow.

Configuration in STEP 7 V5.5

As with all other S7 modules, the configuration of the TIM is performed in the STEP 7 HW Config program. The various TIM modules can be found there in the hardware catalog in the SIMATIC 300 / SINAUT ST7 folder.

You can select the TIM you want to install in a rack from this catalog. The following figure shows an S7-300 station with a TIM and various other modules installed.

Assigning parameters to the TIM

If you double-click on the TIM module, you open the parameter assignment dialog for the TIM. You can then specify the required properties in a series of tabs.

🖳 HW Config - [Station 1 (Configurati	nunol	
Station Edit Insert PLC View O	erties - TIM 3V-IE DNP3 - (R0/54)	×
🗅 🚅 🔓 🖩 🖏 🎒 🗎 🕞	neral Addresses Time Service Interfaces Options	
<u> </u>	hort Designation: TIM 3V-IE DNP3	
1 PS 307 10A 2 SI CPU 312 3	TIM 3 (1 x WAN, 1 x Industrial Ethernet, replacement without PG)	
4 H TIM 3V-IE DNP3 5 AI4/A02x12Bit 0	rder No.: 6NH7 803-3BA00	<u>v</u>
7 D016xAC120V/0.5A	ame: TIM 3V-IE DNP3	
(0) UR		
Slot Module Order num 1 PS 307 10A 6ES7 307-1 2 CPU 312 6ES7 312-1	omment:	
3 4 TIM 3V-IE DNP3 6NH7 803- 5 Al4/A02x12Bit 6ES7 334-0		
6 D116xDC24V 6ES7 334-0 7 D016xAC120V/0.5v6ES7 322-1		
Press F1 to get Help.	OK Cancel	Help

Image 5-3 S7-300 station with installed TIM and TIM parameter assignment dialog

Setting parameters for networks and network nodes

The next step is to connect the various stations in a WAN. This part of the configuration is done with the *NetPro* STEP 7 program.

If you are using an IP-based WAN, take a normal Industrial Ethernet from the NetPro catalog. The classic WAN "DNP3 dedicated line" can also be taken from the NetPro catalog. These networks have been added to the "Subnets" folder.

	Properties - DNP3 Dedicated Line
	General Network Settings Time Service Node List
	Operating mode: polling
Image: Selection of the network Image: Selection of the network	Mestage parameters Connection Message format: FT3 Acknowledgement: short acknowl WAN protocot DNP3 Retry factor: 3 Max. message length: 240
PROFIBUS DP PROFIBUS-PA PROFINET IO Stations Subnets DNP3 Dedicated line PROFIBUS PROFINET IO PROFIBUS PROFIBUS PROFINET IO PROFIDUS PROFIDUS PROFINET IO PROFIDUS PROFINET IO PROFINET IO PROFIDUS PROFINET IO PROFINET PROFINET IO PROFIDUS PROFINET PROFIN	Properties - DNP3 Dedicated Line TIM 3V-IE DNP3 (R0/S5) General Network Connection Basic Param. Dedicated Line Time options
PTP SINAUT Dedicated li SINAUT Dial-up netw Subnets (networks without gateways)	Polling parameters Ratio polling / spontaneous: 1 Number of stations in sub-cycle: 1 Transfer options Transfer mode: transfer data as blocks of single messages
1. Juonali	OK Cancel Help

Image 5-4 Networked system with parameter assignment dialogs for network and network nodes opened

The properties of classic WANs are specified in a parameter assignment dialog. The relevant dialog can be opened by double-clicking on the corresponding network. To set the parameters for the various network nodes, you also double-click on the connecting line between the network and the node to open the relevant parameter assignment dialog.

Configuration in the SINAUT configuration tool

If the system is networked and the properties for the networks or network nodes have been specified, the SINAUT configuration tool is called.



Image 5-5 SINAUT configuration tool for connection configuration and subscriber administration

• Configuration of the telecontrol connections

Open the connection configuration in the SINAUT configuration tool. Here, the connections that are possible from the PC of the control center to the CPU are identified and made available for selection.

Select the required connections from the right-hand pane of the connection configuration and drag them to the left-hand pane.

Configuring the subscribers

After saving the selected connections, you then open Subscriber administration. Here, the connections or the subscriber number can be changed.

All CPUs, PC(s) of the control center and all TIMs are also assigned a subscriber number (DNP3 address) that is unique throughout the system. If no further changes are necessary, this is followed by configuration of the TD7 software.

• Configuring the communications software TD7onTIM

The communication of the CPU of an S7 station is handled by a DNP3 TIM. The TIM supports communication with the following partners:

- Communication of the local CPU with DNP3 control centers
- Communication of the local CPU with MODBUS slaves

The organization of SINAUT communication is handled by the TD7 software. When using the DNP3 protocol, the TD7 software is available only in the version "TD7onTIM"; in other words, it is part of the TIM firmware.

TD7onTIM handles the sending and receiving of process data for the local CPU. Data that the CPU sends is read from the CPU via the backplane bus by the TIM using TD7onTIM. Received data is written to the CPU by the TIM using TD7onTIM.

The communications partners of the CPU, general communications parameters and the data and address parameters are configured in TD7onTIM.

You create the configuration in the subscriber administration in the "TIMs with TD7onTIM" entry.

SINAUT ST7 : Configuration - Pro Project Edit SINAUT View E	ject '_DNP_Bsp400R', Path 'C:\Program Files (x86)\Siemens\Step7\S7Proj\ tras Help	_DN 🗆 🗙
] 🗃 🔪 🧊 🐂 🖬 🎒 🕹 🎄 🖻	? � ③ !	
Subscriber types:	Last change of connection configuration: 28/01/11 14.29.32 Selected CPUs:	0
🕀 🙀 All SINAUT subscribers	Subscriber no. Subscriber type Module Station SINAUT connect	. SINAU 🔺
🗄 👜 Redundant H-CPUs	1001 SINAUT TIM TIM 4R-IE DNP3 DNP3-Station 1 yes	TD7 lib
Redundant ST7cc/ST7sc	1002 SINAUT TIM TIM 4R-IE DNP3 DNP3-Station 2 yes	TD7 lib
TIMs with TD7onTIM	1003 SINAUT TIM TIM 4R-IE DNP3 DNP3-Station 3 yes	TD7 lib
All Destination Subscribers	1004 SINAUT TIM TIM 4R-IE DNP3 DNP3-Station 4 yes	TD7 lib
⊕ 1001 / DNP3-Station 1	1005 SINAUT TIM TIM 4R-IE DNP3-Station 1	
1002 / DNP3-Station 2	1006 SINAUT TIM TIM 4R-IE DNP3-Station 2	-
1004 / DNP3-Station 4	Basic settings for TIM with TD7onTIM:	<u>^</u>
	TD7 read / write cycle	
	Number of configured receive objects = 12 objects	
	Max. write: 1 objects	_
		NUM //

Image 5-6 TD7onTIM configuration

Saving and compiling

On completion of the configuration, the project is saved in the subscriber administration. The SINAUT configuration tool generates the system data blocks (SDBs) resulting from the configuration for all TIMs, the SDBs for the CPUs required by the TD7onTIM software.

5.2 Creating a project in the SIMATIC Manager

Downloading the SDBs to a TIM

Note

The SDBs of a TIM can be stored on the TIM or the S7-300 CPU (not on stand-alone TIMs). This is decided during the parameter assignment of the module (properties dialog of the TIM > "Options" tab).

If you decide to store the SDBs on the TIM, the SDBs must be transferred to the module as described above. If the SDBs are stored on the CPU, it is not necessary to transfer the SDBs separately. The TIM receives the SDBs from the CPU during the common startup of the modules in the S7-300 rack.

With the TIM 3V-IE DNP3 and TIM 4R-IE DNP3, the SDBs are transferred to a TIM via the MPI interface of the CPU or via the Ethernet interface of the TIM.

The SDBs may only be transferred after the TIM has completed its startup. The TIM's LEDs indicate when startup is completed. You will find more detailed information in the section Commissioning the TIM (Page 70).

5.2 Creating a project in the SIMATIC Manager

The first step in configuring a new installation is to create a new project in the STEP 7 *SIMATIC Manager*. This project serves as a directory for all the configuration data of the installation. You create the project in the SIMATIC Manager by selecting the *File / New...* menu and entering the name of the project.

5.3 Copying projects in the SIMATIC Manager

In the SIMATIC Manager, you can copy entire projects by saving them under a different name (File / Save As... menu). After selecting the function, the dialog for saving the project opens in which you enter the name and storage path.

• "With reorganization" option

When you save, you can also select the With reorganization copy option.

Note

Copying projects with / without reorganization

When you copy projects with reorganization, the subscribers and connection data are not copied. These must be reconfigured following the copy function.

If you copy projects without reorganization, the telecontrol configuration data is also copied. There are no disadvantages of using this variant. The without reorganization variant is preferable.

5.4 Creating stations and networks in network configuration

5.4 Creating stations and networks in network configuration

The STEP 7 *NetPro* tool is used for graphic configuration of network topologies. During network configuration, networks and stations are added to a new project, given parameter settings, and interconnected. The various network types and stations are available in the network and station catalog. The basic functions and possible settings are described in the STEP 7 documentation.

5.4.1 Creating non-STEP 7 stations

Creating non-STEP 7 stations

The term "Station" is used in STEP 7 as general term for a station that appears in hardware configuration.

STEP 7 supports the configuration of different types of non-STEP 7 stations. This can be a DNP3 master station (e.g. PCS 7 control center). As with the STEP 7 stations, they are created by double-clicking on the icon in the station catalog or by dragging them to the project window. The following objects must be selected for these subscribers:

• For a PC-based DNP3 master station: "Other station"

This third-party station is simply used as a placeholder for the network configuration. A hardware configuration for a third-party station of the type "DNP3 master station" is not possible since its content is unknown to STEP 7.

Modbus slave

To connect a Modbus slave to the serial interface of the DNP3 TIM, no station needs to be created in STEP 7.

To attach created stations to the networks of the project, module capable of communication are first configured for the STEP 7 stations in HW Config so that the required interfaces can then be configured.

With third-party stations, the interfaces can be created immediately.

Creating the interfaces for non-STEP 7 stations

• DNP3 master station

A DNP3 master station (Other station) can be configured with any number of DNP3 dedicated lines and Industrial Ethernet. To do this call up the Properties dialog using the shortcut menu.

5.5 Configuring stations in STEP 7 / HW Config

The hardware configuration program HW Config is used to install hardware components in stations. The HW Config program is opened by double-clicking on one of the station icons configured in the network configuration.

The module catalog in the window on the right of HW Config contains the available objects. For telecontrol networks, these are:

- Racks
- Power supplies
- CPU modules
- DNP3 modules
- Other modules
- Applications for control centers in the SIMATIC PC station directory

The devices are installed in the station from the module catalog. Possible slot restrictions are checked and reported immediately during configuration of the object. This makes an incorrect hardware configuration impossible.

The installation rules include, for example:

- S7-300 + S7-400 + S7-400H: Power supply permitted only in slot 1
- S7-300: CPU permitted only in slot 2
- S7-300: IM module permitted only in slot 3
- S7-300: Function modules (CPs, I/O, FMs, TIMs) permitted in slots 4 11
- S7-300: There must be no gaps between the modules inserted in slots 4 11

The installation rules for function modules are different in the expansion racks depending on the interface module (IM) with which the expansion rack is connected to the basic rack.

5.5.1 The hardware catalog

The catalog of the hardware configuration contains hardware from the following system families:

- PROFIBUS-DP
- SIMATIC 300
- SIMATIC 400
- SIMATIC PC based Control 300/400
- SIMATIC PC Station

The SIMATIC 300 / SINAUT ST7 directory contains the TIM modules of the telecontrol range Telecontrol Professional.



Image 5-7 The module catalog in the hardware configuration

5.5.2 Installing racks and modules

The editing window of hardware configuration is in two parts. In the upper part of the window, you can see all the existing racks with the modules they contain. In the lower part of the window, you will see a precise listing of the modules used in the current rack along with the order number and the MPI or I/O addresses.

Image: Constraint of the state of the s			nfiguration) D		le le			
Image: Constraint of the second se	-							_ 8 >
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2 CPU 312 3	😑 (0) UR							-
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7 D016xAC120V/0.5A 6ES7 322-1EH00- 1213							272275	
						89	10.10	
	7 D016	AC120V/0.5A	6ES7 322-1EH00-				1213	
ess F1 to get Help. C								

Image 5-8 The window of HW Config with a station configuration with one SIMATIC 300 rack and various modules

Racks are either created by double-clicking on a rack entry in the catalog or by dragging the rack entry, for example a standard rail for S7-300, to the station window. Since the system type SIMATIC 300 or SIMATIC 400 is already specified by the selection of the station, only suitable racks can be installed.

Modules are installed in the rack in one of two alternative ways:

- Selecting a suitable slot in the station window and double-clicking on a catalog entry or
- Dragging a catalog entry to the required slot in the station window

In both cases, the system checks immediately whether the module is permitted in the slot.

Modules can be moved to a new suitable slot at any time with the mouse.

Once a station is complete and has all the required modules, it must be saved with the *Station / Save* menu. When you close hardware configuration, a dialog opens automatically prompting you to save your entries.

When you save, the consistency of your entries is checked and a message output in the configuration errors are detected.

With the Station / Print ... menu, you can print out the configured data of the station.

5.5.3 Configuring modules

When you double-click on one of the modules installed in the rack in the hardware configuration, or when you select *Object Properties* in the context menu, the *Properties* dialog is opened allowing you to set parameters for a module. Here, you can adapt the properties of the particular object precisely to its requirements. The content of the *Properties* dialog depends on the module type. Only practical parameters for this type are displayed.

Since each module has a set of default parameters, it is not absolutely necessary to set parameters at this point. As an alternative, you can also open the same *Properties* dialog in NetPro.

Note

At least all the TIM modules of the project should have parameters set using the *Properties* dialog, for example to create the interfaces.

You can set parameters in the *Properties* dialog both in *hardware configuration* or in *network configuration* (NetPro).

5.5.4 Cycle monitoring time of the CPU

Malfunctions of theTIM 3V-xxx.

Note

No cycle monitoring time of the CPU

If the cycle monitoring time of the CPU is set to very low values, for example 1 ms, this can lead to malfunctions on theTIM 3V-xxx. In this case, increase the cycle monitoring time of the CPU or use a TIM 4R-xxx.

5.6 Configuring networks and network nodes in STEP 7 / NetPro

A fully configured network is required for the next steps in configuration.

- Configuring telecontrol connections
- Configuring telecontrol subscriber data
- Configuring the objects (for example data objects)
- Generating system data blocks (SDBs) and data blocks (DBs)

During the initial network configuration, the following is achieved:

- Connection of the modules with network capability to the networks
- Creation of a graphic view of the network consisting of one or more subnets
- Specification of the required properties and parameters for each subnet and each networked module
- Documentation of the network configuration

Starting the parameter assignment dialogs for networks and network nodes

If you double-click on a network or network node icon or select the Object Properties menu in the shortcut menu (right mouse button), the Properties dialog opens to allow you to set parameters. Here, you can connect modules with networking capability with the networks and adapt the properties of the relevant object to your requirements. All parameters have default settings that simplify parameter assignment.

5.6.1 Configuring WANs

DNP3 WAN networks are configured in the "Properties DNP3 Dedicated Line" / "Properties SINAUT Dial-up Network" dialog. The parameters to be set in the following tabs always apply to the entire network and are identical for all attached network nodes or communications partners:

- "General" tab with general information and for modifying the module name or adding comments
- "Network Settings" tab for setting the communications parameters of the current telecontrol network
- "Time Service" tab for setting parameters for time synchronization on the telecontrol network
- "Node List" tab with the list of all subscribers on the current telecontrol network

"General" Tab

Properties - DNP3 Ded	icated Line	×
General Network Sett	ings Time Service Node List	
Name: S7 subnet ID:	DNP3 (1) 004f - 0005	
Project path:	DNP3\DNP3 (1)	
Storage location of project:	C:\Program Files\Siemens\Step7\s7proj\Dnp3	
Author:		
Date created:	16.09.2010 16:16:03	
Last modified:	24.09.2010 14:48:57	
Comment:		
ОК	Cancel Help	

Image 5-9 Properties - DNP3 Dedicated Line dialog, General tab

The following parameters are available in this tab:

Name:

The default entry in the Name input box is the default name of the network. You can change this to suit your purposes. A new, modified name appears in the SIMATIC Manager and in the network configuration.

• S7 subnet ID:

The S7 subnet ID is made up of two numbers, one for the project and one for the subnet separated by a dash.

If you want to go online with a PG without a consistent project, you must know the subnet ID. The subnet ID is also printed out when you print the network configuration.

- The project path is displayed.
- The storage location of the project is displayed.
- In the Author input box, you can enter the person who created the configuration.
- The date created is displayed.
- The date of the last modification is displayed.
- In the Comment input box, you can enter comments with up to 254 characters.

"Network Settings" tab

The Network Settings tab specifies the basic communications parameters for the current network.

Properties - SINAUT Dial-up Network							
General Network Settings	îme Service Node L	ist					
Mode							
Operating mode: sp	ontaneous		-				
- Message parameters		Connection					
Message format: FT	3 💌	Connection type:	duplex 💌				
Acknowledgement: sho	ort acknowl. 💌	Baud rate [bps]:	9600 💌				
WAN protocol:	3 💌	Dial-up network options	, 				
Retry factor: 7	•	Cancel parameter:	0				
Max. message length:	240	Redialing attempts:	3				
- Identification							
Customer identification:		0 hex: 0					
ОК		(Cancel Help				

Image 5-10 Network Settings tab

The parameters are somewhat different for dial-up networks and DNP3 dedicated lines. The "Identification" and "Dial-up network options" boxes are only available for dial-up networks.

Mode

Operating mode

For DNP3 dedicated lines, the "Polling" mode is preset and cannot be changed.

Polling

In polling mode that is used with dedicated lines, the data exchange is controlled by the master TIM. This polls the connected stations and node stations one after the other. Stations with data to transmit send it as soon as they are polled. Stations that do not currently have any data acknowledge the poll. Only data to be sent from the master TIM to the stations can be transferred at any time between two individual polls.

For dial-up networks, only the "DNP3 mode" can be configured.

- DNP3 mode

For dial-up networks, both the polling and the spontaneous (unsolicited) mode are possible. In spontaneous mode, a TIM with an important data change transfers its data unsolicited and waits for the acknowledgment from the partner. Prior to the actual data transfer, the TIM must first establish a dial-up connection to the partner. Following successful transmission of the data, the TIM waits for the acknowledgment. Following this, the dial-up connection is terminated immediately again if the partner does not use the existing connection to transfer any existing data.

The unsolicited transfer is configured in the properties dialog of the TIM > "Interfaces" tab > "DNP3 parameters" button: "DNP3 parameters" dialog > "DNP3 basic parameters" > "Unsolicited transfer"

Message parameters

In the "Message parameters" box, the following parameters are displayed grayed out:

Message format:

For DNP3 dedicated lines, this parameter has the default setting "FT3" and this cannot be changed. FT3 is recommended in the DNP3 specification.

For dial-up networks, the following values can be configured:

- FT1.2 (8E1): Character format 8 data bits, even parity, 1 start bit, 1 stop bit Modem setting: Data format 11 bits
- FT2 (8N1): Character format 8 data bits, no parity, 1 start bit, 1 stop bit Modem setting: Data format 10 bits
- FT3:

Character format 8 data bits, no parity, 1 start bit, 1 stop bit Modem setting: Data format 10 bits

You will find information on setting the message format of the modems in the documentation of the modems, refer to the Appendix.

Acknowledgment:

The acknowledgment type does not depend on the modem used. It is set dependent on the quality of the transmission line. Default: short acknowl.

For DNP3 dedicated lines, this parameter has the default setting "Short acknowl." and this cannot be changed.

For dial-up networks, the following values can be configured:

- short acknowl.: consists of one byte.
- long acknowl.: consists of 5 bytes. The long acknowledgment is advisable in applications when interference produces spurious characters on the transmission line that could be

interpreted by the TIM as a short acknowledgment. example: Bad wireless link

WAN protocol:

For DNP3 dedicated lines, this parameter has the default setting "DNP3" and this cannot be changed.

For DNP3 dial-up networks, select the setting "FT3".

Retry factor:

This value decides how often a message that has not been acknowledged positively is repeated.

For DNP3 dedicated lines, this parameter has the default setting 3 and this cannot be changed.

For dial-up networks, the following values can be configured: 0 ... 15

Max. message length (in bytes):

For DNP3 dedicated lines, this parameter has the default setting 240 (bytes) and this cannot be changed.

For dial-up networks, the following values can be configured: 40 ... 240

Default setting: 240

For DNP3 networks the parameter has no significance except that with values < 240, PG routing does not work. It is recommended that you use the default value of 240.

Connection

In the Connection box, you can set the following parameters:

• Connection type:

Range of values: Half duplex, duplex Default: Duplex

Note

Half duplex must not be configured if the "Unsolicited transfer" function is enabled (see also the properties dialog of the TIM > "Interfaces" tab > "DNP3 parameters" dialog > "DNP3 basic parameters"), refer to the section "DNP3 parameters" dialog (Page 123).

Baud rate:

This is the transmission speed at which the TIM and modem communicate. The transmission speed in the current network is decided by the modem and is normally identical to the speed of the modem.

If the modem is to be operated at a speed that is not prespecified, the next higher speed needs to be set here (for example19200 bps if the modem operates at 14400 bps).

Dial-up network options

• Cancel parameter:

This is the number of attempted calls before the attempt is finally aborted.

Range of values: 0 ... 127

Default: 0

- 0

The call attempts are finally aborted when a connection was established 127 times in a row but no data could be transferred.

- 1... 127

The call attempts are finally aborted when the calls failed n times in a row, regardless of whether a connection could be established at all or whether no data could be transferred if a connection was established.

• Redialing attempts:

This is the number of attempted calls without successful connection establishment to the communications partner following which a fault is assumed on the CPU.

Range of values: 1 ... 127

Default: 3

Identification

• Customer identification:

The customer identification is used to specify whether connections can only be established to partners permitted for the network. The customer identification has the function of password protection in the network.

Range of values: 0 ... 65535

Default: 0

Configuration in STEP 7

5.6 Configuring networks and network nodes in STEP 7 / NetPro

"Time Service" tab

The Time Service tab specifies the extent to which time synchronization services will be executed by the master station. The time-of-day synchronization for TIM modules is described in the properties dialog of the TIM, refer to the section Configuring TIM modules (Page 114).

Properties - DNP3 Dedicate	ed Line	×
General Network Settings	Time Service Node List	
Time synchronization on Synchronization cycle: Hour scheme [hr]: Minute scheme [min]: Second scheme [s]: Time of day [hr/min]:		
ОК	Cancel	Help

Image 5-11 Time Service tab

You can set the following options for the Synchronization cycle parameter:

- No synchronization: There is no time synchronization on the relevant network.
- Hour scheme:

The number of hours between synchronization activities can be set in the "Hour scheme" drop-down list.

- Start time: If the cycle for time synchronization is longer than 1 hour, you can set a start time for time synchronization in the "Start time" drop-down list.
- Minute scheme:

The number of minutes between synchronization activities can be set in the "Minute scheme" drop-down list.

• Second scheme:

The number of seconds between synchronization activities can be set in the "Second scheme" drop-down list.

• Time of day:

Synchronization takes place once a day. Set the time of day for the synchronization in the "Time of day" drop-down list box (for example 01:00).

On dedicated lines, a synchronization cycle of 1 hour is recommended.

On the DNP3 WAN, the DNP3 master station is the synchronization master.

"Node List" tab

The node list displays all the communications subscribers connected to the current network; in other words, TIM modules. It also lists the station name, the WAN address and the configured node type making it easy to check these parameters throughout the network.

The WAN address has no further significance for DNP3.

Pro	operties - DNP3 Dedicated Line	:		×	l
ſ	General Network Settings Time	Service Node List			
	Name	Station	Address	node type	
	DNP3 Master	DNP3 Master	4	Master	
	TIM 3V-IE DNP3	Station 3	2	Station	
	TIM 3V-IE DNP3	Station 2	1	Station	
	TIM 4R-IE DNP3	Station 4	3	Station	
	1				
-					
	ОК		Cancel	Help	

Image 5-12 Node List tab

5.6.2 Configuring Industrial Ethernet

General tab

You set the parameters for Industrial Ethernet in the Properties - Industrial Ethernet dialog.

Properties - Industri	al Ethernet	×
General		
<u>N</u> ame: <u>S</u> 7 subnet ID: Project path: Storage location of the project: <u>A</u> uthor:	Ethemet(1) 0031 - 010A SINAUT ST7_T4T-Neu\Ethemet(1) C:\Program Files\Siemens\Step7\S7Proj\Sinaut_T4T	
Date created: Last modified: <u>C</u> omment:	03.11.2004 12:32:21 29.11.2004 15:48:51	4
ОК	Cancel H	elp

Image 5-13 Properties - Industrial Ethernet dialog, General tab

The following parameters are available in this tab:

Name:

The default entry in the *Name* input box is the default name of the network. You can change this to suit your purposes. A new, modified name appears in the SIMATIC Manager and in the network configuration.

• S7 subnet ID:

The subnet ID is made up of two numbers separated by a dash:

- The number for the project
- The number for the subnet

If you want to go online with a PG without a consistent project, you must know the subnet ID. The subnet ID is also printed out when you print the network configuration.

- The *Project path* is displayed.
- The Storage location of the project is displayed.
- In the *Author* input box, you can enter the person who created the configuration.
- The *Date created* is displayed.

- The Date of the last modification is displayed.
- In the *Comment* input box, you can enter comments of up to 254 characters.

5.6.3 Generating network attachments

To network a project, the communication-compliant modules (for example CPU or TIM) must be connected to suitable networks. The modules in the station icons in the project window of the network configuration include interface and network node icons displayed in different colors according to the network type.





Note

After changing connections, even if these are re-established again later, the SINAUT configuration tool with the *connection configuration* and the *subscriber administration* must be called.

Printing network information

The project can be printed and documented as a graphic or as text using the *Network / Print* menu.

5.6.4 Configuring WAN network nodes

Tabs of the dialog

Configure the WAN network nodes in the "Properties - DNP3 Dedicated Line / "Properties - SINAUT Dial-up Network dialog in the tabs described below:

- "General" tab with general information on the network node and entry of comments
- "Network Connection" tab for setting the most important network properties

- "Basic Param." tab for setting the basic communications parameters
- "Dedicated Line" tab with parameters specifically for dedicated lines
- "Dial-up Network" tab with parameters specifically for dial-up networks
- "Dialing Param." tab with parameters specifically for call numbers for dial-up network nodes
- "AT Initialization" tab for configuring initialization strings for the dialing mode "AT mode"

General tab

Properties - DNP3 Dedicated Line TIM 3V-IE DNP3 (R0/54)					
General Network Con	nection Basic Param. Dedicated Line				
Name:	TIM 3V-IE DNP3				
Project path:	DNP3\TIM 3V-IE DNP3				
Storage location of project:	C:\Program Files\Siemens\Step7\s7proj\Dnp3				
Author:					
Date created:	17.09.2010 10:59:50				
Last modified:	24.09.2010 14:48:57				
Comment:					
ОК	Cancel Help				

Image 5-15 Properties - DNP3 Dedicated Line TIM dialog, General tab

The following parameters are available in the General tab:

- The "Name" box displays the name of the module in SIMATIC stations. You can only change the default interface name in SIMATIC PC stations and other stations. A new, modified name appears in the SIMATIC Manager and in the network configuration.
- The project path is displayed.
- The storage location of the project is displayed.
- In the Author input box, you can enter the person who created the configuration.

- The date created is displayed.
- The date of the last modification is displayed.
- In the Comment input box, you can enter comments with up to 254 characters.

Network Connection tab

The Network Connection tab allows you to set the most important networking properties of the WAN network node.

Properties - DNP3 Dedic	ated Line TIM 3V-IE DNP3 (R0/54)	X
General Network Conn	ection Basic Param. Dedicated Line	
TIM Node type:	Station	
WAN parameter WAN address:	1 7	
Subnet-		
Not Networked - DNP3 (1)	 polling	New
DNP3 (2)	polling	Properties
OK		Cancel Help

Image 5-16 Properties - DNP3 Dedicated Line TIM dialog, Network Connection tab

The parameters here are:

• Node type

The node type is selected in the drop-down list:

- The master station is the highest hierarchic level in the network. It generally collects information from the underlying network nodes and specifies settings for the nodes in the field.
- A station is at a level close to the field and hierarchically below a master station.

The network attachment of a DNP3 TIM is assigned the type "Station", "Node station" or "Master station".

• The WAN address

The WAN address of the network node is decided by the address of the local CPU and is not relevant.

• Subnet

This lists all the networks of this type in the project. If the subscriber is not connected, the row ----Not Networked---- is shown as selected in the subnet list.

- If the current subscriber is connected, the row of the relevant network is shown as selected. You can set parameters for the current network with the Properties button.
- If no connection exists, a network connection can be set up using the New button.
- An existing connection can be deleted with the Delete button.

Basic Param. tab

The Basic Param. tab contains the communications parameters for the selected DNP3 network node.

roperties - DNP3 Dedicated Line TIM 3V-IE DNP3 (R0/54)		
General Network Connection Basic Param. De	dicated Line	
General Interface: External Interface type: RS232 RS485 termination: nein Operating Interrupt (block) Extra transmission time [ms]:	Message parameters Number of spontaneous messages: Limit for locked messages [%]: 50	
ОК	Cancel Help	

Image 5-17 Properties - DNP3 Dedicated Line TIM dialog, Basic Param. tab

The parameters shown in the following tab cannot be modified for the TIM 3V-IE DNP3 and only partly modified for the TIM 4R-IE DNP3.

Interface:

This parameter cannot be set for DNP3.

Interface type (TIM 4R-IE DNP3 only):

Here, you set the type of interface: RS-232 or RS-485 mode

This parameter cannot be set for the TIM 3V-IE DNP3.

RS485 termination (TIM 4R-IE DNP3 only):

This output box indicates whether the terminating resistor has been activated for the RS-485 bus.

This parameter cannot be set for the TIM 3V-IE DNP3.

• Operating mode:

This parameter cannot be configured for DNP3 and has no significance.

• Extra transmission time:

This parameter cannot be set for DNP3 and has no significance.

• Number of spontaneous messages:

This parameter cannot be configured for DNP3 and has no significance.

• Limit for locked messages:

This parameter cannot be configured for DNP3 and has no significance.

Dedicated Line tab

The Dedicated Line tab contains special parameters required only when using dedicated lines.

Properties - DNP3 Dedicated Line TIM 3V-IE DNP3 (R0/S5)	×
General Network Connection Basic Param. Dedicated Line	
Time options RTS/CTS delay time [ms]: 0 Send delay time [ms]: 0	
Master monitoring time [s]: 0 Max. allowed disruption time [s]: 0	
Polling parameters Ratio polling / spontaneous:	
Number of stations in sub-cycle:	
Transfer options	
Transfer mode: transfer data as blocks of single messages	
OK Cancel Help	



The parameters for dedicated lines include:

• RTS/CTS delay time:

Setting the RTS/CTS delay time is required, for example when connecting a modem to the RS-485 interface of the TIM module. The values necessary for the RTS/CTS delay time can be found in the descriptions of the modems.

Possible values: 0 .. 65535 ms

Default: 0

- RTS/CTS delay time = 0:

After setting the RTS signal, transmission only starts when the CTS signal was set by the modem.

– RTS/CTS delay time > 0:

Transmission is not delayed until the CTS signal of the modem. After the RTS signal has been set, transmission is delayed for the selected time and then started immediately.

Master monitoring time [s]:

Monitoring time for the DNP3 master station. Within the configured time, the TIM expects a signal from the DNP3 master station at the application layer.

If the TIM does not receive a signal from the master station during this time it assumes a fault on the master station, outputs an error message to the diagnostics buffer and, if configured, sets the relevant bit in the PartnerStatus system object to zero. The configured value is transferred to the connected DNP3 master stations.

When the monitoring time has elapsed, the master station must send a 'Daily Measurement' message to the station that must be acknowledged by the station. If the station does not reply to the message, it is classified as being unreachable by the master station.

Range of values: 0...65 535

Default: 0 (no monitoring)

Note: This mechanism can also be used for monitoring passive redundant paths.

• Send delay time:

The send delay time is used only when the CTS signal comes from the modem (RTS/CTS delay time parameter = 0). As soon as the CTS signal comes from the modem, the send delay time is started. Data transmission is started only after this time elapses.

This parameter is required, for example, when additional times are necessary to allow repeaters to start up on wireless links prior to starting data transmission. If 0 is entered, no send delay time is used. Range of values: 0 to 65 535 ms Default: 0

• Max. allowed disruption time:

This parameter cannot be configured for DNP3 and has no significance.

• Ratio polling / spontaneous:

This parameter cannot be configured for DNP3 and has no significance.

• Number of stations in sub-cycle:

This parameter cannot be configured for DNP3 and has no significance.

• Transmission mode:

This parameter cannot be configured for DNP3 and has no significance.

"Dial-up Network" tab

This tab contains special parameters required only when using dial-up networks.

Properties - SINAUT [Dial-up Network TIM 4	R-IE DNP3 (R0/S4)	×
General Network Conne	ection Basic Param. Dial	up Network Dialing Pa	ram. AT Initialization	1,
Parameters for conditi	onal spontaneous messages			
Transmission criteria:	standard conditions 💌 💌	Hours:	0	
		Minutes:	0	
Time options				
Master monitoring time	e (min):			
Max. connection dura	tion [s]: 5	Redial delay [min]:	20	
- Transfer options				
Transfer mode:	transfer data as blocks of		-	<u>-</u>
	transfer data as blocks of transfer data as blocks of			┛╵╽
ОК			Cancel He	alp

Image 5-19 Properties - DNP3 Dial-up Network TIM dialog, Dial-up Network tab

The dial-up network parameters include:

• Transmission criteria:

The transfer criterion for connection establishment to transfer unsolicited messages (events) is only relevant for stations and node stations and as the default "standard conditions" is set for the DNP3 dedicated line which cannot be changed.

- Standard conditions:

If unsolicited messages are pending, no connection is established. The unsolicited frames are only transferred when there is a threat of buffer overflow or the connection is called up from the other end.

• Master station monitoring time [min]:

Monitoring time for the DNP3 master station. Within the configured time, the TIM expects a signal from the DNP3 master station at the application layer.

If the TIM does not receive a signal from the master station during this time it assumes a fault on the master station, outputs an error message to the diagnostics buffer and, if configured, sets the relevant bit in the PartnerStatus system object to zero. The configured value is transferred to the connected DNP3 master stations.

When the monitoring time has elapsed, the master station must send a 'Daily Measurement' message to the station that must be acknowledged by the station. If the station does not reply to the message, it is classified as being unreachable by the master station.

Range of values: 0...65 535

Default: 0 (no monitoring)

Note: This mechanism can also be used for monitoring passive redundant paths.

• Max. connection duration [s]:

Here, the maximum connection duration for dial-up connections can be set. A dial-up connection will be terminated at the latest when the configured time elapses even if there is still data to be transferred.

Range of values: 0 ... 65535

Default: 5

If you enter zero, the function is deactivated.

Redial delay [min]:

This parameter specifies how long after a connection abort, connection termination or unsuccessful connection establishment, a new dial-up connection will be established at the earliest.

Range of values: 0 ... 255

Default: 0

Transmission mode:

This parameter specifies the form in which data messages are sent.

Range of values:

- Sending data messages as individual messages
- Sending several data messages as a block

Default: Single messages

"Dialing Param." tab

The Dialing Param. tab appears only with dial-up network nodes and includes all parameters specific to call-numbers.

Prop	erties - SINAUT Di	al-up Network TIM 4R-IE DNP3 (R0/S4)	×
Ger	neral Network Connec	tion Basic Param. Dial-up Network Dialing Param. AT Initialization	
Г	Dialing parameters		
	Configured modem:	3rd party modem	
	Dialing mode:	AT mode	
	Dialing format:	8 data bits, no parity, 1 stop bit 💌	
	Dialing command:	D Dialing prefix:	
	Own tel. number:		
	Options		
	PIN number:		
	Special service:	no special service	
	ОК	Cancel Help	

Image 5-20 Properties - DNP3 Dial-up Network TIM dialog, Dialing Param. tab

The parameters here are:

Configured modem:

The modem specified in the hardware configuration is displayed.

• Dialing mode:

Type of activation of the modem. Note that only the AT mode can be used on the internal interface of the TIM.

Note

If two MD3 modems communicate with each other, they must not be operated in the 1200 baud, half-duplex, AT mode.

• Dialing format:

The data format of the dial-up phase depends on the type of modem. The following settings are possible:

- 8 data bits, no parity, 1 stop bit
- 8 data bits, odd parity, 1 stop bit
- 8 data bits, even parity, 1 stop bit
- 8 data bits, no parity, 2 stop bits
- 8 data bits, odd parity, 2 stop bits
- 8 data bits, even parity, 2 stop bits
- 7 data bits, no parity, 1 stop bit
- 7 data bits, odd parity, 1 stop bit
- 7 data bits, even parity, 1 stop bit
- 7 data bits, no parity, 2 stop bits
- 7 data bits, odd parity, 2 stop bits
- 7 data bits, even parity, 2 stop bits

Default:

- In AT mode: 8 data bits, no parity, 1 stop bit

Note

MD3 modem

The data listed above applies only to the dialing phase. The data format in the data phase is set with switch 5 on the MD3 modem.

It is only necessary to set the dialing format on older modems that do not support "Autoband". With "Autoband", the modem can determine the character and data format in the dialing phase automatically based on the first AT string.

Dialing command:

This is the dialing command for the local modem. The following dialing commands are possible:

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

Default: D. This default modem dialing command should be used where possible.

• Dialing prefix:

This is the access number (outside line) for a private branch exchange (typical entry 0 or 9) or for an alternative telephone provider. A number up to 12 digits long can be specified. With direct connection to the dial-up network and without an alternative telephone provider, this parameter can remain empty.

The dialing prefix can be changed again in the Properties of subscriber dialog.
• Own tel. number:

Here, you enter your own telephone number for the network node including the area code. This telephone number can no longer be changed later in the Properties of subscriber dialog.

Note

In dial-up networks, in which another subscriber within the same local network cannot be dialed with the local area code, it is advisable to enter your own telephone number in the Own tel. number box (without area code) and to specify the area code in Dialing prefix.

• PIN number:

For a GSM module, the 4 to 8 digit PIN number must be entered here so that this can be transferred from the TIM module to the module.

If you have a contract without a PIN, leave the box empty.

Note

If an incorrect PIN is entered, the SIM card in the module might be disabled. If the fault LED lights up during connection establishment, the diagnostics buffer of the TIM must be checked because an entry for a bad PIN is generated here.

• Special service:

This parameter cannot be configured for DNP3 and has no significance.

"AT initialization" tab

Properties - SINAUT Dial-up Network TIM 4R-IE DNP3 (R0/S4)				
General Network Connection Basic Param. Dial-up Network Dialing Param. AT Initialization				
ATISI45=3NNDF08W				
Type of string: dial-up network, MD3, 19200 bps, FT1.2	1			
Note: - Enter line feeds with CTRL+ENTER (have no influence on the string) - Enter wildcards with \xxxx (xxxx (xxxx in the decimal system) - Enter \ as \\				
OK Cancel Help				

Image 5-21 Properties - DNP3 Dial-up Network TIM dialog, AT initialization tab

The AT Initialization tab appears only for dial-up network nodes and when the AT mode is selected as the Dialing mode in the Dialing parameters tab. The string stored here is formed automatically from the previously set dial-up network parameters and the SINAUT dial-up modem selected on the TIM interface.

If "3rd party modem" is set on the TIM interface, no initialization string is displayed. You will then need to enter the correct string for the modem you are using. The initialization string set here is transferred to the modem operating in AT mode only when the TIM starts up.

Initializing string

In the left-hand input box, the AT string is displayed as text and in the right-hand box in hexadecimal notation. No entries can be made in the right-hand box. In the left-hand box, a string can only be entered when either no entry can be found for the current combination of modem and network parameters in the SINAUT modem database or the User defined option was set. Otherwise the valid string is taken from the database.

• User defined:

This option allows the manual entry of AT Initialization strings for the basic settings of the modem.

• Type of string:

The content of the current string is shown in this output box.

Special features of the MD4 modem (is no longer available)

On the MD4 modem, the standard string is ATS45=83\$P1\N0&W\$M=n. The part string \$P1 defines the V.110 mode at a transmission speed of 9600 bps. The n character at the end of the string is the placeholder for the MSN (last digit of the telephone number) of the subscriber.

The stored standard string allows only transmission rates of 9600 and 19200 bps, no other speeds are supported.

When using the MD4 modem in ISDN networks, it is only possible to operate at a transmission speed of 9,600 bps with the standard setting and not at the maximum speed of 38,000 bps.

If the maximum speed of 38,000 bps is required when using the MD4 in ISDN networks, the entry \$P1 in the default string must be replaced by \$P5. This brings about a change from transmission mode V.110 to the X.75 mode which allows a transmission speed of up to 38,000 bps.

Note

Since the MSN number is automatically added to the generated AT string with the MD4 modem, if you change the telephone number later, remember that the MSN number in the AT string for the MD4 modem may need to be modified manually.

5.6 Configuring networks and network nodes in STEP 7 / NetPro

5.6.5 Configuring Ethernet nodes

"General" Tab

Properties - Ethernet interface TIM 4R-IE DNP3 (R0/54)				
General Parameters	\$			
Name:	TIM 4R-IE DNP3	-		
Project path:	DNP3\TIM 4R-IE DNP3	-		
Storage location of the project:	C:\Program Files\Siemens\Step7\s7proj\Dnp3	-		
Author:		_		
Date created:	09/17/2010 11:07:40 AM			
Last modified:	09/17/2010 11:11:16 AM			
Comment:				
]			
ОК	CancelH	elp		

Image 5-22 Properties - Ethernet interface dialog, General tab

The General tab informs you about general parameters of the Ethernet interface.

- Name: The Name box displays the name of the module.
- The project path is displayed.
- The storage location of the project is displayed.
- In the Author input box, you can enter the person who created the configuration.
- The date created is displayed.
- The date of the last modification is displayed.
- In the Comment input box, you can enter comments with up to 254 characters.

5.6 Configuring networks and network nodes in STEP 7 / NetPro

"Parameters" Tab

roperties - Ethernet interface TIM 4R-IE DNP3 (R0/54)				
General Parameters				
Set MAC address / use ISO protocol				
MAC address:				
Subnet mask: 255.255.255.0	Gateway © Do not use router © Use router Address:			
Subnet:				
not networked Ethernet(1)	New			
Ethernet(2)	Properties			
	Delete			
ОК	Cancel Help			

Image 5-23 Properties - Ethernet interface dialog, Parameters tab

The Parameters tab provides the following parameters:

- Set MAC address / use ISO protocol: Since an Ethernet TIM does not use the ISO protocol but TCP/IP, this option remains disabled.
- The IP address: This has a default entry and cannot be changed here.
- The Subnet mask: This has the default value 255.255.255.0 and can be changed / restricted.

• In the Gateway box, you have the option of specifying whether data transmission is via a router.

If a router exists, the IP address of the router is entered in the Address box.

• The Subnet:

This lists all the networks of this type in the project. If the subscriber is not connected, the row ----Not Networked---- is shown as selected in the subnet list.

- If the current subscriber is connected, the row of the relevant network is shown as selected. You can set parameters for the current network with the Properties button.
- If no connection exists, a network connection can be set up using the New button.
- An existing connection can be deleted with the Delete button.

5.6.6 Plausibility check of the network configuration

A plausibility check of the configured network is performed either when the network is stored with the Save and Compile... function or when the consistency check is started directly from the Network / Check Consistency menu. The following is reported:

- Subscribers not connected to a any subnet
- Subnets with only one subscriber
- Inconsistent connections, for example due to the wrong WAN protocol

The following is also checked for telecontrol networks:

- Compatibility of the connected modem types with each other
- Compatibility of the connected modem types with the network parameters

The following is checked for dedicated line networks:

• The parameter assignment of a master station for the dedicated line network

The configured version must then be saved with the Network / Save menu to allow other STEP 7 and SINAUT applications access to the configured data.

Configuration continues by calling the SINAUT configuration tool.

Note

Save and compile only in "subscriber administration"

From the network configuration, not only the Save but also the Save and Compile... function can be called that generates the system data blocks (SDB) after saving the configuration.

To acquire all the configured parameters of the TD7 software when generating the SDBs both in new projects or when making modifications to the configuration of existing SINAUT installations, the generation of SDBs for telecontrol networks should only be performed in the Subscriber Administration of the SINAUT configuration tool.

The parameters for a TIM module are divided among various tabs of the "Properties - TIM" dialog. The following tabs are available:

- "General" tab with general information and for modifying the module name or adding comments
- "Addresses" tab with information on I/O address areas of the CPU
- "Time Service" tab for setting the parameters for time-of-day synchronization of a TIM module
- "Interfaces" tab for configuring the Ethernet and WAN interface(s)
- "Options" tab with parameter assignment options for the message memory

Note

Communication-specific parameters are entered in the "Properties" dialogs for network and network node parameter assignment. These are explained in the relevant sections.

5.7.1 "General" tab

General tab

The "General" tab informs you about the general properties of a TIM module.

Properties - TIM 4R-IE DNP	23 - (R0/54)	×
General Addresses Time	Service Interfaces Options	
Short Designation:	TIM 4R-IE DNP3 TIM 4 (2 x WAN, 2 x Industrial Ethernet, 2 S7 connections, module replacement without PG, C-Plug)	*
Order No.:	6NH7 803-4BA00-0AA0	
Name:	TIM 4R-IE DNP3	
Comment:		
		▲ ▼
OK Cancel	He	elp

Image 5-24 "Properties - TIM" dialog, "General" tab

This tab contains the following output boxes and parameter assignment options:

- "Short Designation:" output box the module type and a brief description are displayed.
- The "Order No." output box displays the article number of the module.
- The "Name:" input box allows you to change the name of the module.
- In the "Comment:" input box comments, for example relating to the use of the module can be entered.

The subscriber number (DPN3 address) of the TIM module that can be generated as a comment in the "Subscriber Administration" of the SINAUT configuration software is then displayed in this comment box.

5.7.2 "Addresses" tab

Addresses tab

Properties - TIM 4R-IE DNF	23 - (R0/54)	×
General Addresses Time	Service Interfaces Options	
Short Designation:	TIM 4R-IE DNP3 TIM 4 (2 x WAN, 2 x Industrial Ethernet, 2 S7 connections, module replacement without PG, C-Plug)	4
Order No.:	6NH7 803-4BA00	
Name:	TIM 4R-IE DNP3	
Comment:		
		4
OK Cancel	He	lp

Image 5-25 "Properties - TIM" dialog, "Addresses" tab

The "Addresses" tab provides information on the address areas occupied by the TIM module in the I/O from the perspective of the CPU.

These addresses are also relevant to you if the CPU is supplied with the date and time of day by the TIM. In this case, the TIM supplies the time data to the inputs specified here. This is described in detail elsewhere (refer to the section: Synchronization of the CPU time with TD7onTIM (Page 135))

The start address and length of the address ranges are assigned by the system. As an alternative, you can change the inputs and outputs by disabling the system selection option and entering the start address in the input box manually. Since the addresses are always set consistently by the system and are not generally used, it is not normally necessary to make a change.

5.7.3 "Time Service" tab

Time Service tab

This tab applies only to the Ethernet interface of the TIM.

Note

Here, it is not possible to set the time-of-day synchronization via the network attachments to a dedicated line (RS-232/RS-485 interface of the TIM). You make these settings in the properties dialog of the relevant dedicated line network, refer to the section: Configuring networks and network nodes in STEP 7 / NetPro (Page 90). There is no setting per network node in this tab because the hierarchical distribution of the time is specified automatically during parameter assignment (master station/station).

If the TIM is connected to a network on which the DNP3 master station is located, the PC in this network is always time master and the TIM always time slave.

In the *Time Service* tab of a TIM module, you decide how the TIM will react to time synchronization on its interfaces:

- Time-of-day synchronization via the Ethernet interface(s)
- Time-of-day synchronization via the S7-300 backplane bus cannot be configured.

The following figure shows the tab for a DNP3 TIM.

Properties - TIM 4R-IE DNP3 - (R0/54)				
General Addresses Tir	ne Service Interfaces Options			
		Т		
S7-300-Backplane	- No synchronization.			
Ethernet 1	- Synchronized every 2 minutes.			
Ethernet 2	- No synchronization.			
Synchronization cycle:	minute scheme			
Synchronization maste	r: no 💌			
Hour scheme [hr]:	1 Start time: 00:00 💌			
Minute scheme [min]:	2 Second scheme [s]: 10 💌			
Time of day [hr/min]:				
	, _, _			
		_		
OK Cance	el Help			

Image 5-26 Properties - TIM dialog, Time Service tab

If you click on one of the interfaces, the parameters for time synchronization appear below the box for the interface.

Each Ethernet interface to be synchronized by the master must be activated. Otherwise synchronization is not accepted on this port. The setting of the synchronization interval or time of a slave should be identical to that of the master on the Ethernet network because the slave monitors whether or not the synchronization takes place at the specified intervals or at the specified time. Setting a shorter interval or a different time would lead to error messages in the diagnostic buffer of the TIM.

Note

The error message is not exactly coordinated with the interval or the point in time.

- With an interval, the error message comes after 2.5 times the set interval. Example: At an interval of 2 hours, the error message is entered only after 5 hours.
- If a specific time is selected, a tolerance of 2.5 hours is allowed before an error is signaled.

Parameter settings for time synchronization

You can set the following options for the Synchronization cycle parameter:

- No synchronization: There is no time synchronization on the relevant network.
- Hour scheme: The number of hours between synchronization activities can be set in the "Hour scheme" drop-down list box.
 - Start time:
 If the cycle for time synchronization is longer than 1 hour, you can set a start time for time synchronization in the "Start time" drop-down list box.
- Minute scheme:

The number of minutes between synchronization activities can be set in the "Minute scheme" drop-down list box.

- Second scheme: The number of seconds between synchronization activities can be set in the "Second scheme" drop-down list box.
- Time of day:

Synchronization takes place once a day. Set the time of day for the synchronization in the "Time of day" drop-down list box (for example 01:00).

• Synchronization master (only for Ethernet interface)

This parameter cannot be set for DNP3.

5.7.4 "Interfaces" tab

"Interfaces" tab

The "Interfaces" tab displays a list of interfaces of the TIM module.

Properties - TIM 3V-IE DNP3 - (R0/54)	×
General Addresses Time Service Interfaces Options	
Interface State Info MPL not connected address = 3	=
Ethernet 1 connected to 'Ethernet (1)' address = 192,168,0.25 WAN 1 connected to 'WAN 1' station, polling, WAN address = 2	
Ethernet 1 Properties DNP3 parameters	
Send keepalives for connections - Interval [s] (0-65535, 0 = off):	
Keepalive monitoring time [s] (0-255, 0 = use defaults):	
Connection mode: DNP3 station	
Transport protocol UDP:	
DNP3 master monitoring time [s]:	
OK Cancel H	lelp

Image 5-27 "Properties - TIM" dialog, "Interfaces" tab for an Ethernet TIM

If you click on an interface, the parameter box for the relevant interface is displayed below the interface list.

MPI

The DNP3 TIM does not have an MPI interface. The display of the MPI interface depends on the configured CPU type:

• Configurations with CPU 315F, 315T, 317, 319

With these configurations, no MPI interface is displayed for the TIM.

• With configurations with smaller CPU types

With these configurations, the MPI interface is displayed for the TIM. For the TIM, with the "Properties" button, you can only change the station-internal MPI address of the TIM. If an MPI bus is configured, access to the MPI bus is via the CPU.

This applies to configurations with the following CPU types:

- All variants of the CPU 312, 312C, 313C, 314, 314C
- The CPU 315-2 DP and 315F-2 DP

Ethernet 1/2

If an Ethernet interface is selected, the parameters of the interface become visible.

Ethernet 1 corresponds to interface X3, Ethernet 2 corresponds to interface X4.

In the list box for the (static) Ethernet interface, "Ethernet 1" (or "Ethernet 2") is selected as default. You set the IP parameters of the Ethernet interface by clicking the "Properties..." button, see Configuring Ethernet nodes (Page 111).

Note

No switch function

The two Ethernet ports of a TIM 4R-IE DNP3 are not designed as a switch, but are intended for connection to different networks. Operation in the same Ethernet network is not permitted.

If this is ignored, it will not be possible to generate SDBs for the TIM. This is detected during the verification in subscriber administration and signaled.

The IP addresses of the two interfaces must therefore differ in at least one of the three leftmost decimal (separated by a period) numbers (applies to the usual subnet mask 255.255.255.0).

When an Ethernet interface is selected, you will see the following parameters:

• Send Keepalives for Connections - Interval [s]

Range of values: 0...65 535

This parameter specifies the interval in seconds at which keepalives are sent. If the value is set to 0, no keepalive messages are sent.

For connections via mobile wireless networks, a value of 120 seconds is recommended. The keepalive interval should always be shorter than the interval for "dead peer detection" (DPD) on the connected router.

• Keepalive monitoring time [s]

Range of values: 0...255

Default: 0

This parameter specifies the monitoring time in seconds when sending a keepalive. An acknowledgement of the message just sent must arrive within the monitoring time defined here.

If the TIM does not receive an acknowledgement, the TIM outputs an error message to the diagnostics buffer.

If the value is set to 0, the default value (1 second) is used on the TIM.

In mobile wireless networks, a message is normally acknowledged within a few seconds. This may take longer depending on the load on the network. Experience has shown that an "Ethernet timeout" of 10 seconds is practical in wireless networks.

Note

For the influence of the "Master station monitoring time" parameter on the "Keepalive timeout" parameter, see below.

Connection mode

You can set the Ethernet interface as follows:

Neutral

Select this setting if the station is connected to a SIMATIC S7-400/400H via the selected interface.

The S7 connection is then created automatically in NetPro.

DNP3 master station

Select this setting if the TIM is the DNP3 master station or a node station and the selected interface is connected to the lower-level stations.

DNP3 node station

Select this setting if the station is a node station and the selected interface is connected to the higher-level DNP3 master station.

DNP3 station

Select this setting if the station is a DNP3 station and is connected to the DNP3 master station via the selected interface.

• Master station monitoring time[s]:

Monitoring time for the DNP3 master station. Within the configured time, the TIM expects a signal from the DNP3 master station at the application layer.

If the TIM does not receive a signal from the master station during this time it assumes a fault on the master station, outputs an error message to the diagnostics buffer and, if configured, sets the relevant bit in the PartnerStatus system object to zero. The configured value is transferred to the connected DNP3 master stations.

When the monitoring time has elapsed, the master station must send a 'Daily Measurement' message to the station that must be acknowledged by the station. If the station does not reply to the message, it is classified as being unreachable by the master station.

If this parameter is > 0, connection failure at the TCP level that is detected using the keepalive mechanism is not signaled (see above).

Range of values: 0...65 535

Default: 0 (no monitoring)

Note: This mechanism can also be used for monitoring passive redundant paths.

• DNP3 parameters

Clicking the "DNP3 parameters" button opens the "DNP3 parameters" dialog, see section "DNP3 parameters" dialog (Page 123).

WAN 1/2

If a WAN interface is selected, the parameters of the interface become visible.

WAN 1 corresponds to interface X1, WAN 2 corresponds to interface X2.

Behind each interface that is to be connected with a network, there must be a network node of the corresponding type and this can be recognized by the "Properties" button being available for selection.

For each WAN access, you have the following options:

- Interfaces drop-down list
 - Drop-down list locked with "DNP3 dedicated line" display:

There is already a network node for this interface. Using the "Properties..." button, you can branch to the "Properties" dialog of the network node to make parameter settings. Using the "DNP3 parameters" button, you open the dialog with the same name; for the parameter assignment, refer to the section "DNP3 parameters dialog". With the "Delete..." button, you can remove the network node.

The "Properties" dialog of the interface is described in the section dealing with parameter assignment of network nodes.

- Drop-down list selectable with "DNP3 dedicated line" display:

There are not yet any network nodes for this interface. With the "New..." button, you create a network node of the type displayed in the interface list box.

• Modem type

The type of connected modem is displayed for each interface in "Modem type" if a modem exists on the TIM module or can be connected externally. The type of modem on the interface must be configured using the list box.

The modem type is checked during the plausibility checks to establish whether or not it is compatible with the current network parameters.

5.7.5 "DNP3 parameters" dialog

"DNP3 parameters" dialog

This section describes the tabs of the "DNP3 parameters" dialog that is opened from the "Interfaces" tab.

Properties - TIM 4R-IE DNP3 - (R0/S4)	×
DNP3 basic parameters DNP3 station parameters DNP3 even	nt parameters
Polling parameters Event polling interval: Class 0 polling interval:	(0-65535) 10 (0-65535)
Max. polling period [s] (0 = no limit):	10 (0-65535)
Polling mode:	Only after startup
- CPU status	
Signal CPU STOP with bit IIN 1.6:	
Node station parameters Reply without current station image:	
OK Cancel	Help

Image 5-28 The "DNP3 parameters" dialog

The tabs differ depending on the subscriber type of the TIM interface (master station / station).

"DNP3 Basic Parameters" tab

"Transmission settings" box

Unsolicited transfer

The parameter specifies whether or not event messages from a station TIM can be sent spontaneously to the DNP3 master station.

Range of values:

– No:

No unsolicited (spontaneous) messages are sent.

- Yes:

The station TIM can send spontaneous messages.

Default: No

If the option is enabled on the station TIM, this sends a query to the master station TIM. If the option is disabled on the master station TIM, the master station TIM sends a control message (DISABLE_UNSOLICITED) with the information that the sending of unsolicited messages by the station is not permitted and the station TIM saves the events without sending them.

To achieve a consistent configuration you should select the same setting for the communicating interfaces of the station TIM and master station TIM.

Note

If the TIM interface is connected to a serial DNP3 dedicated line with the type of connection "half duplex", you will need to set the "Unsolicited transfer" parameter to "No". To avoid collisions, you should also set the parameter to "No" when connected to full duplex multidrop dedicated lines.

Repetition of spontaneous messages

This parameter specifies how often spontaneous messages are repeated if transmission is disrupted. On serial connections, repetitions may be useful if transmission is not always reliable. On Ethernet connections, the value 0 is generally configured because any necessary repetitions are handled by the protocol implementation.

Possible values: 0 ... 255

Default: 0

• Preselection time [s]

The time value specifies the maximum time between command preselection and command input in seconds (select before operate). If the command is not input within the specified time after the command preselection by the operator in the master station, the command must be selected again. Having to enter the command twice reduces the risk of accidental operation in the master station.

Possible values: 1 ... 255

Default: 5

If a master station sends an object with the control code "DIRECT_OPERATE", the "Preselection time" for the received object is not evaluated in the station.

The following objects are always sent by the master station with the control code "DIRECT_OPERATE": Bin08X_S (12), Cmd01B_S (12), Par12D_S (41), Set01W_S (41)

• Transmission mode

This parameter specifies the order in which the DNP3 events are transmitted to the DNP3 master station.

Possible values:

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 messages somewhat more compact and transmission more efficient.

Chronological

In this mode, events are transmitted strictly chronologically. The optimizing effect of grouping in 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.

Default: Type-specific

"Connection properties data link layer" box

• Frame repetitions

The parameter specifies the maximum number of repetitions at the data link layer. On serial connections, repetitions may be useful if the connection quality is not good. On Ethernet connections, the value 0 is configured here because any necessary repetitions are handled by the protocol implementation.

Range of values: 0 ... 255

Default: 0

• Acknowledgment request (data link layer)

Here, you specify whether or not the TIM requests an acknowledgement from the communications partner on the application layer with sent data messages (sending of the function code "CONFIRMED_USER_DATA"). On Ethernet connections, the DNP3 specification recommends that the acknowledgement requests are not used on the data link layer. On connections that are liable to disturbances, for example wireless links, the configuration of acknowledgement requests can be useful on the data link layer.

Possible values:

- Never:

No acknowledgments are requested.

Always:

Acknowledgments are always requested.

- When segmented:

Acknowledgements are only requested with data messages that are segmented due to their length.

Default: When segmented

Acknowledgment monitoring time [ms]

This value specifies how long an acknowledgement may take on the data link layer before a message is entered in the diagnostics buffer of the TIM. The default value of 2000 ms normally only needs to be increased for slow serial connections.

Possible values: 0...65535

Default: 2000

• TCP / IP listener port

Here, you assign the port number via which the DNP3 station sends connection queries to the DNP3 master station. The DNP3 specification recommends using port number 20000.

Possible values: 0 ... 65535

Default: 20000

"DNP3 event parameters" tab

This tab is shown only for interfaces with the connection mode "DNP3 station" or "node station".

"Event properties " box

• Buffer for class 1 / class 2 / class 3 events

Once the number of events of the specified class entered here is reached in the send buffer (message memory) of the TIM, the relevant messages are sent to the DNP3 master station and the events are deleted from the send buffer.

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

Ranges of values:

- TIM 3V-IE DNP3: 0 ... 65535
- TIM 4R-IE DNP3: 0 ... 200000

Default: 1

Delay time for class 1 / class 2 / class 3 events [s]

Specifies the maximum delay after which an event belonging to the specified class can be sent to the partner after it has occurred if spontaneous transfer is configured (see "DNP3 basic parameters" tab, "Transmission settings" parameter box.

Possible values: 0 ... 65535

Default: 0

"DNP3 station parameters" tab

This tab is shown only for interfaces with the connection mode "DNP3 station" or "node station".

"Polling parameters" box

Event polling interval

Specifies the number of basic intervals after which events in the station should be polled by the DNP3 master. For the basic interval, refer to the "DNP3 master station parameters" tab

This parameter is particularly important for event transfer if no spontaneous transfer of events is configured (see "DNP3 basic parameters" tab, "Unsolicited transfer").

The value configured for the station is transferred to the master station and stored there.

Possible values: 0 ... 65535

Default: 1

• Class 0 polling interval

Specifies the number of base intervals after which the class 0 data should be polled from the image memory of the station. For the basic interval, refer to the "DNP3 master station parameters" tab

The value configured for the station is transferred to the master station and stored there.

Possible values: 0 ... 65535

Default: 1

• Max. polling period [s]

Specifies the maximum period for which the DNP3 master station can poll this station continuously. Even if there is still data to be transferred in the station after this time, polling is stopped by the DNP3 master station. As a result, the DNP3 master station is available for other stations again.

The value configured for the station is transferred to the master station and stored there.

With the setting 0 (zero), the function is disabled; in other words the polling period is unlimited.

Possible values: 0 ... 65535

Default: 10

Polling mode

Here you specify the mode with which the DNP3 master station polls the station.

The value configured for the station is transferred to the master station and stored there. Ranges of values:

Interval query

The stations are queried for the setting of the "Class 0 polling interval " parameter.

Only after startup

The stations are polled only after the first startup of the TIM and after the station restarts.

"CPU status" box

• Signal CPU STOP with bit IIN1.6

If the CPU changes to STOP and if the option is enabled this leads to the following reactions:

- A diagnostics message is entered in the diagnostics buffer of the station TIM.
- The CPU STOP is signaled to the partner.

To do this, the internal indication bit "IIN1.6" is set in the next message.

"Node station parameters" box

Preliminary overview: A node station TIM maintains the station process image in the image memory for each lower-level DNP3 station.

• Reply with current station image

- Option enabled

If the option is enabled, the node only replies to a class 0 poll if the process image in the image memory of the node station is up to date.

- Option disabled

If the option is disabled, the node replies to a class 0 poll even if the process image in the image memory of the node station is not up to date. When polled by a DNP3 master station, the data of all connected DNP3 stations is sent to the master station even if one or more stations are not up to date.

"DNP3 master station parameters" tab

This tab is shown only for interfaces with the connection mode "DNP3 master station".

"Master station parameters" box

• Base polling interval [s]

Here, you specify the base interval for polling stations by the DNP3 master station.

The base polling interval is used to calculate the following parameters in the "DNP3 station parameters" tab:

- Event polling interval
- Class 0 polling interval

Possible values: 0 ... 65535

Default: 30

• Max. number of events per poll

Maximum number of events that can be sent in the reply message of the station after being polled by the DNP3 master station.

If you enter 0 (zero), the function is turned off (no limitation).

Possible values: 0 ... 65535

Default: 0

• Connection monitoring time (application layer) [s]

Time within which a sign of life is expected from the station. If the configured time is exceeded, the DNP3 master station sends a message to the station on the application layer. If this message is not acknowledged by the station, the station is classified as being unreachable. With redundant paths, if the acknowledgment is not received, the transmission path is classified as disturbed.

If you enter 0 (zero), the function is turned off and no message is sent.

Possible values: 0 ... 65535

Default: 5

Note on commands: If a connection to a station is interrupted or disrupted, commands are repeated a maximum of three times before they are discarded by the master station if the interruption to the connection remains.

5.7.6 "Options" tab

"Options" Tab

Properties - TIM 4R-IE DNP3 - (R0/S4)	×				
General Addresses Time Service Interfaces Options NTP					
Global message memory RAM drive Size [Kbytes]: I Size of memory block [bytes]: I	00				
Replace module without PG					
Local subscribers					
Security settings for Ethernet interface					
Security settings for SDBs					
OK Cancel	Help				

Image 5-29 "Properties - TIM" dialog, "Options" tab

"Global message memory" box

• Size:

This parameter specifies how much memory is used to manage buffered DNP3 events.

40 bytes of memory are necessary for each DNP3 event. The maximum number of events that can be stored depends on this value. The available memory is assigned in equal parts to the configured DNP3 master stations. At runtime, the possible number of stored DNP3 events is displayed in the diagnostics dialog of message management.

Example:

If 10 kB (10240 bytes) of global message memory are used with 2 configured DNP3 master stations, this results in 10240 / 40 = 256 events. This means that 128 events can be stored per master station.

If the value zero is configured for the global message memory, the message memory will be created with the maximum possible size. The maximum number of DNP3 events in the message memory is as follows:

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

Remember that the transmission of several thousand events can take a very long time especially with serial connections with a low transmission speed. Since the oldest stored

events are sent first, it takes a correspondingly long time before the latest events are known in the master station.

Range of values: 0 to 1024 KB default: 0

• Size of memory block:

This parameter cannot be set for DNP3, it is set permanently to 128..

RAM drive:

This parameter cannot be set for DNP3, it is set permanently to 100..

"Replace module without PG" box

• Save configuration data on the CPU:

If you enable this option, the system data blocks (SDBs) of the TIM module are stored on the CPU. If the TIM module fails, the defective TIM can be replaced by a TIM of the same type without leading to download the SDBs to the TIM using a PG. The Tim module receives its SDBs during startup from its local CPU.

If the TIM is configured as a stand-alone without a CPU in the rack, this function is not available.

Note

If there is no C-PLUG inserted in a TIM 4R-IE DNP3, the configuration data is stored in flash memory. If there is a C-PLUG inserted in the TIM 4R-IE DNP3, the configuration data is stored automatically on the C-PLUG when it is downloaded to the TIM. If you replace the module, you can insert the C-PLUG with the configuration data in the new module.

"Security settings for Ethernet interface" box

• IP address may be read using DCP

If the option is enabled, the TIM replies to read queries for the IP address using the DCP protocol (Discovery and Basic Configuration Protocol). The address of the TIM cannot be modified using DCP.

DCP is used by a PG with the aid of the Primary Setup Tool (PST) or the addressing function of the SIMATIC Manager.

"Security settings for Ethernet SDBs" box

Check DDB source

The option is only effective when the system data blocks are stored on the CPU, refer to the parameter group "Replace module without PG" ("Save configuration data on the CPU:" enabled).

Enabling the option "Check SDB source" has the following effects:

- When the SDBs are stored on the CPU, the TIM checks the origin of new SDBs. If SDBs are to be loaded on the TIM from a PG, the TIM rejects loading of the SDBs. The deleting of SDBs from a PG is also blocked.
- Resetting the TIM from a PG is blocked.
- Updating the firmware of the TIM is blocked.

5.7.7 "NTP" tab

"NTP" tab

Here, you make the settings for a TIM 4R-IE DNP3 in a master station for time-of-day synchronization by up to two NTP servers.

In NTP mode, UTC (Universal Time Coordinated) is transmitted. This corresponds to GMT (Greenwich Mean Time).

Properties - TIM 4R-IE DNP3 - (R0/S4)	×
General Addresses Time Service Interfaces Option	s NTP
Basic settings Synchronization cycle of Ethemet interface:	02:00 V (hours)
GMT offset: NTP (secure):	+01:00 (hours)
NTP server 1	
Key ID:	33330 (0 - 65.535)
Key name:	(max. 11 characters)
IP address of the server: enable:	192 . 168 . 1 . 0
NTP server 2	
Key ID:	0 (0 - 65.535)
Key name:	(max. 11 characters)
IP address of the server: enable:	0.0.0.0
OK Cancel	Help

Image 5-30 "NTP" tab

5.8 Consistency check and saving

"Basic settings" box

• Synchronization cycle

You specify the synchronization cycle using the drop-down list.

• GMT offset (hours)

Here, select the offset of your local time zone to Greenwich Mean Time.

- NTP (secure)
 - If the option is disabled, NTP without authentication is used.
 - If the option is enabled, the secure method NTP (secure) is used.

NTP (secure) uses authentication with symmetrical keys according to the hash algorithms MD5 or SHA-1.

You then make the settings for the parameters of the NTP servers.

"NTP server 1" / "NTP server 2" boxes

Key ID

Here, enter the key ID agreed with the provider of the NTP server.

The hash function MD5 is supported for the key.

Possible values: 0...65535

• Key name

Here, enter the key name that helps you to identify the key with the key ID entered above. Range of values: 5 ... 11 ASCII characters

• IP address of the server

If you want to use the NTP server, first select the "enable" check box.

Then enter the IP address of the NTP server in decimal numbers.

5.8 Consistency check and saving

Saving and consistency check

Once you have completed the parameter assignment in the hardware configuration, the current version must be saved with the "Station / Save" menu. You can generate system data blocks (SDBs) using the "Save and compile" menu later since there are still other configuration steps necessary before the SDBs can be generated completely. When you close hardware configuration, a dialog opens automatically prompting you to save your entries.

When you select the "Save and compile..." function, a consistency check is run and a message is displayed if configuration errors are detected.

Note

To be able to acquire all the configured parameters for the TD7 software following changes in the hardware configuration of existing installations when the system data is generated, the SINAUT configuration tool must first be started with the connection configuration and then with the subscriber administration. The project should be saved there, and the SDBs should be generated exclusively in "Subscriber administration".

Printing module information

The information on all configured modules in the current rack or for a selected module can be printed out using the "Station / Print..." menu.

5.9 Configuring time-of-day synchronization

5.9.1 Configuring time-of-day synchronization - overview

Configuring time-of-day synchronization

You configure time-of-day synchronization in STEP 7.

Note

Avoiding time-of-day inconsistencies

Note the following points relating to time-of-day synchronization:

- Make sure that only one subscriber ever operates as the time-of-day master in a DNP3 network.
- Make sure that only one of the methods of time-of-day synchronization listed below is used.

Initially, specify 1 time master in the network. This obtains its time of day from a PC or an NTP server.

- You make the settings for synchronization by a PC in the "Time Service" tab of the TIM, see below.
- You make the settings for synchronization of a TIM 4-IE DNP3 by an NTP server in the following tabs: "NTP" tab (Page 132)

To connect the TIM to the network / Internet in which the NTP server is located, you do not need to specify an interface in the configuration. Simply enter the IP address of the NTP server in the "NTP" tab mentioned above.

It is advisable to separate the two interfaces of the TIM 4R IE DNP3 into the internal data network (your system) and external network (connection to NTP server).

The procedure that follows differs depending on the S7 device family (S7-300 / S7-400) and on the network type.

Time-of-day synchronization via the TIM in an S7-300

You specify day direction of the time-of-day synchronization with the type of connected interfaces of the TIM modules. The configuration is slightly different for the various network types:

• Ethernet

The direction of time-of-day transfer is made here by setting the "connection mode" of the TIM interfaces. Set the connection mode in the properties dialogs of the TIM in the "Interfaces" tab; for the master station set "DNP3 master station" and for the other TIM modules set "DNP3 station" or "DNP3 node station".

• Dedicated line / dial-up network

Here, the direction of the time of day transfer is decided by the setting of the "Network node type" of the connected TIM modules (properties dialog of the TIM > "Interfaces" tab > WAN interface X > Properties > Node type) The time of day is sent by the master station to the connected station TIMs or node stations. For information on configuration, refer to the properties dialog of the WAN network, section Configuring WAN network nodes (Page 99)

You configure the time-of-day synchronization of the TIM modules in the properties dialog of the TIM > "Time Service" tab (Page 117).

The station TIM makes the time of day available to the local CPU in its I/O addresses. This makes the time of day available to the assigned S7 CPU. You will find details in the section Time-of-day synchronization of the S7-300 CPU (Page 135).

Time-of-day synchronization via the TIM in an S7-400

You will find a description of the procedure for a TIM as CP of the S7-300 and for the S7-400 in the section Time-of-day synchronization of an S7-400 CPU (Page 137).

Time-of-day synchronization using the CPU

Apart from the time of day synchronization of the station using the TIM, you can also synchronize the time of day of the TIM with that of the CPU.

You will find a description of the procedure for an S7-300 and an S7-400 in the section Synchronization of the TIM time of day by the CPU (Page 138).

5.9.2 Time-of-day synchronization of the S7-300 CPU

Time information provided by the TIM

The time-of-day synchronization of the TIM is configured in STEP 7 in the properties dialog of the TIM, refer to the section "Time Service" tab (Page 117).

The function described below applies only if the TIM is installed as a CP in the S7-300 rack. It does not apply to a stand-alone TIM.

The TIM in the S7-300 makes the time of day available to its local CPU in the I/O addresses. The CPU user program can then read and evaluate the time there.

The I/O addresses of the CPU that makes the date and time information available to the TIM are set in the properties dialog of the TIM, "Addresses" tab; refer to the section "Addresses" tab (Page 116).

The time information of a time-synchronized TIM module with TD7onTIM is stored in 8 bytes of the peripheral inputs. The time information has an offset of 8 bytes from the start value of the inputs. The following table shows the assignment of the 8 bytes of time information.

Time-of-day format

Byte No.	Offset [bytes]	Meaning	High nibble		Lov	v nibble
			Value	Range of val- ues (decimal)	Value	Range of val- ues (decimal)
1	+8	Year	tens	09	ones	09
2	+9	Month	tens	09	ones	09
3	+10	Tag	tens	09	ones	09
4	+11	Hour	tens	09	ones	09
5	+12	Minute	tens	09	ones	09
6	+13	Second	tens	09	ones	09
7	+14	Millisecond	hundreds	09	tens	09
8	+15	Millisecond	ones	09	Status	bit coded

Table 5-1 Format of the time information in the inputs of the I/O addresses of the TIM

Meaning of the entries in the table:

- Offset: Offset to the base value of the peripheral inputs in bytes
- High nibble: Bits 4-7
- Low nibble: Bits 0-3
- Value: Position of the relevant number
 - Year, month, day, hour, minute and second are two-digit (tens + ones)
 - Milliseconds are three-digit (hundreds + tens + ones)
- Status: Status of the time information

Format of "Status"

The status of the time information is available in the four bits of the low nibble of byte 8. The following table shows the meaning and the values of the status.

Bit No.	3	2	1	0
Meaning	Prewarning bit	Not defined	Daylight saving time (DS), standard time (ST)	Validity of the time
Value	0 = -		0 = ST	0 = invalid
	1 = prewarning: Changeover at the next full hour (DS -> ST or ST - > DS)		1 = DS	1 = time valid

Table 5-2 Status bits of the time (low nibble of byte no. 8)

Initial setting of the time

The user program that reads out the time on the CPU should only do this when the validity bit is set. This is the case as soon as the TIM is synchronized the first time, either by the time master in the DNP3 network or by the PG.

Note

If the time on the TIM was set from a PG, this is always indicated as standard time (status bit 1 has the value "0").

5.9.3 Time-of-day synchronization of an S7-400 CPU

Time information provided by the TIM 4R-IE DNP3

If a TIM 4R-IE DPN3 in stand-alone mode is connected to a master station via Ethernet and an S7-400 CPU is connected to the second Ethernet interface, the TIM can synchronize the time of day of the CPU. The TIM synchronizes the S7-400 CPU using SNAP messages.

The parameters for time-of-day synchronization are set in the properties dialog of the TIM in the "Time Service" parameter group:

- The synchronization cycle is set on the Ethernet interface connected to the master station. The TIM automatically obtains the time-of-day from the master station computer.
- The second Ethernet interface that is connected to the S7-400 CPU is set to "Synchronization master".

The S7-400 CPU must be configured in the "Clock" parameter group as a slave.

5.9.4 Synchronization of the TIM time of day by the CPU

Apart from the option of synchronizing the TIM by a master station or using NTP, the TIM can also be synchronized by its local CPU.

Please note: You require an Ethernet CP in the 400 station.

Follow the steps described below when configuring in STEP 7.

Time-of-day synchronization of the TIM by the 300 CPU

- 1. In the properties dialog of the CPU, open the "Diagnostics / Clock" tab.
- 2. In the "Clock" box, select the option "As master" in the "On PLC" drop-down list and select the time interval.
- 3. Close the properties dialog of the CPU.
- 4. Open the properties dialog of the TIM with the "Time Service" tab.
- 5. Select the backplane bus and set the synchronization cycle to the same setting as configured on the CPU.
- 6. Close the dialog and save.

Time-of-day synchronization of the TIM by the 400 CPU

- 1. In the properties dialog of the CPU, open the "Diagnostics / Clock" tab.
- 2. In the "Clock" box, select the option "As master" in the "On PLC" drop-down list and select the time interval.
- 3. Close the properties dialog of the CPU.
- 4. Open the properties dialog of the Ethernet CP and enable the "Enable time-of-day synchronization" option in the "Options" tab.
- 5. Close the properties dialog of the CP.
- 6. Open the properties dialog of the TIM with the "Time Service" tab.
- 7. Select the backplane bus and set the synchronization cycle to the same setting as configured on the CPU.
- 8. Close the dialog and save.

The SINAUT Configuration Tool

6.1 Installing / uninstalling

6.1.1 Installation of the SINAUT standard software package

To install individual or all components of the engineering software, the required versions of the following components must exist on the PC:

- Windows operating system
- STEP 7

You will find the required versions of these software components in Preface (Page 3).

If the Autorun feature is activated on your PC/PG, the SINAUT setup program starts automatically when you insert the CD. Otherwise, use the Explorer to open the root directory on the CD and click on the Setup.exe application.

The setup program checks which components on the CD can be installed and then displays a list from which you can make your selection. Setups are currently available for the following components.

- SINAUT configuration tool: Basic version
- SINAUT TD7 Library

Select the components you want to install (you can select several packages at once using shift-click) and start the installation by clicking the Install button. To configure DNP3 systems, the TD7 Library component does not necessarily need to be installed.

During installation, the setup program will prompt you for or display any further information necessary.

The installation programs perform the following individual operations:

- The programs and data supplied with the engineering software are copied to the correct locations in the STEP 7 directory.
- A new submenu SINAUT ST7 containing the tools of the engineering software is integrated in the SIMATIC menu in the Windows Start menu.
- A SINAUT ST7 Configuration icon is created on your desktop.

Note

The engineering software registers in the Microsoft Windows system files. Do not use Microsoft Windows tools such as the Explorer to move or rename SINAUT files or folders or to modify STEP 7 data in the Microsoft Windows registry. Following such modifications, your program may no longer functioning correctly.

6.2 Version information and link to Internet pages

6.1.2 Uninstalling SINAUT software packages

Uninstalling SINAUT software packages must be in conformity with the operating system you are using. Open the Windows Control Panel and select "Add/Remove Programs".

In the dialog that opens, select Change or Remove Programs and select the required component from the list and then select the Add/Remove button. Following a prompt for confirmation, the component is then removed from your system.

6.2 Version information and link to Internet pages

Version information using the Start menu

The version information wizard displays the currently installed version and compilation time of the most important components of the configuration software. The installed versions of the TD7 library (for the CPU) and the TIM firmware are also shown.

This is called from the Windows Start menu:

Start > Siemens Automation > SIMATIC > SINAUT ST7 > SINAUT ST7 - Information

Version information of the engineering tool and link to telecontrol Internet pages

To display program version information, call up the About dialog of the SINAUT configuration tool with the "Help > About" menu.

Using the Internet address www.sinaut.de (<u>http://www.sinaut.de</u>) at the top right of the About dialog, you open the telecontrol homepage of the Siemens Industry communications division.

6.3 Startup and operation

Starting the SINAUT configuration tool

The SINAUT configuration tool is started from the Start menu:

Start > Siemens Automation > SIMATIC > SINAUT ST7 > SINAUT ST7 Configuration

Open a project using the Project > Recently used" menu or by using the "Open project" button in the toolbar.

After selecting the project, the "SINAUT ST7: Configuration" dialog opens making the three following main functions of the SINAUT Configuration Tool available:

Connection Configuration

For configuring the telecontrol connections

- Subscriber Administration
 - For configuring subscriber-specific properties
 - For configuring the communications software TD7onTIM

Here, you configure the communications procedures and the communications objects

• SINAUT ST1 ...

This tool is not required for DNP3 systems.

SINAUT Configuration Tool				
NAUT ST7	՝ Տղ Տղ	<u>Connection Configuration</u> <u>Subscriber Administration</u> SINAUT ST1 - Configuration <u>O</u> verview		
S	ОК	Cancel Help	J	

Image 6-1 Selection dialog of the SINAUT Configuration Tool

To create the configuration, first select the Connection Configuration option.

Changing between the tools

When the SINAUT Configuration Tool is open, you can change between the three functions using:

- The "SINAUT"... menu
- The corresponding buttons in the toolbar
- The following function keys:
 - F3 for Connection Configuration
 - F4 for Subscriber Administration

Operator input

The SINAUT configuration software fits into the familiar Windows sequences. Functions such as window technology, menu bar, toolbar or the online help for the dialogs correspond to the Windows or STEP 7 standard.

Select a graphic object by clicking it once with the left mouse button.

Further functions for this object are then available over the menu bar, over the buttons of the toolbar or often over a context menu that opens when you select an object with the right mouse button.

Buttons in the properties dialogs have the following functions:

• OK

Applies the entries made and closes the dialog.

6.4 The connection configuration

Cancel

Discards the entries made and closes the dialog.

Exception:

In the "Subscriber Administration, the Cancel button is not available. In this case, the dialog is closed without entering changes by clicking on the close button [x] in the right-hand top corner of the header line of the dialog.

• Help

Opens the online help.

How to work with the functions of the individual configuration tools "Connection Configuration", "Subscriber Administration" and "TD7onTIM" is explained in the following sections.

6.4 The connection configuration

6.4.1 Configuring the connections

The DNP3 connections

In DNP3 systems, connections are always configured between the following subscribers:

- Between the CPU of a station and the CPU of the DNP3 master station
- Between the CPU of a station and a control center PC
- Between two CPUs of stations (only with direct communication in Ethernet / dial-up network)





The connection shown in red in the figure between the DNP3 master station and DNP3 station is not shown in this form in NetPro.

This is taken into account in the SINAUT connection configuration:

- Connections can be configured without knowing the exact connection path.
- The exact connection path can be viewed based on a list of used network nodes. The degree of detail of the connection information can be set.

View of the Connection Configuration window

Open the connection configuration only after the configuration in STEP 7 NetPro has been completed.

After opening the connection configuration, the configuration window opens.



Image 6-3 The Connection configuration window of the SINAUT configuration tool

In the right-half of the window, the possible connections are listed in a tree structure resulting from the network configuration in NetPro. The connections actually required and used for communication in the telecontrol system installation must be transferred from the right-hand to the left-hand window configured connections.

The two lists display the number of connections involved.

6.4 The connection configuration

The entries in the connection tables must be interpreted as follows:

Level	Symbol	Meaning	
1	1	Connection starting point	
2	•	Connection end point	
3	Å	Alternative path	
4		Connection node over which the connection runs	

 Table 6-1
 Symbols in the connection list of the connection configuration

Invalid connections are displayed in red as shown in the example of a connection that no longer exists due to reconfiguration (see figure).

The labeling of the individual connection point in the basic setting describes the relevant subscriber with:

Subscriber number / Station name / Module / Interface.

Example: 5 / Station 3 / CPU 312 / MPI (2)

The representation can be set to meet individual requirements using the Extras / Options menu.

Rules for connection configuration (DNP3)

- For each path (physical network) only one connection can be configured.
- Between a DNP3 master station and a DNP3 station, a maximum of 2 paths can be configured.

Exception: a redundant DNP3 master station is involved. In this case, a station TIM can have a maximum of 4 connections on 2 paths (interfaces).

- In DNP3 dedicated line networks, connections can only be configured between the following partners:
 - DNP3 master station DNP3 station

DNP3 master station - node station

Node station - DNP3 station

• In Ethernet and dial-up networks, connections between two stations can also be selected for direct communication.
Functions of connection configuration

To make configuration of the required connections as simple as possible for the user, the SINAUT Configuration Tool uses the following strategy:

- The entire currently configured network is analyzed. All potential communications subscribers from the engineering software perspective are assigned a subscriber number (DNP3 address) if they do not already have one. The subscriber numbers for CPU modules and third-party stations are assigned starting at no. 1, for TIM modules there are assigned starting at no. 1001.
- A tracking algorithm detects all connections in the current network. These connections can also extend over several LAN and WAN networks. The connections permitted based on specified rules are represented on the right as possible connections in a tree structure.
- Telecontrol connections that have already been configured are displayed in the left-hand window for configured connections. Each of the connections loaded there is then checked to establish whether its configured parameters match the current network and hardware configuration. If this is not the case, and error message indicating incorrect connections is displayed as soon as the connection configuration is opened and the bad connection is displayed in red in the configured connections window.

If a station of the type other station was configured in NetPro, connections from the stations to stations of the type DNP3, PG/PC, or a PCS 7 control center are not displayed. This does not, however, mean that these connections do not exist. These connections are in fact displayed in the opposite direction; this means, for example, from a DNP3 station to a station of the type other station.

As a general rule, a connection displayed in the configured connections in only one direction, works in both directions.

Selection of the required connections

If no connections are displayed in the left-hand window, the required connections must be transferred from the right-hand window. Follow the steps outlined below:

- 1. Expand the tree structure by clicking on the branch symbol (+) or by double-clicking on the connection group. The tree structure opens.
- 2. Select a possible connection in the right-hand window.
- 3. Enter the possible connection as a configured connection in the left-hand window by
 - selecting the Edit / Apply menu or
 - pressing the right mouse button and selecting Apply in the displayed shortcut menu.

If alternative communications paths exist and you want to use them, expand the possible connection structure in the possible connections by double-clicking on it and select the connection and apply it.

Redundant connections

With redundant connections, for example those of a redundant DNP3 master station, the higher connection in the tree structure is the preferred path and the lower connection is the substitute path. The master station always sends via the preferred path first. It only sends via the substitute path if the preferred path fails.

6.4 The connection configuration

The connection with the preferred path should therefore be applied first.

A station always replies on the path on which it received the polling message.

Connections that are not required can be removed from the list of configured connections at any time. Follow the steps outlined below:

- 1. Select the connection in the "Configured connections" window.
- 2. Select the "Edit" > "Delete" menu.

or

Select the "Delete" menu in the displayed shortcut menu (right mouse button).

Bad connections displayed in the configured connections window are shown in red and can result from bad configuration or subsequent changes to a configuration. If there is an incorrect connection between two subscribers, the old and no longer valid connection must be deleted from the configured connections and the current connection must be taken from the list of possible connections again.

Note

If a connection configured in the network configuration is not included in the list of possible connections because it is invalid, this is displayed in the list of invalid connections. The invalid connections dialog is described separately and contains information on connections that do not conform.

Saving the connection configuration

Once any invalid connections have been checked and removed and all required connections configured so that they appear in the left-hand window, the connection configuration must be saved with the SINAUT / Save menu or the Save button in the toolbar. Saving is necessary to store the connections permanently.

If a message is displayed during saving indicating that a connection between two stations configured in NetPro could not be found, the connection must be checked in NetPro and reconfigured.

After saving the connection configuration, open Subscriber Administration of the SINAUT Configuration Tool to configure the subscriber data and to generate the system data blocks there.

Changing the connection configuration

By opening the connection configuration again, you can change the scope of the configured connections at any time. By changing parameter settings or by reconfiguring, it is possible that a previously configured connection no longer exists. This then appears in the Recover lost connections list that is described separately.

After changing the connection configuration, this must be saved, Subscriber Administration must be called and the generation of the system data blocks started.

To document the configured DNP3 connections, the SINAUT configuration tool allows connection lists to be printed in 2 formats. You start a printout with the *Project / Print* menu.

Before printing, you can use a print preview function to check the printout using the *Project / Print Preview* menu.

6.4.2 Invalid Connections

With its algorithms, connection configuration finds all the possible connections in the current project. Connections that do not meet certain rules are displayed for the user in the Invalid Connections dialog. The connections contained here are then not included in the list of possible connections. If there is a large number of invalid connections, memory space does not always allow all invalid connections to be displayed.

The Invalid Connections dialog is displayed using the SINAUT / Show Invalid Connections menu or the Show Invalid Connections button in the toolbar.

Invalid Connections
invalid connections - total number: 100
□ 1 / DNP3 Master / DNP3 master / Ethernet(1) □ 3 / Station 3 / CPU 312 / MPI □ via subscriber-1004 -1003 □ via subscriber-1 -1004 -1003 □ via subscriber-1 005 -1004 -1003 □ via subscriber-1005 -1004 -1003 □ via subscriber-1005 -1004 -1003 □ • • •
Error: This connection contains at least one TIM that is neither at the beginning or end of the connection but is configured as a "Station". This constellation is not allowed.
ОК Нер

Image 6-4 Invalid Connections dialog

If you expand a connection structure in the list of invalid connections by double-clicking on it and if you then select a single connection, the reason for the invalidity and a note on how to remedy the situation are displayed in the lower part of the dialog. The note might, for example, inform you that the connection should be configured in the reverse direction.

6.4 The connection configuration

The permitted connections must keep to the following rules:

• A connection must not run through an inconsistent network. Examples are described along with the plausibility check in the network configuration.

Note

To avoid including large numbers of connections unnecessarily in the list of possible and configured connections, some connections used between two subscribers in both directions are shown only in one direction.

A connection displayed in the configuration tool is always valid in both directions.

6.4.3 Recovering lost connections

If changes are made to connections in a project, it is advisable to open the *Recover lost connections* window afterwards. You can do this with:

- The SINAUT / Recover lost connections menu or
- The *Recover lost connections* button on the right of the toolbar

If changes to the connection configuration, previously existing connections were modified and either linked to other objects or completely deleted, connection configuration has algorithms with which to find these lost connections in the project.

Deleted connections are displayed in red in the left-hand part of the *Recover lost connections* window. Connections that are similar to the deleted connections may also be listed in the right-hand part of the window. This allows you to check whether there is a substitute or successor to the last connection.

If you no longer require the lost connections in the left-hand part of the window, you can delete these by selecting and clicking the *Delete lost connections* button.

If connections are displayed in the right-hand part of the window that are similar to the last connections you can insert these again if you have accidentally deleted connections and still require them. To do this, select the connection in the right-hand part of the window and click the *Recover connections* button.

6.5.1 Functions of subscriber administration

Configuring subscriber data

Once the telecontrol connections have been configured, all the requirements are met so that you can configure the subscriber data for the DNP3 communications subscribers as follows:

- Generating subscriber data
- Displaying subscriber data
- Editing subscriber data
- Pack the subscriber data so that it can be understood by the hardware components; in other words, in data blocks (DBs) or system data blocks (SDBs).

Processing is always necessary when data needs to be acquired that is connection-related; in other words cannot be assigned to a particular subscriber. Processing of subscriber data is also necessary when data other than for objects is stored,

for example the DB configuration for the CPU modules.

After starting subscriber administration, first the previously known data of the subscribers is loaded from the data management and then updated. The following data is updated:

- Subscriber information: Which subscribers exist?
- Networking information: Who communicates with whom over which connections?
- DB configuration information: Which data blocks are generated for a CPU?

Configuring TD7 software

The last entry in the navigation to the left in the window contains the subscribers with TD7onTIM. With these subscribers, the properties of the TD7 software are configured directly on the TIM.

The parameter assignment for this data is described in the section TD7onTIM (Page 158).

Printing subscriber lists

To provide users with an overview of the existing subscribers, the SINAUT configuration tool provides the option of printing out the list of subscribers in a brief overview format and as a long version.

A print preview function is available to check the output before printing.

6.5.2 Subscriber list

Information in the subscriber list

The window of the subscriber administration contains the following areas:

- Directory tree in the left-hand part of subscriber administration
- Subscriber list top right
- Parameter area below the subscriber list

SINAUT ST7 : Configuration - Project '_C		:\Program Files`	\Siemens\Step7	\S7Proj_DNP_	B_0' - [Subscribe				
🍺 🔌 🦻 🏘 🖬 🖨 🖇 🖻 💡	()								
Subscriber types:	Last change of conne	ction configuration	: 06/07/1	2 17.17.00	Selected CPUs: ()			
🖃 🖓 All SINAUT subscribers	Subscriber no.	Subscriber type	Module	Station	SINAUT connect	ed SIN 🔺			
SINAUT TIM subscribers	01	CPU 314	CPU 314	DNP3-Station 1	yes				
SINAUT CPU subscribers	2	CPU 314	CPU 314	DNP3-Station 2					
SINAUT ST7cc/ST7sc subscri	3	CPU 314	CPU 314	DNP3-Station 3		TD			
SINAUT ST1 subscribers	4	CPU 314	CPU 314	DNP3-Station 4		TD			
SMS control center	5	CPU 314	CPU 314	DNP3-Station 5		TD			
DNP3 master	6	CPU 417-4	CPU 417-4	SIMATIC 400(1)		TD			
	100	Other Station		DNP3-Zentrale	yes				
TIMs with TD7onTIM	1001	SINAUT TIM	TIM 3V-IE DNP3	DNP3-Station 1	yes	TD 🖵			
	1								
									
	No data available								
						_			
Press F1 for help.					NL	M //			



Directory tree

By making a selection in the directory tree, a selection of subscriber types is displayed in the subscriber list.

When using DNP3, the following subscriber types are not relevant: SMS master stations, SINAUT ST1 subscribers, redundant ST7cc/ST7sc subscribers

The lowest directory "TIMs with TD7onTIM" is used to configure the TD7 software for the TIM modules. You will find the description of the TD7onTIM configuration in the section TD7onTIM (Page 158).

Subscriber list

In the subscriber list on the right, you will see the following entries for the DNP3 communications subscribers:

• Subscriber no.

DNP3 address

The subscriber number is the DNP3 address of a subscriber for DNP3 communication

and is unique throughout the project. The subscriber number of a CPU that is assigned to a TIM module is used as the address for DNP3 communication.

Changing the subscriber number

To change the subscriber number, click on the required subscriber. By clicking again on the subscriber number, the "Subscriber no." box can be edited (alternatively also using the function key 2 or the Edit / Change Subscriber menu). You can assign a subscriber number that has not yet been assigned from the range 1 ... 65519.

The subscriber number 0 is reserved and cannot be assigned.

• Red. Subscriber no.

The redundant subscriber number is used only when there is a redundant partner for the subscriber in question. The number specifies the common subscriber number under which the redundant system can be addressed by other subscribers.

In the case of an S7-400H CPU, the common subscriber number is displayed in the "Red. Subscriber no." column. At the same time, this is the subscriber number of the primary redundancy partner.

You can change the subscriber numbers of the two partners in the appropriate input field for the numbers or in the "Properties - CPU redundant" dialog. You can open this dialog by expanding the "Redundant H CPUs" directory in the directory tree, selecting the H CPU below it and then selecting "Properties" in the shortcut menu (right mouse button). In this dialog, you can also change the primary CPU.

• Subscriber no. of red. Partner

The "Subscriber number of the redundant partner" only has an entry when there is a redundant partner for this subscriber. The parameter specifies which of the subscribers belong to a redundant relationship.

• Subscriber type

The "Subscriber type" specifies the class of subscriber involved. This cannot be changed by the user.

Module

The module, application or PC/PG name. This can be changed in the configuration. As default, this is the name of the module type or the application as specified in the configuration.

Station

Name of the station assigned in the network configuration in "NetPro".

• SINAUT connected

Specifies whether or not a telecontrol connection was configured for the subscriber.

• SINAUT library

Name of the TD7 block library for CPUs (not for DNP3) or for TD7onTIM-compliant TIM modules.

You set the parameters for some subscriber-related properties in the "Properties of subscriber" dialog, see section The "Properties of Subscriber" dialog (Page 152).

Parameter area

The dialogs below the subscriber list are used for configuring the TD7 software for the TIM (TD7onTIM).

- 6.5.3 The "Properties of Subscriber" dialog
- 6.5.3.1 Parameter overview

Overview of the tabs of the Properties of subscriber dialog

By double-clicking on a subscriber number or by selecting the Edit / Properties menu, the Properties of subscriber dialog is displayed. The content and number of the tabs of the Properties of subscriber dialog depend on the subscriber type.

Tab	CPU	ТІМ	Other station, SIMATIC S5, PC station, PG	Names of follow-up dialogs	Note
Info	yes	yes	yes	-	-
Partner	yes	yes	DNP3 master station	-	-
Connections	yes	yes	-	Properties - Local Connec- tion	-
Polling List	-	-	-	Properties - Poll list entry	-
DB Configura- tion	yes	-	-	-	Not relevant for DNP3 because the CPU does not require any telecontrol-specific DBs.
Library Infor- mation	yes	-	-	-	Not relevant for DNP3 (information on TD7onCPU).

Table 6-2 Overview of the Properties dialog tabs according to subscriber type

6.5.3.2 "Info" tab

Info tab

Prope	ties of subscriber 2		×
Info	Partner Connections	DB Configuration SMS Configuration Library Info	
⊢S	ubscriber information		
N	lame:	CPU 312	
s	tation:	Station 1	
s	ubscriber	2	
s	tatus from:	24/09/10 15.42.50	
	ubscriber type		
	asic type:	CPU 312	
E	xtended type:	DNP3 CPU	
		,	
	ОК	Help	

Image 6-6 Properties of subscriber dialog (CPU), Info tab

The Info tab displays the following information on the selected subscriber:

- *Name* shows the default name of the module or the name assigned in network configuration
- Station displays the set network node type
- The subscriber number is displayed
- Status from displays the date of the last configuration
- The *date created* is displayed.
- Basic type displays the network object type from the network configuration
- Extended type displays the extended network object type adopted in the NetPro (for example DNP3 CPU, DNP3 TIM, DNP3 master station)

To display a DNP3-CPU, a completed connection configuration is required.

6.5.3.3 "Connections" tab

Connections tab

This tab lists all the configured local connections over LAN along with their most important properties for the current subscriber:

• X connections

Unconfigured S7 connections that use the SFCs "X_SEND" and "X_RCV".

PBC connections

Configured S7 connections that use the SFBs "BSEND" and "BRCV".

CR connections

Read/write connections of the TD7 software "TD7onTIM" to the local CPU that do not require S7 connections.

• S7-400H connections (local)

Connection to the local partner (S7-400H CPU or TIM)

DNP3 connections

Connection to the remote destination partner (DNP3 master station)

Note

If, during the analysis of the subscriber data, the configuration software recognizes that processing a DNP3 connection requires STEP 7 homogeneous connections, then these are created automatically. The prerequisite is that the connection mode of the Ethernet interface is set to "neutral".

STEP 7 homogeneous connections are connections from an S7-400 CPU to a TIM module and from TIM to TIM module via the MPI bus and communications block connections.

As an alternative, you can create these connections manually during network configuration. Existing connections are automatically used by the SINAUT configuration tool.

Pro	perti	es of sub	scriber 10			×
In	fo	Connecti	ons DB Con	figuration SMS Configuration	on Library Info	
		l connectio	, 			
	_			0		
	0 0	ibscriber	Partner	Connection type	length of the send buffer	
	2	. 10	1001	PBK connection	2020	
		10	2	PBK connection	2020	
		المعالمة مالية	0011		2020	
				fer for PBC connections	2020	
	To o	change ent	tries double cl	ick on the list item.		
	01					Usla
	OK					Help

Image 6-7 Properties of subscriber dialog (CPU), Connections tab

Here, you can configure the following:

• Length of the CPU send buffer for any existing communications block connections [bytes]

This parameter cannot be set for a DNP3 CPU.

The length of the CPU send buffer for any existing communications function block connections of a CPU. This is the same for all communications function block connections of the current CPU. Range of values: 202 .. 65208 bytes Default: 2020 bytes

By double-clicking on a subscriber row in the *local connections* output box, you open the *Properties - Local Connection* dialog for this connection.

Properties - Local Connection dialog for the TIM

This dialog displays the properties of the local LAN connection of a TIM module to its CPU.

Properties - Local Connection	n				
Connection identification					
from subscriber: 1007	to subscriber: 1001				
connection ID: 1	(= CFB reference)				
Connection properties					
Connection type:	 PBC connection X connection, configured X connection, not conf. CR connection P-Bus connection 				
Establishing type:	© static ⊂ dynamic				
Send Keepalives for this con	nection 🔽 (10 s)				
Queue entries (number):	64				
ОК	Cancel Help				

Image 6-8 Properties - Local Connection dialog (TIM)

For the local connection of the TIM module, you can set the following here:

- Send Keepalives for this connection: If this option is enabled, keepalive messages are sent on this connection at the intervals set in the network configuration for the TIM.
- Queue entries [number]: Range of values: 10...256 Default: 64

The number of queue entries is the number of messages that the TIM module can buffer prior to transmission. In general, you do not need to change the default setting.

Properties - Local Connection dialog for the CPU

This dialog visualizes the properties of a local LAN connection of a CPU and allows the following properties to the selected:

- CPU modules with X connections / P bus connections:
 - The length of the send buffer [bytes] for these connections

Range of values: 76 ... 65382 bytes Default: 760 bytes This parameter is not relevant for PBC connections.

This parameter cannot be set for a DNP3 CPU.

 The *Connection monitoring time [s]*, in other words, the time that must elapse before dummy messages are sent to check the connection.

Range of values: 1 ... 32 s Default: 5 s

This parameter cannot be set for a DNP3 CPU.

- CPU modules with PBC connections:
 - The Connection monitoring time [s], Range of values: 1 ... 32 s Default: 5 s

This parameter cannot be set for a DNP3 CPU.

Properties - Local Connection	
Connection identification	to subscriber: 6
connection ID: 2 (=	= MPI no. of partner)
Connection properties	
	 PBC connection X connection, configured X connection, not conf. CR connection P-Bus connection static
() dynamic
Length of the send buffer [bytes]	: 760
Connection monitorinig time [s]:	5
OK	Cancel Help

Image 6-9 Properties - Local Connection dialog (CPU)

6.5.3.4 "DB Configuration" tab

DB Configuration tab

This tab has no significance for DNP3, because the CPU does not require any telecontrolspecific data blocks.

6.5.3.5 "Library Info" tab

Library Info tab

This tab shows the name, path, version, date of creation and source information for the German and English version of the *SINAUT TD7 library* with which system data for the current CPU will be generated.

Nothing is displayed here for a DNP3 CPU because TD7onTIM is used if you use the DNP3 protocol.

6.6 TD7onTIM

6.6.1 Function of the TD7 software

Functions

The telecontrol communication of the CPU of an S7 station is handled by a DNP3 TIM. The TIM supports communication with the following partners:

- Communication of the local CPU with DNP3 control centers
- Communication of the local CPU with MODBUS slaves

The organization of telecontrol communication is handled by the "SINAUT TD7" software package. When using the DNP3 protocol, the TD7 software is available only in the version "TD7onTIM"; in other words, it is part of the TIM firmware.

TD7onTIM handles the sending and receiving of process data for the local CPU. Data that the CPU sends is read from the CPU via the backplane bus by the TIM using TD7onTIM. Received data is written to the CPU by the TIM using TD7onTIM.

The communications partners of the CPU, general communications parameters and the data and address parameters are configured in TD7onTIM.

6.6.2 DNP3 elements with TD7onTIM

6.6.2.1 Implementation of DNP3 elements in TD7onTIM

Overview of the elements with DNP3 and TD7onTIM

The DNP3 protocol specifies various elements for addressing subscribers and for classifying and identifying data to be transmitted. Below you will find an overview of how the DNP3 elements are implemented in the corresponding elements of the TD7onTIM communications software.

DNP3	TD7onTIM
Station address	Subscriber number
The station address on the data link layer is the address of a subscriber in the DNP3 network.	The communications partner in the DNP3 net- work is addressed using the subscriber number.
	The subscriber number is assigned automatically but can be modified manually, refer to the section Subscriber list (Page 150).
Point	Data point
Uniquely identifiable physical or logical unit	Smallest data unit that corresponds to a binary or analog process input or output or a calculated value.
Point Index	Index
The index is used for the unique identification of a	The index is adopted in TD7onTIM.
data point.	Note:
	Refer to the information in the section Configuring the index (Page 160).
Object	Data object
Coded representation of data point or another data unit for transmission.	The data points are also configured in objects for TD7onTIM. The objects are assigned to the sub- scribers from the TD7onTIM library in the SINAUT configuration tool.
Group	Object group
Objects are grouped according to the following criteria:	The most important object groups for the transfer of process data are adopted in TD7onTIM.
• Signal type (binary, analog, counter, time info)	The signal type and transmission direction are specified by the type of the data object.
Transmission direction (input, output)	The transmission type is specified in the chan-
• Transmission type (read, event)	nels; refer to the lower part of the table.
Other groups are defined for special tasks.	
Variation	
Variations further specify the object groups ac- cording to the data format.	There is no direct counterpart for variations in TD7onTIM. The data format is specified by the data object.

Table 6-3 Implementation of the DNP3 elements in TD7onTIM

DNP3	TD7onTIM
-	Channels
Channels are not defined in the DNP3 protocol.	Each data object has a fixed set of one or more channels for sending or receiving data (send channels, receive channels).
	Depending on the object type, one or more data points are configured in a channel.
	The transmission type and the CPU memory area of the data points are configured in the channels.

6.6.2.2 Configuring the index

Configuring the index or start index

The index is used for the unique identification of data points.

Rule

Note

Unique index per subscriber and per object group

For every subscriber, the index of a data point within an object group must be unique.

Configuring using the "Start index"

The index is configured with the data objects. Objects containing more than one data point therefore have an index band with several indexes.

In the configuration, the index band of an object is specified using the start index. You specify the start index manually.

If objects have several data points, the index is assigned by the system continuously starting from the start index. This means that data points within a data object are numbered through with ascending indexes; refer to the next example.

You will find an overview of the number of indexes occupied by the data objects in the section Data objects: Partner and send parameters (Page 194).

Note

Continuous index assignment

For each station (subscriber) make sure that the numbering of objects of an object group starts at zero, is consecutive and, where possible, without gaps. Gaps in the numbering and very high index numbers reduce the data throughput.

Example of the index assignment for the object "Bin04B_S"

The data object belongs to object group 1 "Binary input with flag".

The data object contains 4 channels each with 1 byte for receiving binary data. In each channel, 8 data points are assigned an ascending index according to the 8 bits.

You configure the preassigned start index "0" for the object.

The following indexes will be assigned:

- Channel 1: Index 0 to 7
- Channel 2: Index 8 to 15
- Channel 3: Index 16 to 23
- Channel 4: Index 24 to 31

In this station, the indexes 0 to 31 cannot be used for any other object of the type "Bin04B_S" or "Cmd01B_S".

6.6.2.3 Classification of the data according to the type of transmission

Classification of process data according to the type of transmission

The process data that the TIM sends to a communications partner is assigned to classes during configuration. This assignment decides whether the values are only read by the master station or (if there is a defined change) stored and sent unsolicited to the partner:

• Static data (class 0)

Static data means all the pending analog and binary measured values or calculated values in DNP3 stations intended for transfer. This is the data of the image memory on the TIM.

Static data is known as class 0 data in the DNP3 specification. Static data can be transmitted in the following ways:

- Reading by the DNP3 master station

The DNP3 master station can request any number of individual values that are addressed using the object group and the DNP3 index. Here, the DNP3 master station can specify the variation in which the data is to be sent by the station.

Sending following a general request by the DNP3 master station

All configured values can be transmitted in a general request. Here, the station selects the default variation of the object.

• Events (class 1, 2, 3)

The values of process data configured as an event are written to the send buffer (message memory) when a trigger fires. The events have a higher priority for transfer compared with static data. The triggers fire when there are configurable changes in the process value, at certain intervals, at configurable points in time or in response to programmable signals.

The DNP3 protocol specifies two possibilities for transmission of the stored events:

- The DNP3 master station can request the stored events of one or all event classes and read them like static data.
- The station can transmit the events spontaneously (unsolicited).

Whether or not the station can report spontaneous events is specified in the configuration of the DNP3 master station. The spontaneous sending of events by the station is initiated by the master station with a corresponding control message to the station.

Division into event classes

When configuring the TIM module, each process value to be transmitted to the DNP3 master station can be defined as an event with a selectable class.

The DNP3 protocol defines object groups for events and these are listed below. The DNP3 specification also recommends assigning events according to the priority of the process value of an event class:

- Critical events, for example process alarms are assigned to event class 1.
- Less critical events such as tolerance violations are assigned to classes 2 and 3.

You can group the events in the various classes to suit your purposes, for example based on technological aspects.

You specify the event class for each object in TD7onTIM, refer to the section Data objects: Partner and send parameters (Page 194).

Note

Changing the event class for node stations

The classification of events of class 2 and 3 in substations is set uniformly to class 1 in the node station when sending via a node station.

Note

No spontaneous sending on half duplex connections

To avoid data collisions, the TIM modules do not send any spontaneous messages on half duplex connections.

6.6.2.4 Supported DNP3 object groups

Object groups supported by DNP3 TIM modules

The following table provides an overview of the DNP3 object groups and variations supported by the DNP3 TIM. For both station types "station" and "master station" you will find the suitable TD7onTIM objects.

The station type "master station" can be a TIM module in a master station or a TIM 4R IE DNP3 in a node station.

For some TD7onTIM objects, the communications partner must support certain DNP3 implementation levels. If there are special requirements, you will find the corresponding information in the right-hand column.

Object group	Variation	Format according to the DNP3 speci- fication	Station type	TD7onTIM object	S7 data type	DNP3 level of the part- ner ***	
1	2	Binary input with	Station	Bin04B_S, Cmd01B_S	BOOL		
	f	flag	Master sta- tion	Bin04B_R			
2	2	Binary input event	Station	Bin04B_S	BOOL		
		- with absolute		Cmd01B_S	BYTE		
		time	Master sta- tion	Bin04B_R	BOOL		
10	2	Binary output -	Station	Bin08X_S **	BOOL		
		status with flags		Cmd01B_R	BYTE		
			Master sta-	Bin08X_R **	BOOL		
			tion	Cmd01B_R	BYTE		
11	2	Binary output	Station	Bin08X_S **	BOOL	As of DNP3 level 4	
	ever	event - with time	event - with time	Master sta- tion	Bin08X_R **		
12	1	Binary command - control relay output block		Station	Bin04B_R	BYTE	
				Bin08X_R	BOOL		
				Cmd01B_R	BYTE		
				DNP3_Cmd01X_R	BOOL		
			Master sta-	Bin04B_S	BYTE		
			tion	Bin08X_S ****	BOOL		
				Cmd01B_S ****	BYTE		
20	2		Station	Cnt01D_S, Cnt04D_S	WORD		
		with flag	Master sta- tion	Cnt01D_R, Cnt04D_R			
21 *	2	Frozen counter - 16-bit with flag	Station	Cnt01D_S, Cnt04D_S	WORD	DNP3 level 1 to 4	
	16	Frozen counter - 16-bit with flag and time		Cnt01D_S, Cnt04D_S	WORD	DNP3 level 5 only	
22	2	Counter event -	Station	Cnt01D_S, Cnt04D_S	WORD	DNP3 level 1 to 4	
		16-bit with flag	Master sta- tion	Cnt01D_R, Cnt04D_R			
	6	Counter event -	Station	Cnt01D_S, Cnt04D_S	WORD	DNP3 level 5 only	
		16-bit with flag and time	Master sta- tion	Cnt01D_R, Cnt04D_R			

Table 6-4 Assignment of DNP3 object groups and TD7onTIM objects

Object group	Variation	Format according to the DNP3 speci- fication	Station type	TD7onTIM object	S7 data type	DNP3 level of the part- ner ***
23 *	2	Frozen counter event - 16-bit with flag	Station	Cnt01D_S	WORD	
30	1	Analog input -	Station	Dat12D_S	DINT	
		32-bit with flag	Master sta- tion	Dat12D_R		
	2	Analog input - 16-bit with flag	Station	Ana04W_S, Mean04W_S	WORD	
				Dat12D_S	BYTE, INT, WORD	
			Master sta- tion	Ana04W_R, Mean04W_R	WORD	
				Dat12D_R	BYTE, INT, WORD	
	5	Analog input -	Station	Dat12D_S	REAL	DNP3 level 5 only
		32-bit float with flag	Master sta- tion	Dat12D_R		
32	1	Analog input event - 32-bit	Station	Dat12D_S	DINT	DNP3 level 1 to 3
			Master sta- tion	Dat12D_R		
	2	2 Analog input event - 16-bit	t Station	Ana04W_S	WORD	DNP3 level 1 to 3
				Mean04W_S	WORD	
				Dat12D_S	BYTE, INT, WORD	
			Master sta- tion	Ana04W_R	WORD	
				Mean04W_R	WORD	
				Dat12D_R	BYTE, INT, WORD	
	3	Analog input event	Station	Dat12D_S	DINT	As of DNP3 level 4
		- 32-bit with time	Master sta- tion	Dat12D_R		
	4	Analog input event	Station	Ana04W_S	WORD	As of DNP3 level 4
		- 16-bit with time		Mean04W_S	WORD	
				Dat12D_S	BYTE, INT, WORD]
			Master sta-	Ana04W_R	WORD	
			tion	Mean04W_R	WORD	
				Dat12D_R	BYTE, INT, WORD	
	7	Analog input event	Station	Dat12D_S	REAL	DNP3 level 5 only
	- 32-bit float with time		Master sta- tion	Dat12D_R		-

Object group	Variation	Format according to the DNP3 speci- fication	Station type	TD7onTIM object	S7 data type	DNP3 level of the part- ner ***
40 *, ** 1	1	Analog output	Station	Dat12D_R	DINT	
		status - 32-bit with		Par12D_R **		As of DNP3 level 4
		flag	Master sta- tion	Par12D_S **		As of DNP3 level 4
	2	Analog output status - 16-bit with	Station	Ana04W_R, Mean04W_R	WORD	
		flag		Set01W_R **		As of DNP3 level 4
				Dat12D_R	BYTE, INT, WORD	
			Master sta- tion	Set01W_S **	WORD	As of DNP3 level 4
	3	Analog output - 32-bit float with flag	Station	Dat12D_R	REAL	DNP3 level 5 only
41	1	Analog output -	Station	Dat12D_R, Par12D_R	DINT	
2		32-bit	Master sta- tion	Dat12D_S Par12D_S ****	DINT	
	2	2 Analog output - 16-bit		Ana04W_R, Mean04W_R, Set01W_R	WORD	
				Dat12D_R	BYTE, INT, WORD	
			Master sta- tion	Ana04W_S, Mean04W_S; Set01W_S ****	WORD	
				Dat12D_S	BYTE, INT, WORD	
	3	Analog output -	Station	Dat12D_R	REAL	DNP3 level 5 only
		32-bit float	Master sta- tion	Dat12D_S		
42 *, **	3	Analog output	Station	Par12D_R **	DINT	As of DNP3 level 4
		event - 32-bit with time	Master sta- tion	Par12D_S **		
	4	Analog output	Station	Set01W_R **	WORD	
		event - 16-bit with time	Master sta- tion	Set01W_S **		
110	1 255	Octet string	Station / master sta- tion	Dat12D_R, Dat12D_S	CHAR	
111	1 255	Octet string event	Station	Dat12D_S	CHAR	
			Master sta- tion	Dat12D_R		

* The object groups 21, 23, 40 and 42 are formed in the stations only by being polled by a master or by internally generated events.

** These objects are used to mirror back values from the station to the master station, see the following reference.

*** If there is no information included about the DNP3 level, the object is supported by all implementation levels. Otherwise the required implementation level of the communications partner is specified.

**** The following objects are always sent by the master TIM with the control code "DIRECT_OPERATE": Bin08X_S (12), Cmd01B_S (12), Par12D_S (41), Set01W_S (41)

Mirroring back: You will find an description of the function in the section in the section Mirroring back (Page 183).

The DNP3 implementation level is specified for every subscriber in the SINAUT configuration tool:

> Subscriber Administration > TIMs with TD7onTIM > All Destination Subscribers

You will find a table sorted according to TD7onTIM objects in the section Objects of TD7onTIM (Page 177).

TD7onTIM objects not supported

The "Par12x1D_R" object is not supported for the DNP3 protocol.

6.6.3 Configuring TD7onTIM (overview)

Configuring the TD7 software

The configuration of TD7onTIM is set in the subscriber administration of the SINAUT configuration tool in the following steps:

- 1. Parameter assignment / configuration of the basic settings for each TIM with TD7onTIM
- 2. Specifying the parameters specific to the destination subscribers
- 3. Adding objects:

The objects are grouped together in the TD7onTIM library that is called from the subscriber administration.

- System objects

Using the system objects, system information is displayed and communications functions are activated and set.

- Data objects

Which data is to be sent or received is configured using standardized data objects.

- MODBUS-specific objects

MODBUS-specific properties are configured with these objects.

- 4. Parameter assignment / configuration of the objects
- 5. Parameter assignment / configuration of the send and receive channels of the data objects

Basic settings for TIMs with TD7onTIM

For each TIM with TD7onTIM, several settings must be made that are always required for communication, for example specifying the read/write cycle.

Parameters specific to the destination subscribers

Destination subscribers are the communications partners of the local CPU of the S7 station. Data is exchanged with the partner via the TIM module that has TD7onTIM.

The basic settings for each destination subscriber that apply to the data traffic of all DNP3 TIMs in the project with this subscriber are made here.

MODBUS slaves are not configured as destination subscribers. You will find an overview of configuring MODBUS communication in the section Configuring MODBUS communication (Page 223).

System objects

The system objects provide information for the CPU user program relating to communication.

Data objects

The sending and receiving of process data is configured with the aid of standardized data objects. The data objects are available in a standard library and are inserted from the library into the TD7onTIM configuration.

An example of a data object is Ana04W_S that organizes the transmission of 4 analog values.

Each data object contains one or more send or receive channels. The number and type of send and receive channels per data object cannot be modified.

Send and receive channels

The send and receive channels of the data objects are responsible for the processing of an individual process value, for example for processing and sending an analog value or receiving and outputting a command.

The data object Ana04W_S, for example, has 4 send channels of the type send analog value.

6.6.4 Dialogs for TD7onTIM

Calling and appearance of the parameter assignment dialogs

The displayed information and parameter assignment boxes of TD7onTIM are divided into three areas in subscriber administration:

- Directory tree in the left-hand part of subscriber administration
- Subscriber list top right
- · Parameter area below the subscriber list

📅 SINAUT ST7 : Configuration - Proj	ect '_DNP_Bsp300', Path 'C:\Program Files\Sieme	ens\Step7\S7Proj_DNP_B_0' - [Subscribe 💶 🗙
🍓 Project Edit SINAUT View Extr	as Help	_ <u>8 ×</u>
📔 🖻 🔪 🦅 🐂 🖬 🖨 🕹 🕹 🖿	💡 🏟 🌒 🚦	
Subscriber types:	Last change of connection configuration: 06/	07/12 17.17.00 Selected CPUs: 0
All SINAUT subscribers	Subscriber no. Subscriber type Module	Station SINAUT connected SINAUT I
	1001 SINAUT TIM TIM 3V-IE DN 1002 SINAUT TIM TIM 3V-IE DN	· · · · · · · · · · · · · · · · · · ·
SINAUT ST7cc/ST7sc	1002 SINAUT TIM TIM 3V-IE DN	-
SINAUT ST1 subscriber:	□ 1003 SINAUT TIM TIM 304E DN	· · · · · · · · · · · · · · · · · · ·
SMS control center	1005 SINAUT TIM TIM 4R-IE DN	
DNP3 master		
Redundant ST7cc/ST7sc		
	Basic settings for TIM with TD7onTIM:	<u> </u>
	TD7 and Augusta angle	TD7
	TD7 read / write cycle	TD7 message receive
	Number of configured receive objects = 1 objects	Check of source address:
	Max. write: 1 objects	
	Max. whe.	
	Number of configured send objects	
	in normal cycle = 3 objects	
	in fast cycle = 0 objects	MODBUS poll cycle
	Max. read: 1 objects	S7 CPU poll pause [ms]: 200
I	Cycle pause:1 ms	MODBUS poll pause (ms): 200

Image 6-10 Subscriber administration of the SINAUT Configuration Tool

The "TIMs with TD7onTIM" directory is selected in the directory tree.

The subscriber list shows the subscribers with TD7onTIM.

The parameter area for these subscribers shows the "Basic settings for TIM with TD7onTIM".

Directory tree

The TD7-compliant TIM modules of a project are shown in the directory tree in the "TIMs with TD7onTIM" directory. If you expand the directory with the (+) symbol or double-click on the directory, the following contents are displayed:

- The "All Destination Subscribers" directory
- The directories of all TIMs with TD7onTIM

If you expand a single TIM directory, the data objects already configured on this TIM are displayed.

Subscriber list

At the top right of the subscriber administration there is a subscriber list that lists certain subscriber types, objects, or send/receive channels depending on what is selected in the directory tree. By successively expanding the "TIMs with TD7onTIM" directory, the subscriber list displays the following content:

- TD7-compliant TIMs of the project
- Destination subscribers with which the TD7-compliant TIMs can communicate
- System and data objects of a TD7-compliant TIM
- Channels of a data object

The SINAUT objects are displayed with the following symbols:

- Blue symbols: System objects
- Yellow symbols: Data objects

The channels are distinguished as follows:

- Receive channels are displayed with an incoming arrow.
- Send channels are displayed with an outgoing arrow.

SINAUT ST7 : Configuration - Project ' SP Project Edit SINAUT View Extras He	DNP_Bsp300', Path 'C:\Program Files\Siemens\Step7\S7Proj_DNP_B_0' - [Subscriber a] [] X #p
Subscriber types:	Last change of connection configuration: 06/07/12 17.17.00 Selected CPUs: 0 Channel name Channel type Input addr. Output addr. 0
Redundant H-CPUs Redundant ST7cc/ST7sc Ims with TD7onTIM Structure St	Deta send Deta send Deta send SetpointInput Data send SetpointOutput SetpointInput
□ 1 / BinO4B_S 2 / Set01W_R 1 / BinO4B_S 2 / Set01W_R 1003 / DNP3-Station 3 1 1004 / DNP3-Station 4 1 / ModbusWrite 2 / ModbusRead 3 / ModbusWrite 5 / ModbusRead 5 / ModbusRead 1005 / DNP3-Station 5	Channel name: Local Channel active:
, , , , , , , , , , , , , , , , , , , ,	

Image 6-11 Selected channel of a data object in the node list, below this the parameter range of the channel

Parameter area

In the parameter area below the subscriber list, you set the parameters for the TD7onTIMrelevant subscribers, objects and channels. The parameter area is only visible when the "TIMs with TD7onTIM" directory or a subdirectory is selected.

Depending on the selection in the navigation pane or node list, the following parameters are displayed in the parameter area:

- Basic parameters of a TD7-compliant TIM
- · Parameters of a destination subscriber
- · Parameters of a system or data object
- Parameters of a send or receive channel

If a subscriber with TD7onTIM is selected in the directory tree, the parameters of the first object of this subscriber are displayed in the parameter area.

If an object is selected in the directory tree, the parameters of the first channel of the selected object are displayed in the parameter area.

Entering and saving parameters

To simplify data input, the relevant parameter area is not opened and closed using separate buttons or menus but is shown automatically.

Entries in the parameter assignment dialogs are adopted immediately with the following actions:

- Activating or deactivating an option
- Exiting the input box with the mouse or tab key

The entries are applied permanently using the Save function.

6.6.5 Basic settings for subscribers with TD7onTIM

To make the basic settings for the TD7 software of the individual TIM subscribers, you first select the "TIMs with TD7onTIM" directory in the directory tree. The subscriber list then displays all the TD7-compliant TIM modules of the project.

The parameter area with the parameters of the TIM selected in the subscriber list opens below the subscriber list.

SINAUT ST7 : Configuration - Proj		ath 'C:\Program	Files\Siemens	\Step7\S7Proj_	_DNP_B_0' - [9	
Project Edit SINAUT View Extra		_				
🛛 🗃 🔪 🦅 🐂 🖬 🗁 🕹 🕹 🗎	😵 🎨 🤁 🚦					
Subscriber types:	Last change of connec	ction configuration	: 06/07/	/12 17.17.00	Selected CPUs:	0
E STALL SINAUT subscribers	Subscriber no.	Subscriber type	Module	Station	SINAUT conn	ected SINAUT li 🔺
SINAUT TIM subscribers	1001	SINAUT TIM	TIM 3V-IE DNP3		yes	TD7 librar
SINAUT CPU subscriber	1002	SINAUT TIM	TIM 3V-IE DNP3			TD7 librar
SINAUT ST1 subscriber	1003 1004	SINAUT TIM	TIM 3V-IE DNP3 TIM 4B-IE DNP3			TD7 librar TD7 librar
SMS control center	1004	SINAUT TIM	TIM 4R-IE DNP3			TD7 librar
DNP3 master	1					
TIMs with TD7onTIM	Basic settings for TIM	with TD7onTIM:				<u> </u>
	F TD7 read / write cyc	le		TD7 message rece	ive	
	Number of configure receive objects =		objects	Check of source ad	ddress:	Y
	Max. write:	1	objects			
	Number of configure	ed send objects				
	in normal cycle =	= 3	objects			
	in fast cycle =	0	objects	MODBUS poll cycle	ə	
	Max. read:	1	objects	S7 CPU poll pause	[ms]: 2	0
	Cycle pause:	1	ms	MODBUS poll paus	e [ms]: 2	
						_

Image 6-12 Parameter area with basic settings for the TIM subscriber 1001

The parameters of the basic settings for TIM subscribers with TD7onTIM relate to the following:

- Configuration of the read/write cycle of the TIM
- Checking the source address when a message is received
- MODBUS polling cycle (only with MODBUS configuration)

TD7 write / read cycle

Data to be sent by TD7onTIM, is read by the TIM over the backplane bus of the CPU and received data is written to the CPU.

The TIM also writes system information to the CPU (see system objects "Watchdog", "PartnerStatus" and "OpInputMonitor") and certain data is reset; in other words, 0 is written. In the latter situation, this involves send trigger and command information that was read from the memory bit area or data blocks. TD7onTIM ensures that these are reset to 0 automatically after they have been acquired. All of these procedures take place within a defined and selectable read/write cycle.

The writing and reading of data takes place in consecutive read/write cycles. A basic cycle of the read/write cycle of TD7onTIM is made up as follows:

- 1. Write all pending system information (see system objects) to the CPU and reset all currently acquired send triggers and commanded entries. If no such data is currently pending, there is no write procedure in the basic cycle.
- 2. Read all data of the send objects that were assigned to the fast cycle. If no objects were configured for the fast cycle, this read procedure is omitted in the basic cycle.
- 3. Read data from some of the send objects that were assigned to the normal cycle. How many objects per basic cycle will be read can be set by the user. Refer to the "Max. read" parameter below.
- 4. Write data of some of the currently pending receive objects. How many objects this can be as a maximum per basic cycle can be selected by the user. Refer to the "Max. write" parameter below.
 If less received data is currently pending than is permitted as maximum per basic cycle, only this subset is written in the basic cycle.
 If there is currently no received data from the remote partner, this write procedure is omitted in the basic cycle.
- 5. Cycle pause (optional) to relieve the TIM and backplane bus communication.

With the "Max. read" and "Max. write" parameters and by specifying how many objects are assigned to the fast cycle, the user can set the duration of a basic cycle. Essentially, this specifies how fast the fast cycle really is: It is identical with the duration of the basic cycle. With the default value 1 for the "Max. read" and "Max. write" parameters, the basic cycle has the shortest possible duration.

It must also be taken into account that the make-up of the basic cycle decides how long TD7onTIM requires to read all the data of the objects assigned to the normal cycle once. If, for example, 12 objects are assigned to the normal cycle and if "Max. read" is set to 2 objects per basic cycle, it takes 6 basic cycles until all the data of the 12 objects has been read once completely from the memory areas of the CPU.

Parameters in the TD7 Read / Write Cycle box

Name: Range of val- ues: Default: Explanation:	 Max. write 32000 1 This is the maximum number of (different) data objects whose data is written to the CPU per basic cycle. If there are several messages of the same receive object in the buffer, only the data of one message of this object is written per basic cycle. As information, the number of receive objects configured for the TIM in total by the user is displayed above the input box beside <i>Number of configured receive objects</i>.
Name: Range of val- ues: Default: Explanation:	Max. read 0 32000 1 This is the maximum number of data objects whose data is read from the CPU per basic cycle. As information, above the input field beside <i>Number of configured send ob- jects</i> , you can see how many send objects the user configured for the TIM - in the <i>normal cycle</i> and - in the <i>fast cycle</i>
Name: Range of val- ues: Default: Explanation:	Cycle pause 0 32000 [ms] 1 1 A pause may be necessary if communication of other modules on the back- plane bus is disrupted too much by the write and read jobs between the TIM and CPU. This also applies to subscribers on the MPI bus (further CPUs or PG) if the backplane bus is implemented as a party line. By setting a suitable time for the pause, the other bus subscribers have time for their communica- tion. Specifying a cycle pause may also be necessary to relieve the TIM itself; in other words, when it becomes clear that it has too little time for other tasks due to the fast read/write cycle.

Parameters in the TD7 Message receive box

Name:	Check of source address
Range of val- ues:	Function active, function deactivated
Default:	Function active
Explanation:	With this parameter, you specify whether or not the source address of the sending subscriber is checked prior to accepting data from a received message. If the function is activated, all messages that do not originate from the configured partner are discarded.
	Note : If a data object receives messages from several partners, the check of the source address must be deactivated.

Parameters in the MODBUS polling cycle box

The parameters in this box are relevant only if the TIM uses MODBUS communication.

Name:	S7 CPU polling pause
Range of val-	0 to 65535 [ms]
ues:	
Default:	200
Explanation:	The parameter specifies the duration of the pause on the TIM between two CPU polls.

Name:	MODBUS polling pause
Range of val- ues:	0 to 65535 [ms]
Default:	200
Explanation:	The parameter specifies the duration of the pause on the TIM between two MODBUS slave polls.

Copying basic settings to other TIMs

Once the basic settings of a subscriber with TD7onTIM have been made, the settings can also be transferred to other TIMs that require the same parameters. Follow the steps outlined below:

- 1. Select a TIM for which you have already set the parameters in the subscriber list.
- 2. Select "Copy" in the shortcut menu (right mouse button).
- 3. Select a second TIM.
- 4. Transfer the parameters to this second TIM using "Paste" in the shortcut menu.

6.6.6 Parameters specific to the destination subscribers

Core statement

Each TIM with TD7onTIM can exchange data with one or more partners, known as destination subscribers. Which subscribers in the project can be destination subscribers depends on the connection configuration. There, you specify which TIM with TD7onTIM will have a connection to which subscriber in the network.

The destination subscriber of a DNP3 station is always a DNP3 master station.

Several settings are required for each of the possible destination subscribers that apply to data traffic between the TD7onTIM of a project and this subscriber.

To set the parameters specific to destination subscribers, open the TD7 on TIM directory and select the "All Destination Subscribers" directory. The list displays all potential destination subscribers of the TD7-compliant TIM modules.

Destination subscribers are:

- SIMATIC S7 CPU modules
- SIMATIC PCS 7 control centers (DNP3 master stations)

3 SINAUT ST7 : Configuration - Project	DNP_Bsp400R', Path 'C:\Program Files\Siemens\Step7\S7Proj_DNP_B_2' - [Sul	osc <mark>_ D X</mark>
Noject Edit SINAUT View Extras H	lelp	_ 8 ×
🖉 🔌 🧊 🐂 🖬 🚭 🐰 🛍 💡	🕸 🕲 !	
Subscriber types:	Last change of connection configuration: 28/01/11 14.29.32 Selected CPUs	: 0
E-St All SINAUT subscribers	Subscriber no. R. S Subscriber type Module Station	SINAUT conn
🕀 👰 Redundant H-CPUs	1 1 1 11 CPU 417-4 H CPU 417-4 H (1) DNP Station 1 (S7 400H)	yes
Redundant ST7cc/ST7sc		yes
E TIMs with TD7onTIM		yes
- Station Subscribers 1001 / DNP3-Station 1		yes
	100 Other Station - DNP3-Zentrale	yes
	T	F
	Basic settings per destination subscriber:	<u>^</u>
	DNP3 protocol	
	DNP3 conformity level: 3	
	Timestamp: 📈	
		-
[']	•	
		NUM //

Image 6-13 Directory tree, subscriber list, and parameter area with destination subscriber-specific parameters of a DNP3 master station as destination subscriber

The parameter area of the selected destination subscriber opens below the subscriber list. The parameters to be entered here are valid in terms of communication with the configured communications partners (destination subscribers) for all TD7-compliant TIM modules of the project. The parameter area for the destination subscriber-specific parameters is opened and the parameters are set for every configured destination subscriber.

The following destination subscriber-specific parameters are available:

Parameters of the DNP3 master station

Name: Range of val- ues:	DNP3 implementation level 1 5
Default: Explanation:	 3 With the SINAUT configuration software, you can specify the DNP3 implementation level for each configured DNP3 master station (subscriber type: other station). Specify the highest conformity level supported by the DNP3 master station. Values can be assigned in the range from 1 to 5. Based on this information, the TIM firmware selects the suitable standard variations of the process data for this master station. Level 5 that is not specified in the standard corresponds to implementation level 4 and additionally includes the support of the following objects / data types (object group/variation): Frozen counter with time of day in 16-bit format (21/6) Counter event with time of day in 16-bit format (22/6) Analog input, floating point, 32-bit format (30/5) Analog output status, floating point, 32-bit format (40/3) Analog output, floating point, 32-bit format (41/3)
Name:	Time stamp
Default:	Function activated
Explanation:	When using DNP3, the parameter is always activated. This cannot be deac- tivated.
	The parameter assignment is only practical if the DNP3 master station was selected as the destination subscriber.
	Data read by the local CPU is given a time stamp before it is sent to the des- tination subscriber.

Copying parameters to other destination subscribers

Once the destination subscriber-specific parameters have been set for a destination subscriber, they can be transferred to other destination subscribers that require the same parameters. Follow the steps outlined below:

- 1. Select a destination subscriber for which you have already set the parameters in the list box.
- 2. Select "Copy" in the shortcut menu (right mouse button).

- 3. Select a second destination subscriber in the list box.
- 4. Transfer the parameters to this other destination subscriber using "Paste" in the shortcut menu.

6.6.7 Objects of TD7onTIM

Transmission direction of the objects

The transmission direction of the objects can be seen in the name suffixes $_S$ or $_R$ (send or receive):

• _S

send direction

- Use in the station type "station" for the monitoring direction (in)

Station sends message to master station.

- Use in the station type "master station" for the control direction (out)
 Master station sends message to station.
- _R

Receive direction

- Use in the station type "station" for the control direction (out)
 Station receives message from master station.
- Use in the station type "master station" for the monitoring direction (in)
 Master station receives message from station.

Overview of the TD7onTIM objects

Table 6-5 System objects of TD7onTIM

System object	Function	
General system ob	jects	
WatchDog Monitoring of the CPU-TIM connection		
	Indicates to the CPU whether the communication between CPU and local TIM is still working; in other words, whether TD7onTIM is still reading from and writing to the memory areas of the CPU.	
PartnerStatus	Displays the status of the connection with a maximum of 8 communications partners	
	Signals to the CPU whether communication with a partner "DNP3 master station" is functioning or disrupted.	
OpInputMonitor	Signals detection of hardware entries	
	Indicates the status of operator input to the CPU (with command, setpoint, and parameter input).	
	Is not normally used with the DNP3 protocol.	

System object	Function	
System objects for MO	DBUS communication	
ModbusGateway	Configuration of the MODBUS protocol for a serial interface of the TIM	
	The use of the MODBUS protocol for a serial interface of the DNP3 TIM is specified using the "ModbusGateway" object. The interface and various connection parameters are configured with this object.	
ModbusPartnerStatus	Displays connection status of max. 8 MODBUS slaves	
	Signals to the CPU whether communication with a partner "MODBUS slave" is functioning or disrupted.	
System objects not supported		
SmServiceCenter	The object is not supported for the DNP3 protocol.	

Table 6- 6 Data objects of TD7onTIM

Data object	Object type and function	Number of indexes occupied	DNP3 object group [vari- ation] (S7 data type)	DNP3 level *	Use in stations type **
Message / bir	nary objects				
Bin04B_S	Binary value object for send direction Send 4 bytes of binary infor- mation	32 (4 x 8)	 1 [2] (BOOL) 2 [2] (BOOL) 12 [1] (BYTE) 	1 5	• S • S • M
Bin04B_R	Binary value object for receive direction Receive 4 bytes of binary in- formation	32 (4 x 8)	 1 [2] (BOOL) 2 [2] (BOOL) 12 [1] (BYTE) 	1 5	• M • M • S
Bin08X_S	Binary value object for send direction Send 8 x 1 bits of binary infor- mation independently of each other	8	 10 [2] (BOOL) *** 11 [2] (BOOL) *** 12 [1] (BOOL) **** 	 1 5 4 5 1 5 	• S • S • M
Bin08X_R	Binary value object for receive direction Receive 8 x 1 bit of binary information	8	 10 [2] (BOOL) *** 11 [2] (BOOL) *** 12 [1] (BOOL) 	 1 5 4 5 1 5 	• M • M • S
Analog value	/ mean value objects				
Ana04W_S	Analog value object for send direction Send 4 analog values (16-bit value)	4	 30 [2] (WORD) 32 [2] (WORD) 32 [4] (WORD) 41 [2] (WORD) 	 1 5 1 3 4 5 1 5 	 S S S M
Ana04W_R	Analog value object for receive direction Receive 4 analog values (16-bit value)	4	 30 [2] (WORD) 32 [2] (WORD) 32 [4] (WORD) 41 [2] (WORD) 	 1 5 1 3 4 5 1 5 	• M • M • M • S

Data object	Object type and function	Number of indexes occupied	DNP3 object group [vari- ation] (S7 data type)	DNP3 level *	Use in stations type **
Mean04W_S	Mean value object for send direction Send 4 mean values (16-bit value)	4	 30 [2] (WORD) 32 [2] (WORD) 32 [4] (WORD) 41 [2] (WORD) 	 15 13 45 15 	• S • S • S
Mean04W_R	Mean value object for receive direction Receive 4 mean values (16-bit value)	4	 30 [2] (WORD) 32 [2] (WORD) 32 [4] (WORD) 41 [2] (WORD) 	 15 13 45 15 	• M • M • M • S
Counted value	obiects				
Cnt01D_S	Counted value object for send direction Send 1 counted value	1	 20 [2] (WORD) 21 [2] (WORD) 21 [6] (WORD) 22 [2] (WORD) 22 [6] (WORD) 23 [2] (WORD) 	 1 5 1 4 5 1 4 5 1 5 	S
Cnt01D_R	Counted value object for re- ceive direction Receive 1 counted value	1	 20 [2] (WORD) 22 [2] (WORD) 22 [6] (WORD) 	 1 5 1 4 5 	М
Cnt04D_S	Counted value object for send direction Send 4 x 1 counted value	4	 20 [2] (WORD) 21 [2] (WORD) 21 [6] (WORD) 22 [2] (WORD) 22 [6] (WORD) 	 1 5 1 4 5 1 4 5 	S
Cnt04D_R	Counted value object for re- ceive direction Receive 4 x 1 counted value	4	 20 [2] (WORD) 22 [2] (WORD) 22 [6] (WORD) 	 1 5 1 4 5 	М
Command obje	ects	1	r		
Cmd01B_S	Command object for send di- rection Send 1 command (1 bit)	1	 1 [2] (BYTE) 2 [2] (BYTE) 12 [1] (BYTE) **** 	1 5	• S • S • M
Cmd01B_R	Command object for receive direction Receive 1 command (1 bit)	1	 1 [2] (BYTE) 2 [2] (BYTE) 10 [2] (BYTE) 12 [1] (BYTE) 	1 5	 M M M S
DNP3_Cmd0 1X_R	Command object for receive direction Receive 1 command (1 bit) (with mirroring back function)	1	• 12 [1] (BOOL)	1 5	S

The SINAUT Configuration Tool

6.6 TD7onTIM

Data object	Object type and function	Number of indexes occupied	DNP3 object group [vari- ation] (S7 data type)	DNP3 level *	Use in stations type **
Setpoint and	parameter objects				
Set01W_S	Setpoint object for send direc- tion Send 1 setpoint (16 bits), object with 3 channels:				
	"LocalOperation"		- not used -		
	 "ReturnedSetpoint" 	1	• 40 [2] (WORD) ***	• 15	М
	Function: Mirrored back setpoint		• 42 [4] (WORD) ***	• 45	
	Channel type: Data receive				
	"SetpointInput" Function: Setpoint input Channel type: Setpoint send	1	• 41 [2] (WORD) ****	• 15	
Set01W_R	Setpoint object for receive direction Receive 1 setpoint (16 bits), object with 3 channels:				
	"Local"		- not used -		
	"LocalSetpointInput" Function: Local setpoint Channel type: Data send	1	 40 [2] (WORD) *** 42 [4] (WORD) *** 	• 1 5 • 4 5	S
	"SetpointOutput" Function: Setpoint output Channel type: Setpoint re- ceive	1	• 41 [2] (WORD)	• 15	_
Par12D_S	Parameter object for send direction Send max. 12 double words with parameters or setpoints, object with 3 channels:				
	"LocalOperation"		- not used -		
	"ReturnedParameter"	1 12	• 40 [1] (DINT) ***	• 15	М
	Function: Returned parame- ter		• 42 [3] (DINT) ***	• 45	
	Channel type: Data receive				_
	"ParameterInput" Function: Parameter input Channel type: Setpoint send	1 12	• 41 [1] (DINT) ****	• 15	
Data object	Object type and function	Number of indexes occupied	DNP3 object group [vari- ation] (S7 data type)	DNP3 level *	Use in stations type **
----------------	---	----------------------------------	---	---	--
Par12D_R	Parameter object for receive direction Receive max. 12 double words with parameters or setpoints, object with 3 channels:			1	
	"Local"		- not used -		
	"LocalParameterInput" Function: Local parameters Channel type: Data send	1 12	 40 [1] (DINT) *** 42 [3] (DINT) *** 	 1 5 4 5 	S
	"ParameterOutput" Function: Parameter output Channel type: Setpoint re- ceive	1 12	• 41 [1] (DINT)	• 15	_
Universal data	a objects		1	r	1
Dat12D_S	Data object for send direction Send max. 12 double words (at least 1 double word) with any information	1 12	 30 [1] (DINT) 30 [5] (REAL) 32 [1] (DINT) 32 [3] (DINT) 32 [7] (REAL) 41 [1] (DINT) 41 [3] (REAL) 	 1 5 5 1 3 4 5 5 1 5 5 	 S S S S M M
		2 24	 30 [2] (INT, WORD) 32 [2] (INT, WORD) 32 [4] (INT, WORD) 41 [2] (INT, WORD) 	 15 13 45 15 	• S • S • S • M
		4 48	 30 [2] (BYTE) 32 [2] (BYTE) 32 [4] (BYTE) 41 [2] (BYTE) 110 [1255] (CHAR) 111 [1255] (CHAR) 	 15 13 45 15 15 15 	 S S S M M/S S

The SINAUT Configuration Tool

6.6 TD7onTIM

Data object	Object type and function	Number of indexes occupied	DNP3 object group [vari- ation] (S7 data type)	DNP3 level *	Use in stations type **
Dat12D_R	Data object for receive direction	1 12	• 30 [1] (DINT)	• 15	• M
	Receive max. 12 double words		• 30 [5] (REAL)	• 5	• M
	(at least 1 double word) with any information		• 32 [1] (DINT)	• 13	• M
			• 32 [3] (DINT)	• 45	• M
			• 32 [7] (REAL)	• 5	• M
			• 40 [1] (DINT)	• 15	• S
			• 40 [3] (REAL)	• 5	• S
			• 41 [1] (DINT)	• 15	• S
			• 41 [3] (REAL)	• 5	• S
		2 24	• 30 [2] (INT, WORD)	• 15	• M
			• 32 [2] (INT, WORD)	• 13	• M
			• 32 [4] (INT, WORD)	• 45	• M
			• 40 [2] (INT, WORD)	• 15	• S
			• 41 [2] (INT, WORD)	• 15	• S
		4 48	• 30 [2] (BYTE)	• 15	• M
			• 32 [2] (BYTE)	• 13	• M
			• 32 [4] (BYTE)	• 45	• M
			• 40 [2] (BYTE)	• 15	• S
			• 41 [2] (BYTE)	• 15	• S
			• 110 [1255] (CHAR)	• 15	• M/S
			• 111 [1255] (CHAR)	• 15	• M
Objects for dat	a exchange with MODBUS slaves	(only in stati	on)		
ModbusWrite	Write data from the station CPU to the MODBUS slave	-	-		
ModbusRead	Read data from the MODBUS slave to the station CPU	-	-		
Data objects n	ot supported	•		•	
Par12x1D_R	Cannot be used for the DNP3 protocol	-	-		

* DNP3 implementation level that must be supported by the communications partner.

** Station type: M = master station TIM, S = station TIM

*** These objects are used to mirror back values from the station to the master station, see the following reference.

**** The following objects are always sent by the master TIM with the control code "DIRECT_OPERATE": Bin08X_S (12), Cmd01B_S (12), Par12D_S (41), Set01W_S (41)

Mirroring back: You will find an description of the function in the section in the section Mirroring back (Page 183).

You will find a table sorted according to DNP3 object groups in the section Supported DNP3 object groups (Page 162).

6.6.8 Mirroring back

Mirroring back

The values of data points in DNP3 stations that are set by commands or setpoints by the DNP3 master station can also be set by manual operator input in the station. This overwrites the values set by the master station.

With the following object pairs, the current values in the station can be mirrored back to the DNP3 master station:

Setpoint objects Set01W_S / Set01W_R (object groups 40/42)

Setpoints with mirror back functionality are sent by the master to a station using the Set01W_S object. The station receives the data via the Set01W_R object.

The receive object (..._R) of the station mirrors the current or, if applicable, locally entered value back to the master station using the channel type "LocalSetpointInput".

To receive the value mirrored back by the station, the send object $(\dots S)$ of the master station has the channel type "ReturnedSetpoint".

Set01W_R in the DNP3 station

Send channel of Set01W_R for the local setpoint: LocalSetpointInput

- Set01W_S in the DNP3 master station

Receive channel of Set01W_S for the mirrored back setpoint: ReturnedSetpoint

• Parameter objects Par12D_S / Par12D_R (object groups 40/42)

Parameter settings with mirror back functionality are sent by the master to a station using the Par12D_S object. The station receives the data via the Par12D_R object.

The receive object (..._R) of the station mirrors the current or, if applicable, locally entered value back to the master station using the channel type "LocalParameterInput".

To receive the value mirrored back by the station, the send object $(\dots S)$ of the master station has the channel type "ReturnedParameter".

- Par12D_R in the station

Send channel of Par12D_R for the local parameters: LocalParameterInput

- Par12D_S in the master station

Receive channel Par12D_S for the mirrored back parameters: ReturnedParameter

• Message/binary value objects Bin08X_S / Bin08X_R (object groups 10/11)

Messages / binary values are sent by the master to a station using the Bin08X_S object (object group 12). The station receives the data via the Bin08X_R object.

The mirrored back value can be sent to the master station by the station using the Bin08X_S object (object group 10 or 11). The master station receives the mirrored back value with the Bin08X_R object (object group 10 or 11).

• Command object DNP3_Cmd01X_R (object group 12)

A command with Control Code is sent by the master (SCADA system) to the station with a suitable command of the object group 12 / variation 1. The station receives the data via

the DNP3_Cmd01X_R object and sends the local value back to the master via the mirror back channel.

You will find a detailed description of the channel types in the section Data objects: Specific channel parameters (Page 206).

During configuration make sure that the two objects of every pair in the station access the same address range in the CPU when mirroring back.

Mirroring back a value changed by local operator input

The mirror back mechanism is explained based on Bin08X_x.

- 1. A value sent by the master station is written to the CPU by the receive object of the station.
- 2. Following this, the value is changed in the memory area of the CPU by local operator input.
- 3. The modified value can be mirrored back to the master station with one of the two following types of transmission:
- Static

Example: Bin08X_S without configured event class (basic settings of the object)

This corresponds to the DNP3 object group 10, variation 2.

The new value is transferred only when polled by the DNP3 master station.

As event

Example: Bin08X_S with configured event class (basic settings of the object)

This corresponds to the DNP3 object group 11, variation 2.

For the transfer of the new value to the DNP3 master station, one of the two following options can be set for the send trigger of the channel in the station:

Send at change of"

Here, you define the deviation of the value in the memory area of the CPU at which message transfer is triggered.

With this send trigger, all values are sent back to the master station that have either been changed manually or overwritten by a new value from the master station.

"Time trigger"

With this send trigger, you can trigger the transfer of a message according to the following time-related criteria:

- Time of day
- Time scheme
- Trigger signal"

With this send trigger, for example, you can configure the signal resulting from manual intervention as an input that then triggers transfer of the message.

6.6.9 Inserting and copying objects and channels

Opening the TD7onTIM library

After setting the basic parameters of TD7onTIM and the destination subscriber-specific parameters, the objects of TD7onTIM are configured. To do this, a TIM module is selected in the directory tree. If no objects have yet been configured for the TIM (as is the case in a new project), the directory of the TIM cannot be expanded any further and the list box is empty.

The TD7onTIM library can be opened either using:

- The "TD7onTIM library" icon in the toolbar
- The "SINAUT" > "TD7onTIM Library" menu
- The F7 function key

Every TIM with TD7onTIM now has the required objects added from the library.

Inserting objects in the project

To insert new objects in the TD7onTIM of a subscriber, follow the steps outlined below:

- 1. Go to the directory tree and select the TIM for which you want to configure the objects.
- 2. Open the TD7onTIM library (see above).

The library is opened in a separate window. The objects are listed with the object name and a brief object description.

3. Select an object with the mouse in the window of the library.

To insert several objects at the same time, select an object and move up or down using the arrow keys while holding down the Shift key or select several distributed objects one after the other while holding down the Ctrl key.

All selected objects are shown on a colored background.

4. In the TD7onTIM library window, click the "Paste" button or select "Paste" in the shortcut menu (right mouse button).

The selected objects are then added to the TIM. They are all displayed in the subscriber list. Only the data objects are displayed in the directory tree below the selected TIM.

- 5. Delete objects that are not required from the directory of the TIM by selecting them in the directory tree or in the subscriber list and then selecting the shortcut menu "Delete".
- 6. Close the library with the "Close" button when you no longer require it.

Note

A maximum of 100 objects can be configured per TIM with TD7onTIM.

Copying objects to other TIMs

Once all the objects for a TIM have been configured and have had parameters assigned, you can copy the objects and the parameter assignments to another TIM in the project that requires the same or similar objects.

Follow the steps outlined below:

- 1. Select the objects in the subscriber list (<Shift > + arrow keys or select the objects + <Ctrl>).
- 2. Select the "Copy" shortcut menu.
- 3. Select another TIM in the "TIMs with TD7onTIM" directory.
- 4. Add the selected objects to this TIM with "Paste" in the shortcut menu.

The objects along with their entire parameter assignment are adopted by the TD7onTIM of the other TIM. In the copied object and its channels, it may be necessary to adapt the subscriber-specific parameter assignment (for example the input and output addresses).

If the complete parameter assignment of TD7onTIM is required for other TIM modules, you can also transfer the entire objects to a different TIM. Follow the steps outlined below:

- 1. Select a TIM in the "TIMs with TD7onTIM" directory.
- 2. Select the "Copy" shortcut menu.
- 3. Select another TIM in the "TIMs with TD7onTIM" directory.
- 4. Add all objects to the other TIM with "Paste" in the shortcut menu.

Overview of the channel types

Each data object has a defined number of channels with default parameters. The number of channels and the data type cannot be changed for an individual data object.

The data type of the channels depends on the object type. Apart from the setpoint and parameter objects, all data objects have one or more channels of the same type.

The channel types differ in the transmission direction relative to the communications partner and fall into the following two classes:

Send channels

Function: Data send

Channel types: Binary send, analog send, data send, mean value send, counted value send, command send, setpoint send

Receive channels

Function: Data receive

Channel types: Binary receive, analog receive, data receive, mean value receive, counted value receive, command receive, setpoint receive

Dialogs for setting channel parameters

Depending on their function, the channels have different parameters:

• Obligatory parameters

These are general parameters that can be set depending on the channel class:

- Obligatory parameters of the send channels
- Obligatory parameters of the receive channels
- Specific parameters

These are special parameters for some channel classes. Not all channel classes have specific parameters.

To set the parameters for the channels, you select the data object of a TIM with TD7onTIM in the directory tree. The list box displays the channels of this object with the channel name and channel type. If channels have already had parameters set, the input or output address is displayed in the list.

Below the list box, there is a parameter assignment dialog for the channel selected in the list box.

STZ SINAUT ST7 : Configuration - Project Project Edit SINAUT View Extras He	t 'SINAUT ST7_T4T new', Path 'C:\Program Files\Siemens\Step7\S7proj 💶 🗙
🕞 🔌 🧊 🍋 日 🖨 🕹 🖿	
Subscriber administration *	
Subscriber types:	Last change of connection configuration: 03/12/04 Selected CPUs: 0
All SINAUT subscribers Redundant ST7cc/ST7sc Redundant ST7cc/ST7sc All Destination Subscr All Destination Subscr I 1001 / Station 2_IE I / Bin048_S I 2 / Bin048_B	Channel name Channel type Input addr. Output addr. OutputByte_1 Binary receive P#DB 3.DBX 6.0 BYTE 1 OutputByte_2 Binary receive OutputByte_3 Binary receive OutputByte_4 Binary receive
	Channel name: OutputByte_1 Channel type: Binary receive Channel active: ✓ Output address Memory area: ● DB< © Memory © Output

Image 6-14 Object "Bin04B_R" with the selected channel "Binary receive" in the list box and its parameter dialog below

Copying channels

To simplify parameter assignment, channels along with their parameter assignment can be copied. If a data object requires more than one channel with the same parameter assignment (except for the input or output address) and if the parameter settings have been completed for one channel, this channel along with its parameters can be copied.

When you copy channels, the channel you are copying is not added to the existing channels since the number of channels is fixed per data object. The channel selected prior to paste is overwritten by the copied channel and its parameters.

To copy, follow the steps outlined below:

- 1. Select a channel in the list box.
- 2. In the shortcut menu (right mouse button), select the "Copy" menu or use the key combination <Ctrl>+C.
- 3. Select a different channel of the same object or the channel of another data object of the same type.
- 4. Insert the channel after parameter assignment using the shortcut menu (right mouse button) "Insert" or use the key combination <Ctrl>+V.

The selected channel is overwritten by the copied channel and its parameters.

Note

You will find a practical example of the configuration of the send triggers in the section Data objects: Memory area and triggers of the channels (Page 200).

6.6.10 System objects: Configuration

You will find a description of the MODBUS-specific system objects in the section Configuring MODBUS communication (Page 223).

Configuration - procedure

Configure the system objects you have assigned to a subscriber as follows:

- 1. Select a subscriber in the "TIMs with TD7onTIM" directory.
- 2. Select the required system object in the list.

The corresponding parameters are displayed in the parameter area.

3. Assign the parameters there.

SINAUT ST7 : Configuration - Project Project Edit SINAUT View Extras Hel	'SINAUT ST7_T4T new', Path 'C:\Program Files\Siemens\Si p	tep7\S7proje 💶 🗖 🗙
😂 🛰 🏂 🏘 🖬 🚭 🐰 🛍	₽ � ! №	
Subscriber administration *		<u>_</u> _×
Subscriber types:	Last change of connection configuration: 03/12/04	Selected CPUs: 0
Bedundant ST7cc/ST7sc ▲ Bedundant ST7cc/ST7sc ▲ TIMs with TD7onTIM	Object no. Object name Partner no.(s) Partner object no.	^
- Station Subscrib - MI Destination Subscrib - MI Destination 2_IE - MI / Bin048_S	PartnerStatus 4 2 WatchDog 9 1 Bin048_S 2 8 1	_
😚 2 / Bin04B_R 😚 3 / Ana04W_S 🈚 4 / Ana04W_R		
	System Object: WatchDog	<u> </u>
	Memory area: C DB C Memory C Output	_
- 😚 11 / Cnt04D_S - 🥱 12 / Cnt04D_R - 🥱 13 / Cmd01B_S 🔤	Address [Byte.Bit]:	
	•	- - -
		NUM

Image 6-15 TIM with selected system object "WatchDog" and the corresponding parameters

WatchDog

The "WatchDog" system object can be included as an option. It indicates to the CPU program whether the communication between CPU and local TIM is still working; in other words, whether TD7onTIM is still reading from and writing to the memory areas of the CPU. As long as communication is functioning correctly, a selectable output bit changes state at 5 second intervals. The constant status change can be evaluated by the CPU user program.

Parameters in the "Output Bit" box:

Name: Output bit

Memory area: The following options are available:

- DB: Data block
- Memory bit: Memory bit area
- Output: Process output image (PIQ)
- DB No.: Specifies the DB number in the CPU if the data block memory area (DB) was selected

Address Input fields for the byte and bit number in the selected memory area [Byte.Bit]:

PartnerStatus

The optional PartnerStatus object can be used to monitor the reachability of up to 8 communications partners (DNP3 master stations). The status is made available to the CPU in an output byte. One bit per communications partner is reserved in the output byte to indicate the status of the partner:

If TD7onTIM has a connection to more than 8 partners whose status needs to be monitored, the "PartnerStatus" system object needs to be configured more than once.

System Object: PartnerStatus	
Status Output Byte	Partner
Memory area: • DB C Memory C Output	Bit 0: 6 / Station 5
DB-No.: 3	Bit 1: 3 / Station 3
Address [Byte]: 7	Bit 2:
	Bit 3:
	Bit 4:
	Bit 5:
	Bit 6:
	Bit 7:

Image 6-16 Parameter assignment dialog of the "PartnerStatus" system object

Name:	Status output byte
Memory area:	The following options are available:
	DB: Data block
	Memory bit: Memory bit area
	Output: Process output image (PIQ)
DB No.:	Specifies the DB number in the CPU if the data block memory area (DB) was selected
Address [byte]:	Input box for the byte number in the selected memory area
Name:	Partner
Explanation:	In the 8 selection boxes, the communications partners to be monitored are assigned to the 8 status bits of the output byte. The list boxes display only the partners with which the TIM can actually communicate; in other words, to which a connection was configured.
Bit status:	Status = 0: Problem on partner or bit not assigned Status = 1: Partner OK

OpInputMonitor

OpInputMonitor indicates the status of operator input to the CPU when a command, setpoint or parameter is input. The current status can be displayed to the operator for each user program in a suitable form, for example using the LEDs, on an operator panel etc.

Note

OpInputMonitor is not normally used when using DNP3.

The OpInputMonitor system object can only be included once per subscriber with TD7onTIM.

TD7onTIM should therefore have the OpInputMonitor system object added when one or more of the following objects is used with this TD7onTIM:

- Set01W_S (Setpoint object for send direction)
- Par12D_S (Parameter object for send direction)

Check for the input time of hardware inputs

The OpInputMonitor is recommended particularly when commands are entered over digital inputs, for example using buttons connected to them. This also applies to the situation when setpoint and parameter entries are transmitted as the result of the send trigger signal and when this triggering is over a digital input, for example, once again using a button.

Using OpInputMonitor reduces the risk of incorrect input when the entries are made over digital inputs. For these inputs, the "minimum input time" can be specified for OpInputMonitor, in other words, the button must be pressed for the minimum time. Accidental activation of a button does not then lead to unwanted command, setpoint or parameter transfer. When the minimum input time has elapsed and the button can be released, OpInputMonitor indicates this with its status byte for operator input in the "Input OK" bit.

Apart from the minimum duration, the "maximum input time" can also be set for digital inputs. This allows a button that is sticking or defective digital inputs that supply a permanent 1 signal to be detected in good time. Such errors are once again indicated in the status byte for operator input of OpInputMonitor, in this case in the "Input error" bit.

The two times and the code bits mentioned above are relevant only for operator input over digital inputs.

1-out-of-n check of memory bit, DB and hardware input

For all types of operator input, in other words both for input via digital inputs as well as input via the memory or data blocks, OpInputMonitor also returns the error status 1 out-of-n error. It is set when TD7onTIM has detected that there is more than 1 operator entry pending within a fast read cycle (input error):

- If there is only 1 operator entry pending, the entry will be processed and transferred.
- If there is more than one entry, the entries are rejected (double input lock).

A new setpoint or parameter is processed only when previously no entry was acquired in at least 1 fast cycle.

If increased reliability is required for the input of commands, setpoints and parameters, all objects with which this data is sent must be assigned to the fast read cycle (see Data

objects: Partner and send parameters (Page 194) > "Read cycle" parameter). All setpoint and parameter objects in the fast cycle are subjected to a 1-out-of-n check; in other words, at the end of the fast cycle there is a check to make sure that there is a setpoint or parameter entry for only 1 of the acquired objects.

Note

Resetting the input bits

- If entries are made via a memory or data byte, or a setpoint or parameter entry is enabled by a memory or data bit (via the send trigger "Triggersignal"), the set entry bit or trigger signal is automatically reset to zero by TD7onTIM.
- If, however, a 1-out-of-n error is detected, the bit is not automatically reset. You then need to reset the input bit manually or have it reset by the user program.

System object:	OpInputMonitor
- Status byte for op	erator input
Memory area:	O DB O Memory 💿 Output
DB-No.:	0
Address [Byte]:	7
- Tolerance time fo	r hardware input
Max. input time:	2 × 1.0 s
Min. input time:	5 x 0.1 s

Image 6-17	Parameter assignmen	t dialog of the	"OpInputMonitor"	system object
------------	---------------------	-----------------	------------------	---------------

"Status byte for operator input" box

Name:	Status byte for operator input
Memory area:	The following options are available:
	DB: Data block
	Memory bit: Memory bit area
	Output: Process output image (PIQ)
DB No.:	Specifies the DB number in the CPU if the data block memory area (DB) was selected
Address [byte]:	Input box for the byte number in the selected memory area
Explanation:	The status byte for operator input is the output byte of the OpInputMonitor system object.
	In the status byte for operator input, the next 3 bits are assigned (explanation see above).

Assignmer	Assignment of the status byte for operator input							
Bit no.	7	6	5	4	3	2	1	0
Status	-	-	-	-	-	1-out-of- n error	Input error	Input OK
For val- ue:	0	0	0	0	0	1	1	1
Unused bit	Unused bits are set to 0							

"Tolerance time for hardware input" box

Name:	Max. input time
Range of val- ues:	Enter value x 1 [s] (10 corresponds to 10 seconds)
Default:	0
Explanation:	Monitoring time for commands entered over hardware inputs, or setpoints and parameters whose transmission is triggered over a hardware input. If the 1 signal is set at these hardware inputs for longer than defined in Max. input time, then the "input error" bit is set in the status byte for operator input. Fur- ther hardware entries are not processed as long as the "input error" bit is set. The max. input time is specified in seconds. A time of at least 30 seconds is recommended (entry: 30). 0 (zero) can be entered if the parameter is not required.
Name:	Min. Input Time
Range of val- ues:	Enter value x 0.1 [s] (10 corresponds to 1 second)
Default:	0
Explanation:	Delay time for commands entered over hardware inputs, or setpoints and parameters whose transmission is triggered over a hardware input. The message is entered in the send buffer of the TIM only if the currently entered command, setpoint for parameter remains unchanged for the specified delay time and no other command or setpoint input is detected during this time.
	The min. input time is specified in tenths of seconds. A time of at least 1 second is recommended (entry: 10). 0 (zero) can be entered if the parameter is not required.

6.6.11 Data objects: Partner and send parameters

Configuration of the objects and channels

You configure the data objects and their channels in two steps:

1. Configuring the objects

Here, you specify the properties valid for the entire object and all its channels.

- The communication partner
- Start index of the object
- Object number
- Send parameters
- 2. Configuring the channels

Here, you specify the properties of the individual channels of an object:

- Memory area of the CPU
- Send trigger for send channels
- Specific properties of the individual object types

Configuration of the objects (partner, start index, object number, send parameters)

Follow the steps outlined below:

- 1. Select a TIM with TD7onTIM in the directory tree.
- 2. Select the required data object in the list box at the top right.

The parameter assignment dialog below now shows the parameters of this object.

3. You set the parameters in this dialog.

Subscriber types: All SINAUT subscribers Redundent H-CPUs Modbus@ateway G 55520 Modbus@ateway G 65520 All Destination Subscribers Modbus@ateway G 65520 All Destination Subscribers Modbus@ateway G 65520 G 65520<th>SINAUT ST7 : Configuration - F</th><th>Extras Help</th><th>⊐× ∎×</th>	SINAUT ST7 : Configuration - F	Extras Help	⊐× ∎×
4 / Ana04W_R 5 / Ana04W_S 1003 / DNP3-Station 3 1004 / DNP3-Station 4 1005 / DNP3-Station 1 1005 / DNP3-Station 1 1006 / DNP3-Station 1 1007 / DNP3-Station 1 1008 / SIMATIC 300(1) Sub Station 32001 DNP3-Zentrale Send parameters Event class 1: Event class 2: Event class 3:	Subscriber types:	Last change of connection configuration: 28/01/11 14.29.32 Selected CPUs: 0 Object no. Object name Partner no.(s) DNP3 start index:	
	4 / Ana04W_R 5 / Ana04W_S 1003 / DNP3-Station 3 1004 / DNP3-Station 4 1005 / DNP3-Station 1 1006 / DNP3-Station 2 1006 / DNP3-Station 1	Partner Object Available partners: Selected partners: Sub Station 32001 DNP3-Zentrale Send parameters Event class 1: Event class 2: Event class 3:	
DNP3 start index:] -

Image 6-18 Subscriber administration with the parameter assignment dialog of a data object

Note

In the subscriber management, if a TIM is selected with TD7onTIM with the system object "ModbusGateway", in the object list in the column "Partner no." with the Modbus objects, the gateway number is displayed preceded by "G".

Parameters in the "Object" box

Name:	Object no.
Range of val- ues:	1 32000
Explanation:	The object number is assigned consecutively and uniquely by the configura- tion tool. As long as this uniqueness is retained, you can change the value as necessary. This value serves only as a criterion for the internal organiza- tion of the objects.

Parameters in the "Partner" box

From the "Available partners" list, select the DNP3 master station to which the process values of the data object will be sent. With receiving objects in stations, only one DNP3 master station is normally selected as the data source.

Note

Selection of at least one partner

All partners from which data of the object will be received must be added to the "Selected partners" list. If you do not enter a partner in the "Selected partners" list, the object will not be processed.

Partners with communication via node stations

If there is communication between master stations and stations in which the messages are transferred via a node station, for both directions only the destination partner is entered in the list of selected partners. The node station is not taken into account here.

Inter-station communication (DNP3 dedicated lines)

With inter-station communication between stations on DNP3 dedicated lines, the messages are transferred via a node station. In this case, the node station must be selected as the partner. After being saved in the CPU of the node station, the data is forwarded to the destination subscriber by a second object in the node station. In other words, the actual destination partner is configured in the node station.

Direct node station (Ethernet, dial-up networks)

With direct communication between stations in Ethernet networks and dial-up networks, only the communications partner is entered in the list of selected partners. The node station is not taken into account here.

Name: Selected partners

Explanation: The "Selected partners" list displays the communications partners for the relevant data object. These are selected from the "Available partners" list box.

You enter partners in the "Selected partners" list by selecting one or more (using the Ctrl key) partners in the "Available partners" list and clicking on the button with the arrow pointing to the right. The selected partners are then entered in the "Selected partners" list. The double arrow button is used to enter all available partners.

With the left arrow button, you remove a selected subscriber from the list of selected partners.

Up to 8 partners can be configured per data object.

Name: DNP3 start index Range of val- 0 ... 32000 ues: Default: 0

Explanation: By assigning the DNP3 start index, each process value of a TD7 data object is assigned a consecutive index number that must be unique within a DNP3 object group.

Rules for configuring the start index:

• Assign an index only once per DNP3 object group

An index may only be assigned once per DNP3 object group (not once per data object)!

Example:

If the value 100 is assigned as the start index of the data object "Ana04W_S" from the DNP3 object group "Analog Input", no other data object of this DNP3 object group (Ana04W_S, Mean04W_S, Dat12D_S) can use the indexes 100 to 103 as the start index.

Note

You will find an overview of the indexes occupied by the individual object types and the DNP3 object groups in the table in the section Objects of TD7onTIM (Page 177).

• Data objects with more than one channel

With data objects that have more than one channel, a channel that is configured as being "inactive" also occupies one or more indexes.

Example

With a data object with 3 channels each with 1 byte, the following indexes are occupied:

- Channel 1: Start index up to start index + 7
- Channel 2 (inactive): -
- Channel 3: Start index + 16 up to start index + 23

• Addressing the bits in a channel

The least significant bit of the first channel (bit 0) is always addressed with the "start index" the most significant bit with "start index + 7".

Parameters in the "Send parameters" box

Event classes

With the sending data objects, the process values of the object can be assigned to DNP3 event class1, 2 or 3.

If an event class is configured, changed process values of the data object are buffered as an event in the send buffer (message memory) and reported to the master station. This ensures that the history of process value changes is transferred to the master station.

The event classes 1 and 2 can, for example, be used to transfer values of an alarm sequence display.

The transfer of events is triggered by the send trigger, refer to the section Data objects: Memory area and triggers of the channels (Page 200).

Event class 1

All changes of a process value are buffered in the event memory and reported immediately to the master station.

Event of	class 2
----------	---------

All changes of a process value are buffered in the event memory and reported immediately to the master station.

Event class 3

Only the last change to a process value is buffered in the event memory. The current, modified value is transferred to the master station when the master station requests events of event class 3.

Event class 3 is, for example, suitable for transferring counter readings since only the last counted value is of interest.

No event class

If you do not specify an event class, there is no change monitoring of the process values of the data object and changes are not reported to the master station as an event (class 0 poll).

Command direction

Range of val- ues:	IN / OUT
Default:	TIM with master station function: ON (cannot be changed)TIM with station / node station function: OUT
Explanation:	The parameter specifies whether an object is sent with the master station function or the station function of the TIM.
	• "Command direction" activated: The object is sent with the master station function of the TIM. The object is assigned a master station connection (session).
	 "Command direction" deactivated: The object is sent with the station function of the TIM.
	The parameter must be identified differently for the two corresponding ob-

The parameter must be identified differently for the two corresponding objects by two communicating stations (object pair). The option is enabled for the sending object and disabled for the receiving object.

Note the differences in the configuration for the various subscriber types:

- Master TIM
 - For a TIM whose interfaces only have the master station function, the parameter is automatically enabled and grayed out.
- Node station TIM

For a node station, you need to enable or disable the parameter individually. An object cannot be sent simultaneously via two interfaces if one has the master and the other the station function.

Station TIM

For the station TIM, the parameter is configured individually for each object.

For objects that are sent to the master station, the parameter must be disabled.

For objects that are sent to a different station (inter-station communication), the TIM has the master function and the parameter must be enabled.

Name: Range of val- ues:	Read cycleNormal cycleFast cycle
Default: Explanation:	Normal cycle Each data object that sends data must be assigned to one of the two read cycles. The normal cycle is the most suitable selection for most process da- ta. Data that must be acquired quickly such as alarms and pulse messages are suitable for assignment to the fast cycle.
	Command, setpoint and parameter objects for which a 1-out-of-n check is required, must be assigned to the fast cycle. If these objects are acquired in the normal cycle, they are not included in the 1-out-of-n check.
	All send channels of a data object are included in the same read cycle. The parameters of the read/write cycle themselves are set in the basic set- tings for all objects of a subscriber, refer to the section Basic settings for subscribers with TD7onTIM (Page 171).

6.6.12 Data objects: Memory area and triggers of the channels

Enabling the channels of an object

When configuring the send and receive channels, you need to enable the individual channels so that the transfer of data during operation is enabled for this channel. To allow this, each channel of an object has the following option:

Channel active

Select this check box to enable the channel for data transfer.

If you are not sure whether or not you actually require a channel that has already had parameters assigned or you want to block a channel later (possibly only temporarily), you can disable it here without losing the parameters that have been entered.

If you do not require certain channels of a data object, ignore them and leave them without a parameter assignment.

Memory area and triggers

With the two channel classes send channel and receive channel, apart from the object-specific parameters, the following information is always configured:

• For send channels:

- Input address

Here, you specify the source address in the memory area of the CPU for the data to be sent.

To send data to the communications partner, the TIM accesses this data area of its local CPU.

- Send trigger

Here, you specify whether the data transfer will be triggered and which trigger with which setting will be used.

- For receive channels:
 - Output address

Here you specify the destination address in the CPU memory for the received data.

The parameters are described below.

You can see examples of the parameter assignment dialogs in the two figures below.

Channel name:	Counter_1	Channel type:	Counted value send
Channel active:			
Send trigger		Input address	
Send at change	e of: 0	Memory area:	● DB C Memory C Input
Time trigger		Data type.:	WORD 💌
Active:		Number:	1
Time of day:	Hour: Minute:	DB-No.:	4
Time scheme:	Hour: Minute: Second:	Address [Byte]:	3
- Trigger signal			
Active:			
Memory area:	C DB C Memory C Input		
DB-No.: Address [Byte	0 .Bit): 0 . 0		
		1	

Image 6-19 Parameter assignment dialog of a send channel based on the example of Counted value send

Channel name:	OutputByte_1	Channel type:	Binary receive
Channel active:			
Output address		1	
Memory area:	● DB ⊂ Memory ⊂ Output		
Data type.:	BYTE		
Number:	1		
DB-No.:	3		
Address [Byte]:	6		

Image 6-20 Parameter assignment dialog of a receive channel based on the example of Binary receive

Input / output address

Data transferred from TD7onTIM to a communications partner is first read from the work memory of the CPU. For each send channel, the source address (*input address*) must be specified in the relevant memory area of work memory on the local CPU module from which the data will be read.

Name:

Memory area: The following options are available for the source or destination address:

DB: Data block

Input address

- Memory bit: Memory bit area
- For sending channels:

Input: Process input image (PII)

• For receiving channels:

Output: Process output image (PIQ)

Only the specified address areas can be read or written by TD7onTIM. Data from other areas, for example analog values acquired via peripheral input words (PIW) or output via peripheral output words (PQW) must be mapped to the bit memory or data block area by the user program.

Data type: Apart from the objects Dat12D_S, Dat12D_R, Par12D_S, Part12D_R, the box shows the default data type for the particular channel:

- Binary send/receive: BYTE
- Analog send/receive: WORD
- Mean value send/receive: WORD
- Counted value send: WORD
- Counted value receive: DWORD
- Command send/receive: BYTE
- DNP command received / DNP command return message: BOOL
- Send/receive data:
 - Bin08X_S/Bin08X_R: In each case 1 status bit of the byte
 - Dat12D_S/Dat12D_R: BYTE, CHAR, WORD, DWORD, INT, DINT, REAL
- Setpoint send/receive
 - Object Set01W_S/Set01W_R: WORD
 - Object Par12D_S/Par12D_R: BYTE, CHAR, WORD, DWORD, INT, DINT, REAL

Number: Amount of data included in the array (maximum 12 double words or 48 bytes). The parameter is only active for channels that can be configured with a variable length. The parameter is available for the following channel/object types and is explained further below with the specific channel parameters:

- Data send / Dat12D_S
- Data receive / Dat12D_R
- Setpoint send / Par12D_S
- Setpoint receive / Par12D_R

- DB No.: Specifies the DB number in the CPU if the data block memory area (*DB*) was selected
- Address [Byte]: Input field for the byte number in the selected memory area. For data types involving more than one byte (WORD, DWORD, DINT), the least significant byte number must be entered as in STEP 7.

Send trigger

With all send channels, the send trigger specifies the reason for the data to be read from the CPU and transferred to the process image or to the send buffer (message memory for events) of the TIM.

Note that it is not the configuration of the send trigger that decides whether or not the data point of a channel is transferred as an event, but rather the setting of the send parameters of the entire object, refer to the section Data objects: Partner and send parameters (Page 194).

Four options are available for the send trigger. For each channel, you can configure a single option or a combination of different options.

Note

Transfer of the data of all channels when the send trigger of only one channel fires

Note the following for objects with multiple channels of the same type:

The send trigger can be configured individually for each channel. Note that if the send trigger of an individual channel fires, all channels of the object are transferred.

Since the various options of the send trigger must be activated alternatively or additionally with most channel types, make sure that the configuration is selected to produce practical results.

Note

Consistent trigger settings for multiple channels by copying

To simplify consistent configuration of the send trigger, you can copy a configured channel more than once into the same object. When you have copied a fully configured channel (shortcut menu or <Ctrl>+C), select a second channel and insert the first channel there (shortcut menu or <Ctrl>+V). The last selected channel is overwritten. You then need to activate the copied channels and adapt their address ranges.

Note

Threshold trigger (Send at change of): Calculation only after analog value preprocessing

Note that the analog value preprocessing is performed before the check for a configured threshold value, refer to the section Data objects: Specific channel parameters (Page 206).

Name:	Send at change of
Range of val-	In general: 0 32767
ues:	Exceptions:
	 Channel type Command send (Cmd01B_S): 0 or 1
	 Channel type Data send (Dat12D_S): 0 or 1
	 Channel type Setpoint send (Set01W_S / Par12D_S) 0 or 1
Default:	• For binary value, counted value, data and command channels: 1
	 For mean value and setpoint channels: 0
	 For analog value channels: 270 (1% of the raw value of S7 analog input modules, 27648 = 100%)
Explanation:	In the input box, the value must be entered as an integrated value (an inte- ger) by which the process value must change so that it is transferred again.
	If you enter 0 (zero), the function is deactivated.

How the integration calculation of the threshold value trigger "Send at change of" works with analog values

To calculate the threshold value trigger, the integration method is used. In the integration threshold value calculation, it is not the absolute deviation of the process value from the last transferred value that is evaluated but rather the integrated value of the integrated deviation.

Calculation cycle: 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 integrated value is calculated in every calculation cycle according to the following formula:

 $I_{N} = I_{O} + |D| / (((|D| * 10) / T) + 1)$

- I_N = Current integrated threshold value (as a natural number)
- Io = Previous integrated threshold value
- D = Amount of deviation of the current process value from the last stored process value
- T = Configured threshold value (Send at change of)

When the amount of the integrated value reaches the value configured for the threshold value trigger, the trigger is set and a new process value is entered in the send buffer.

The calculated threshold value is shown in the following example.

Time [s] (calculation cycle)	Process value stored in the send buffer	Current process value	Value of the devia- tion	Integrated threshold value
0	30	30	0	0
0.5		28	2	1
1.0		30	0	1
1.5		32	2	2
2.0		32	2	3
2.5		34	4	4
3.0		34	4	5
3.5		36	6	6
4.0		34	4	7
4.5		36	6	8
5.0		38	8	9
5.5		36	6	10
6.0		38	8	11
6.5	36	36	6	12
7.0		38	2	1

Table 6-7 Example of the integration calculation of a threshold value configured with 12

The configured threshold value of 12 in this example is reached after 6.5 seconds and a new process value of 36 is entered in the send buffer.

Time trigger

The "Time trigger" is activated with the "Active" option.

A combination of the two alternatives "Time of day" and "Time scheme" is not possible.

If the "Time trigger" is, for example, initially set to "Time of day" and then changed to "Time scheme", the previously set time of day is deleted.

Name: Range of val-	Time of day Time of day (hour and minute)
ues:	
Default:	Function not active
Explanation:	With a time-of-day controlled send trigger, the data is read out at the select- ed time of day.
Name:	Time scheme
	Time scheme Time scheme (hour, minute or second)
Range of val-	

Name:	Trigger signal
Memory area:	The following options are available for the source address:
	DB: Data block
	Memory bit: Memory bit area
	Input: Process input image (PII)
Default:	Function deactivated
DB No.:	Specifies the DB number in the CPU if the data block memory area (DB) was selected
Address [Byte]	: Input box for the byte number in the selected memory area
Explanation:	If a trigger signal is specified, the data of the object is transferred when the trigger signal changes from 0 to 1.
	If the trigger signal is a memory or data bit, it is automatically reset after it has been read. The reset can, if required, be evaluated by the user program.

The "Trigger signal" area includes the option of an external send trigger that can be activated

6.6.13 Data objects: Specific channel parameters

with the "Active" option.

Note

Assignment of DNP3 index and start index

With the data objects described here, you should take special care with the assignment of the DNP3 start index and the occupation of the indexes by the various channels.

The indexes used by the individual data objects and the assignment of the TD7 data objects to the DNP3 object groups is available as an overview in the section Data objects: Partner and send parameters (Page 194).

Mirroring back

The following objects provide a mirror back function:

- Bin08X_S/_R
- Set01W_S/_R
- Par12D_S/_R
- DNP3_Cmd01X_R (integrated mirroring back via the channel CmdFeedBack)

For a description of the function, refer to the section Mirroring back (Page 183).

You will find a description of the specific channels in the following sections of the data objects.

Bin04B_S

Channel "InputByte_x" Channel type: Binary send Bin04B_S allows sending of up to 32 binary values. The object contains 4 channels each for 1 byte (8 binary values).

The object occupies 32 indexes if all 4 channels are configured.

The "Masks" box provides three options for transmitting binary value messages. You can specify bit-by-bit whether certain bits do not trigger message transmission or which bits trigger a different type of transmission than was specified in the basic parameters of the object.

– Masks	
Alarm mask.:	A3 HEX
Send buffer principle mask:	MEX
Disable mask:	00 HEX

Image 6-21 The "Masks" box in the parameter assignment dialog of the "Binary send" channel type

Name:	Alarm mask
Range of val- ues:	Mask in hexadecimal format
Default:	00 (hex)
Explanation:	This alarm mask is not relevant for DNP3.
Name:	Send buffer principle mask
Range of val- ues:	Mask in hexadecimal format
Default:	00 (hex)
Explanation [.]	Changes in masked bits in the byte of the "Binary send" channel

Explanation: Changes in masked bits in the byte of the "Binary send" channel cause a message transmission according to the send buffer principle. Changes from 0 to 1 and from 1 to 0 are evaluated.

The corresponding bits are masked in hexadecimal format.

Name:	Disable mask
Range of val- ues:	Mask in hexadecimal format
Default:	00 (hex)
Explanation:	Masked bits in the byte of the "Binary send" channel are ignored when changes are checked. This means that changes to the masked bits for this channel do not trigger message transmission. A masked bit always has the value 0 in the message.
	The corresponding bits are masked in hexadecimal format.

The bits are masked as shown in the following example in which the hexadecimal value "A3" is entered in the input box of the parameter assignment dialog. The bits with the value 1 are masked; in other words bits no. 0, 1, 5 and 7 cause the relevant masking function in the described masks.

Byte assignment								
Bit no.	7	6	5	4	3	2	1	0
Masked	1	0	1	0	0	0	1	1
Hexadecimal mask	A			3				

Bin04B_R

Channel "OutputByte_x"

Channel type: Binary receive

Bin04B_R theoretically allows receipt of up to 32 binary values in 4 channels each of 1 byte (8 binary values per byte). The object occupies 32 indexes if all 4 channels are configured.

In the station, however, due to the control code "LATCH_ON" (see below) the object can only be received 1 bit at a time. To receive binary information, the "Bin08X_R" object is therefore recommended.

Taking control codes into account

Note

Interlock function (LATCH_ON) for receiving only 1 bit

With control codes sent from a master station in a message (DNP3 object group 12, variation 1), Bin04B_R only takes into account the interlock function LATCH_ON. If more than 1 bit is set at the same time in the entire object, LATCH_ON only sets the bit with the highest index in the object. All other bits of the object are set to zero.

LATCH_OFF is not supported by Bin04B_R. The bit set with LATCH_ON must be reset by the user program of the CPU.

Bin08X_S

Channel "StatusBit_x"

Channel type: Data send

Bin08X_S allows sending of up to 8 binary values. The object contains 8 channels each for 1 bit.

The object occupies 8 indexes if all 8 channels are configured.

Each index is written with a separate message. The messages are sent independently of other.

The object in a master station corresponds to the DNP3 object group 12 with the function code "Direct Operate".

Bin08X_R

Channel "StatusBit_x"

Channel type: Data receive

Bin08X_R allows receipt of up to 8 binary values. The object contains 8 channels each for 1 bit.

The object occupies 8 indexes if all 8 channels are configured.

Taking control codes into account

Note

LATCH_ON / LATCH_OFF

The object in the station takes into account the control codes LATCH_ON and LATCH_OFF sent in a message from a master station (DNP3 object group 12, variation 1).

Ana04W_S

Channel "AnalogInput_x"

Channel type: Analog send

Ana04W_S allows sending of up to 4 analog values. The data object is divided into 4 channels to each of which an analog value is assigned.

With 4 configured channels, the object occupies 4 indexes (1 index per channel).

Each index is written with a separate message. The messages are sent independently of other.

As the data source, an S7 word variable with a range of validity of 0 to 32766 is specified for each active channel. With variable value less than zero, zero is transferred. Values greater than $32766 (7FFE_H)$ are not transferred. For other ranges of validity, the data object "Dat12D_S" is available.

Analog value preprocessing

In the parameters described below, you configure the methods and parameters of analog value preprocessing. The analog value preprocessing takes place before the analog value is transferred to the communications partner.

Note

Threshold trigger (Send at change of): Calculation only after analog value preprocessing

Note that the analog value preprocessing is performed before the check for a configured threshold value. This has effects on the configured value of the "Send at change of" parameter for the trigger conditions, refer to the section Data objects: Memory area and triggers of the channels (Page 200).

Analog value processing is handled in the following order:

- 1. Reading the data from the input area of the CPU
- 2. Analog preprocessing in the following steps:
 - Unipolar analog value
 - Fault suppression time
 - Smoothing factor
- 3. Threshold value calculation for the trigger condition "Send at change of"
- 4. Storage of the value in the send buffer

Transfer of the value to the partner if trigger and threshold value conditions are met.

Processing parameters

The following parameters are available in the "Processing parameters" box:

Name:	Unipolar analog value
Range of val- ues:	Function active, function deactivated
Default:	Function active
Explanation:	If the function is activated, negative analog values are corrected to the value zero.
	The error ID 8000 $_{\rm H}$ (-32768), that is displayed, for example, if there is a wire break in life zero inputs, is nevertheless transmitted.

Name:	Smoothing factor
Range of val- ues:	1 = none, 4 = weak, 32 = medium, 64 = strong
Default:	1
Explanation:	Using the smoothing factor, quickly fluctuating analog values can be smoothed to a greater or lesser extent depending on the parameter setting. It may then be possible to set a lower value for the send trigger "Send at change of".
	The smoothing factors are identical to the smoothing factors that are config- ured for some S7 analog input modules. The smoothing in the channel func- tions according to the same formula as on an input module:
	$y_n = \frac{x_n + (k-1)y_{n-1}}{k}$

where

y_n = smoothed value in the current cycle n

 y_n = acquired value in the current cycle n

k = smoothing factor

Name:	Fault suppression time
Range of val- ues:	0 32767 [s]
Default:	0
Explanation:	Transmission of an analog value located in the overflow or underflow range $(7FFF_H \text{ or } 8000_H)$ is suppressed for the time period specified here. The value $7FFF_H$ or 8000_H is only sent after this time has elapsed, if it is still pending. If the value returns to below $7FFF_H$ or above 8000h again before this time elapses, it is immediately sent again as normal. The suppression time is started again for the full duration the next time $7FFF_H$ or 8000_H is detected.
	This is typically used for temporary suppression of current values that may occur when powerful motors are started. The analog input may exceed several times the maximum range under some circumstances. Suppression prevents these values from being signaled as faults in the control center system.
	The suppression is adjusted to analog values that are acquired 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 life-zero inputs).
	When the user provides specific values, fault suppression is only possible if these also adopt the values $7FFF_H$ or 8000_H when the permitted ranges are exceeded. If this is not the case, the parameter does not need to have a value entered.

Ana04W_R

Channel "AnalogOutput_x"

Channel type: Analog receive

Ana04W_R allows receipt of up to 4 analog values. The data object is divided into 4 channels to each of which an analog value is assigned.

With 4 configured channels, the object occupies 4 indexes (1 index per channel).

As the data destination, an S7 word variable is specified for each active channel.

When receiving analog values of a master station, values in the range from 0 to 65535 are accepted.

If values outside the valid range are received, there is no transfer of the value to the S7 CPU. The DNP3 master station receives a negative acknowledgment for such a command. For other ranges of validity, the data object "Dat12D_R" is available.

Note that with a write operation of the DNP3 master station, all active channels of the data object are transferred to the assigned S7 CPU by TD7onTIM, even if the DNP3 master station only sends 1 channel.

Mean04W_S

Channel "MeanValueInput_x"

Channel type: Mean value send

Mean04W_S allows sending of up to 4 analog mean values. The data object is divided into 4 channels to each of which an analog value is assigned. Values in the range from 0 to 65535 are transferred.

The object occupies 4 indexes (1 index per activated channel).

Mean04W_R

Channel "MeanValueOutput_x"

Channel type: Mean value receive

Mean04W_R allows receipt of up to 4 analog mean values. The data object is divided into 4 channels to each of which an analog value is assigned.

The object occupies 4 indexes (1 index per activated channel).

As the data destination, an S7 word variable is specified for each active channel. When receiving, values in the range from 0 to 65535 are accepted.

If values outside the range of validity are received, in the case of a station, the value is not transferred to the S7 CPU. The DNP3 master station receives a negative acknowledgment for such a command. For other ranges of validity, the data object "Dat12D_R" is available.

Note that with a write operation of the DNP3 master station, all active channels of the data object are transferred to the assigned S7 CPU by TD7onTIM, even if the DNP3 master station only sends 1 channel.

Dat12D_S

Channel "DataInput"

Channel type: Data send

Dat12D_S allows the sending of data of a size up to 12 double words in 1 channel.

Input address

Input address	
Memory area:	💿 DB 🔿 Memory 🔿 Input
Data type.:	DINT
Number:	12
DB-No.:	0
Address [Byte]:	0



Specifying the data type specifies how the data of the S7 CPU is interpreted and transmitted to the communications partner.

The number of required elements, in other words the size of the data field is configured in the Number input box.

The configured number of values specifies how many DNP3 indexes are occupied consecutively by the object starting with the specified start index. The following assignment between the data type used and the index used applies:

Data type	Range of values	Number of DNP3 indexes occupied
BYTE	0 255	4 48
CHAR	Printable ASCII characters	4 48
WORD	0 65 535	2 24
INT	-32 768 32 767	2 24
DINT	-2 147 483 648 2 147 483 647	1 12
DWORD	0 4 294 967 295	1 12
REAL	≈ -3,4 * 10 ³⁸ 3,4 * 10 ³⁸	1 12

You will find the DNP3 object groups compatible with the individual data types in the section Objects of TD7onTIM (Page 177).

Note

Reducing network load

By reducing the maximum size (parameter "Number"), the message length can be reduced to the actually required length if the entire data range of the object is not required. This saves transmission time.

Dat12D_R

Channel "DataOutput"

Channel type: Data receive

Dat12D_R allows receipt of data with a size of up to 12 double words.

The master station can send all variations of the DNP3 object group "Analog output". If the transferred analog value is outside the range of validity of the configured data type, this value is not transferred to the S7 CPU. A negative acknowledgement is sent to the master station.

Output address

Setting the data type specifies how the data of the communications partner will be interpreted and in the case of the station transferred to the S7 CPU.

The number of required elements, in other words the size of the data field is configured in the Number input box.

The configured number of values specifies how many DNP3 indexes are occupied consecutively by the object starting with the specified start index. The following assignment between the data type used and the DNP3 indexes used applies:

Data type	Range of values	Number of DNP3 indexes occupied
BYTE	0255	4 48
CHAR	Printable ASCII characters	4 48
WORD	0 65 535	2 24
INT	-32 768 32 767	2 24
DINT	-2 147 483 648 2 147 483 647	1 12
DWORD	0 4 294 967 295	1 12
REAL	≈ -3,4 * 10 ³⁸ 3,4 * 10 ³⁸	1 12

You will find the DNP3 object groups compatible with the individual data types in the section Objects of TD7onTIM (Page 177).

Note

Reducing message length

By reducing the maximum size (parameter "Number"), the message length can be reduced to the actually required length if the entire data range of the object is not required. This saves transmission time.

Cnt01D_S / Cnt04D_S

Note

Configuring counted values as an event

For reliable transfer, counted values should always be assigned to an event class, for example, event class 3. If counted values are transferred only as static unacknowledged DNP3 data, there is a danger that these are not sent consecutively to the DNP3 master station if there are disruptions in communication.

Channel "Counter_x"

Channel type: Counted value send

The object always occupies 1 or 4 indexes (1 index per activated channel).

Cnt01D_S sends 1 counted value, Cnt04D_S sends 4 counted values to a DNP3 master station.

The objects can only be used in the station.

As the data source, an S7 word variable with a range of validity of 0 to 65535 is specified for each active channel. The value transferred by the S7 CPU is added up in the DNP3 TIM and transferred as a 16-bit counted value to the DNP3 master station. When the CPU or DNP3 TIM is restarted and if there is overflow of the counted value, the corresponding flag (restart / discontinuity) of the counter is set.

The master station can freeze counted values with a "Freeze" command and then read them as a "Frozen counter". Counted values that are assigned to an event class are stored in the event memory as a "Frozen counter" event when the "Freeze" command is received.

Decrementing the counter reading is not supported.

Cnt01D_R / Cnt04D_R

Channel "CounterValueOutput_x"

Channel type: Counted value receive

The object always occupies 1 or 4 indexes (1 index per activated channel).

Cnt01D_R receives 1 counted value, Cnt04D_S receives 4 counted values from a station.

The objects can only be used in the master station.

As the data source, an S7 word variable with a range of validity of 0 to 65535 is specified for each active channel. The value transferred by the S7 CPU is added up in the DNP3 TIM and transferred as a 16-bit counted value to the DNP3 master station. When the CPU or DNP3 TIM is restarted and if there is overflow of the counted value, the corresponding flag (restart / discontinuity) of the counter is set.

The master station can freeze counted values with a "Freeze" command and then read them as a "Frozen counter". Counted values that are assigned to an event class are stored in the event memory as a "Frozen counter" event when the "Freeze" command is received.

Cmd01B_S

Channel "CommandInputByte"

Channel type: Command send

The object occupies 1 index.

Cmd01B_S allows the sending of 1 binary value. Only the least significant bit 0 of the transferred byte can be used. The object sends only when there is a $0\rightarrow 1$ transition.

The object in a master station corresponds to the DNP3 object group 12 with the function code "Direct Operate".

Control Code "LATCH_ON"

The command is sent with the interlock ID LATCH_ON. LATCH_OFF cannot be sent to a station. For resetting the bit in the station (LATCH_OFF), see below (Cmd01B_R).

Send trigger

Special feature of the send trigger: For the Send at change of send trigger, only the values 0 and 1 can be set. Values higher than 1 are meaningless for command input.

Mask

Individual bits of the byte to be sent can be blocked using the disable mask for command acquisition:

Name:	Disable mask
Range of val- ues:	Mask in hexadecimal format
Default:	00 (hex)
Explanation:	Masked bits in the byte of the "Command send" channel are ignored when changes are checked. This means that changes to the masked bits for this channel do not trigger message transmission. A masked bit always has the value 0 in the message.
	The corresponding bits are masked in hexadecimal format.

The bits are masked as shown in the following example in which the hexadecimal value A3 is entered in the input field of the parameter assignment dialog. The bits with the value 1 are masked; in other words bits no. 0, 1, 5 and 7 are ignored in command acquisition.

Byte assignment								
Bit no.	7	6	5	4	3	2	1	0
Masked	1	0	1	0	0	0	1	1
Hexadecimal mask	A				;	3		

Cmd01B_R

Channel "CommandOutputByte"

Channel type: Command receive

The object occupies 1 index.

Cmd01B_R it is intended for the station and is pointless for a master station.

Cmd01B_R allows receipt of a binary command. Only the least significant bit 0 of the transferred byte can be used. The other bits are set to zero.

Only ON commands (bit status 1) are accepted.

As the data destination of the command, a byte variable of the S7 CPU is specified.

Control Code "LATCH_OFF"

Automatic resetting of the bit: In the station, the object resets a bit set by the master station back to zero immediately if the command output time (see below) is set to zero.

LATCH_OFF is not used if the command output time is set higher than zero.

Name: Command output time

Range of val- $0 \dots 50$ [s x 0.1] (tenths of seconds; 5 = 0.5 seconds) ues:
Default:

5

Explanation: Time during which the command output of the channel is active. When the configured time has elapsed, the bit is reset to zero by TD7onTIM.

DNP3_Cmd01X_R

Channel "CmdReceive"

Channel type: Receive DNP3 command

The object is intended for the station and occupies 1 index.

As the data destination of the command, a bit variable of the S7 CPU is specified.

The channel allows receipt of a DNP3 command with the following control information:

- LATCH_ON / LATCH_OFF
- PULSE_ON
 - NUL
 - CLOSE
 - TRIP

When the byte "Control Code" is received with the function "PULSE_ON" information sent with it by the master "Count", "On-time" and "Off-time" is evaluated. This information is compared with the relevant object parameters "Max.pulse duration", "Pulse duration equivalent time" and "Number ofpulses" (see below).

The data object supports the following control codes id the object is suitably configured and the necessary information is received from the master.

Receipt of:		of:	Reaction of the object depends on the configuration	
Control Code	тсс	Ор Туре	Output mode = Pulse on	Output mode = 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	The command is rejected.	The output is set permanently to 1.
0x04	NUL	LATCH_OFF	The command is rejected.	The output is set permanently to 0.
0x41	CLOSE	PULSE_ON	The output is set permanently to 1 (as with LATCH_ON).	The command is rejected.
0x81	TRIP	PULSE_ON	The output is set permanently to 0 (as with LATCH_OFF).	The command is rejected.

Table 6- 8Functions of the data object

Note that DNP3_Cmd01X_R only has one output. If both the function "LATCH_ON/OFF" and the function "PULSE_ON" are to be used for a switching device. separate objects need to be created for both functions.

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Parameters of CmdReceive:

Name: Range of val- ues: Default: Explanation:	 Output mode Pulse on Latch on/off Pulse on Specifies the type of command The control code received from the master is evaluated. 	
Name: Range of val- ues: Default:	Max. pulse duration 0 2147483647 0	
Explanation:	Monitors the pulse duration sent by the master (On-time). If the pulse dura- tion received from the master exceeds the value configured here, the com- mand is rejected. If you enter 0 (zero), the monitoring is disabled.	
Name: Range of val- ues:	Pulse duration equivalent time 0 2147483647	
Default: Explanation:	0 Replacement value for the pulse duration If the pulse duration received from the master exceeds the value configured in "Max pulse duration". The pa- rameter is only used when "Max. pulse duration" is configured. If the value is 0 (zero), no replacement value is used.	
Name: Range of val- ues: Default: Explanation:	 Number of pulses 0 255 0 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 rejected. If you enter 0 (zero), the monitoring is disabled. 	
Channel "Cmd	Channel "CmdFeedBack"	

Channel "CmdFeedBack"

Channel type: DNP command response

Returns the value of the output address of the receiving channel "CmdReceive" to the master.

Set01W_S

Set01W_S sends 1 setpoint. The locally valid setpoint can also be indicated by this object.

The object can only be used in the master station.

Checking the input time and 1-out-of-n check of entries

For information on checking the input time and on the 1-out-of-n check of inputs for increased reliability when inputting setpoints and parameters, see the description of "Par12D_S" below.

Channel "LocalOperation"

Channel type: Data receive Function: Status 'Local setpoint input'.

The channel is not used for the DNP3 protocol.

Channel "ReturnedSetpoint"

Channel type: Data receive

Function: Mirrored back setpoint

The partner object in the station that receives the setpoint mirrors back the currently valid setpoint if the "LocalSetpointInput" channel parameter is set (see Set01W_R). This mirrored back value is displayed here at the ReturnedSetpoint output.

If you do not require the parameter, leave it disabled.

Channel "SetpointInput"

Channel type: Setpoint send

Function: Setpoint input

The entered setpoint is sent to the partner object via this channel. This channel of the object corresponds to the DNP3 object group 41 with the "Direct Operate" function code.

Set01W_R

Set01W_R receives 1 setpoint. The object also has an input over which the locally valid setpoint can be returned.

The object can only be used in the station.

Channel "Local"

Channel type: Data send Function: Status input mode 'local'.

The channel is not used for the DNP3 protocol.

Channel "LocalSetpointInput"

Channel type: Data send

Function: Local setpoint input

Via this input, the locally active setpoint can be mirrored back to the send block. This can be useful if a different setpoint from the one output previously by the master is entered locally.

If you do not require the parameter, leave it disabled.

Channel "SetpointOutput"

Channel type: Setpoint receive

Function: Setpoint output

The setpoint sent by the partner object or entered locally at LocalSetpointInput is output at SetpointOutput.

Par12D_S

Par12D_S sends 1 to 12 parameters. In addition to this, the parameters currently valid in the station can be displayed with this object.

The object can only be used in the master station.

1-out-of-n check of inputs

If increased reliability is required for the input of setpoints and parameters, all objects with which this data is sent should be assigned to the fast cycle. All setpoint and parameter objects in the fast cycle are then subjected to a 1-out-of-n check.

With the 1-out-of-n check, a check is made at the end of the fast cycle to ensure that there is one setpoint or only 1 parameter entry ready for transmission for precisely one of the acquired objects. Only then is the corresponding entry processed and transferred.

If there is more than one entry, the entries are rejected. A new setpoint or parameter is processed only when previously no entry was acquired in one fast cycle. The error status is indicated in the output byte of the "OpInputMonitor" system object using the "1-out-of-n error" bit, refer to the section System objects: Configuration (Page 188).

Checking the input time

If a parameter entry is transmitted as a result of the "Trigger signal" send trigger, and if this is triggered via a digital input, for example by a connected button, the button must remain activated until the signal has been acquired by TD7onTIM. The status byte for operator input of the OpInputMonitor system object indicates whether acquisition was successful in the "Input OK" bit. OpInputMonitor also takes into account any "Min. input time" configured there; in other words the button must be pressed at least as long as this selected time. Only then is "Input OK" indicated.

If the trigger signal is a memory or data bit, the bit is automatically reset by TD7onTIM as soon as it is acquired. Successful acquisition can be recognized indirectly because the trigger bit was reset.

Channel "LocalOperation"

Channel type: Data receive Function: Status 'Local parameter input'.

The channel is not used for the DNP3 protocol.

Channel"ReturnedParameter"

Channel type: Data receive

Function: Returned parameter

In TD7onTIM, the partner object in the station receiving the parameter values reports back the currently valid local parameter values if the "LocalParameterInput" channel is set in the receive object in the station. These returned values are indicated at the "ReturnedParameter" output. If new input is made to the partner object, the parameters changed there are indicated here by "ReturnedParameter".

The address range is taken form the channel "ParameterInput"

If you do not require the parameter, leave it disabled.

Channel "ParameterInput"

Channel type: Setpoint send

Function: Parameter input

The entered parameters are sent to the partner object via this channel. This channel of the object corresponds to the DNP3 object group 41 with the "Direct Operate" function code.

The number of required elements, in other words the size of the data field is configured in the "Number" (address) input box.

The configured number of values specifies how many DNP3 indexes are occupied consecutively by the object starting with the specified start index. The following assignment between the data type used and the index used applies:

Data type	Range of values	Number of DNP3 indexes occupied
BYTE	0255	4 48
CHAR	Printable ASCII characters	4 48
WORD	0 65 535	2 24
INT	-32 768 32 767	2 24
DINT	-2 147 483 648 2 147 483 647	1 12
DWORD	0 4 294 967 295	1 12
REAL	≈ -3,4 * 10 ³⁸ 3,4 * 10 ³⁸	1 12

Note

Reducing network load

By reducing the maximum size (parameter "Number"), the message length can be reduced to the actually required length if the entire data range of the object is not required. This saves transmission time.

Par12D_R

"Par12D_R" receives 1 to 12 parameters, for example setpoints. The object also has an input channel via which the current locally valid parameters can be mirrored back.

The object can only be used in the station.

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Channel "Local"

Channel type: Binary send Function: Parameter input mode 'local'.

The channel is not used for the DNP3 protocol.

Channel "LocalParameterInput"

Channel type: Data send

Function: Local parameter input

Local active parameters can be returned to the send block via "LocalParameterInput". The data area corresponds to the data area set for "ParameterOutput" of the same object.

The address range is taken form the channel "ParameterOutput".

If you do not require the parameter, leave it disabled.

Channel "ParameterOutput"

Channel type: Setpoint receive

Function: Parameter output

The parameters sent by the partner object or entered locally at "LocalParameterInput" are output at "ParameterOutput".

The number of required elements, in other words the size of the data field is configured in the "Number" (address) input box.

The configured number of values specifies how many DNP3 indexes are occupied consecutively by the object starting with the specified start index. The following assignment between the data type used and the index used applies:

Data type	Range of values	Number of DNP3 indexes occupied
BYTE	0 255	4 48
CHAR	Printable ASCII characters	4 48
WORD	0 65 535	2 24
INT	-32 768 32 767	2 24
DINT	-2 147 483 648 2 147 483 647	1 12
DWORD	0 4 294 967 295	1 12
REAL	≈ -3,4 * 10 ³⁸ 3,4 * 10 ³⁸	1 12

Note

Reducing network load

By reducing the maximum size (parameter "Number"), the message length can be reduced to the actually required length if the entire data range of the object is not required. This saves transmission time.

6.6.14 Configuring MODBUS communication

Differences in the configuration of MODBUS communication

Since MODBUS slaves are not SIMATIC devices or stations they are not configured as stations in STEP 7 nor are they configured as destination subscribers. Connections to MODBUS slaves are therefore also not configured in the connection configuration.

Configuring MODBUS communication

MODBUS communication is configured in the areas and objects of the subscriber administration listed below:

- 1. Select the "TIMs with TD7onTIM" directory.
- 2. Select a TIM in the subscriber list.

Parameters of the MODBUS polling cycle of the CPU of this station are set in the parameter area.

- 3. Select a DNP3 TIM in the "TIMs with TD7onTIM" directory.
- 4. Open the TD7onTIM library and insert the MODBUS-specific objects.

The following MODBUS-specific objects are inserted from the TD7onTIM library for a TIM with TD7onTIM:

System object "ModbusGateway"

The use of the MODBUS protocol for the serial interface of the DNP3 TIM is specified using the "ModbusGateway" object. The interface and parameters of the connection to the MODBUS slaves are configured with this object.

• System object "ModbusPartnerStatus"

The object signals the reachability of the MODBUS slave to the CPU.

• Data object "ModbusWrite"

Writes data from the configured input memory area of the CPU to a MODBUS slave.

• Data object "ModbusRead"

Reads data from a MODBUS slave and writes this to the configured output memory area of the CPU.

The objects are described in the sections that follow.

6.6.14.1 MODBUS-specific system objects

ModbusPartnerStatus

The optional object "ModbusPartnerStatus" is used to monitor the reachability of the connected MODBUS slaves. The status is made available to the CPU in an output byte. One bit per communications partner is reserved in the output byte to indicate the status of the partner:

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If the serial interface is set to the standard RS-485, up to 8 MODBUS slaves can be connected and monitored (1 slave with RS-232).

Name: Explanation:	Gateway number Internal partner number of TD7onTIM, cannot be set. Note on the gateway number In the subscriber management, if a TIM is selected with TD7onTIM with the system object "ModbusGateway", in the object list in the column "Partner no." with the Modbus objects, the gateway number is displayed preceded by "G".
Name: Memory area:	 S7 CPU status output byte The following options are available: DB: Data block Memory bit: Memory bit area Output: Process output image (PIQ)
DB No.:	Specifies the DB number in the CPU if the data block memory area (DB) was selected
Address [byte]:	Input box for the byte number in the selected memory area
Name:	MODBUS slaves
Explanation:	In the 8 input boxes, the MODBUS slaves to be monitored are assigned to

Explanation: In the 8 input boxes, the MODBUS slaves to be monitored are assigned to the 8 status bits of the output byte. The MODBUS address is specified for each MODBUS slave.
Bit status: Status = 0: Problem on partner or bit not assigned Status = 1: Partner OK

ModbusGateway

The "ModbusGateway" system object is used to activate the MODBUS protocol for a serial interface of the TIM and to configure the connection to the MODBUS slaves.

"Gateway property" box

Name:	Connection to TIM interface
Explanation:	Specifying the serial interface of the TIM
	Selection for TIM 4R-IE DNP3:

- WAN 1 = interface X1
- WAN 2 = interface X2

Name:	MODBUS role
Explanation:	Specifies the MODBUS role for the TIM.
	Only the default role "Master" is possible.

"WAN connection" box

Name: Explanation: Range of val- ues:	 Interface type: Selection of the interface standard and the directional dependency of the interface TIM 3V-IE DNP3: RS-232 half duplex RS-232 duplex TIM 4R-IE DNP3: RS-232 half duplex RS-232 half duplex RS-232 duplex RS-232 duplex RS-485 not terminated (TIM not as bus terminator) RS-485 terminated
	(TIM as bus terminator)
Name: Explanation: Range of val- ues:	Transmission speed Transmission speed on the serial interface [bps] 300, 600, 1200, 2400, 4800, 9600
Name:	Retry factor
Explanation: Range of val-	This value decides how often a message that has not been acknowledged positively is repeated before an error is signaled. 0255
Explanation:	This value decides how often a message that has not been acknowledged positively is repeated before an error is signaled.
Explanation: Range of val- ues:	This value decides how often a message that has not been acknowledged positively is repeated before an error is signaled. 0255
Explanation: Range of val- ues: Default: Name:	This value decides how often a message that has not been acknowledged positively is repeated before an error is signaled. 0255 3 Send timeout Time within which the acknowledgement is expected after sending a mes-
Explanation: Range of val- ues: Default: Name: Explanation: Range of val-	This value decides how often a message that has not been acknowledged positively is repeated before an error is signaled. 0255 3 Send timeout Time within which the acknowledgement is expected after sending a message [ms].
Explanation: Range of val- ues: Default: Name: Explanation: Range of val- ues:	This value decides how often a message that has not been acknowledged positively is repeated before an error is signaled. 0255 3 Send timeout Time within which the acknowledgement is expected after sending a mes- sage [ms]. 0 to 86 400 000 ms (= 24 hours)

Default:	0 If you configure the value 0, a message is only sent after setting the RTS signal when the CTS signal has been received from the partner and the send delay time (see below) has elapsed.
Name:	RTS off delay
Explanation:	Time that is waited after sending the last data before the RTS signal is cleared.
Range of val- ues:	0 to 255 ms
Default:	0
Name:	Send delay time
Explanation:	The send delay time is only used if the clear to send (CTS) signal has been received from the modem (if it exists) and no time was set for the RTS/CTS delay time.
	As soon as the CTS signal is received from the modem, the send delay time is started. The transfer of the data starts only after the time has elapsed.
Range of val- ues:	0 to 65535 ms
Default:	0
	0 = no send delay time
Name:	Data format
Explanation:	Format with which individual characters are transferred
Range of val-	8 data bits, odd parity, 1 stop bit
ues:	8 data bits, even parity, 1 stop bit

6.6.14.2 The "ModbusWrite" object

The "ModbusWrite" object

To map the data to be written between the S7 CPU and MODBUS slaves, the "ModbusWrite" object is available. A separate "ModbusWrite" object is configured for each MODBUS slave.

• 8 data bits, no parity, 2 stop bits

The input address

Data written from TD7onTIM to the MODBUS slaves is read from the input address area of the CPU. Only the specified address areas can be read by TD7onTIM. Data from other areas, for example analog values acquired over peripheral input words (PIW) must be mapped to the bit memory or data block area by the user program.

Name:	S7 CPU input address
Memory area:	The following options are available for the source address:
	DB: Data block
	Memory bit: Memory bit area
	Input: Process input image (PII)
Data type:	By specifying the data type, you specify the data type with which the data is transferred from the S7 CPU to the MODBUS slaves. The drop-down list offers the following data types for the three memory areas: BOOL, BYTE, CHAR, WORD, DWORD, INT, DINT, REAL
Number:	Number of double words included in the array (maximum 100).
DB No.:	Specifies the DB number in the CPU if the data block memory area (DB) was selected
Address [Byte]	: Input field for the byte number in the selected memory area. For data types involving more than one byte (WORD, DWORD), the least significant byte number must be entered as in STEP 7.

MODBUS output

Here, the register address on the MODBUS slave to which the data will be written is specified.

Name:	MODBUS output
Register ad-	Specifies the register address.
dress:	You will find the permitted address ranges in the documentation of your MODBUS slave.
Range of val- ues:	065535

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Function code:	Specifies the MODBUS data type. The following MODBUS data types are available:
	Write single coil
	(write 1 value, 1 bit)
	Write multiple coils
	(write multiple values,1 bit)
	Write single register
	(write 1 parameter,16 bits)
	Write multiple registers
	(write multiple parameters,16 bits)
Default setting:	MODBUS output
	 Function code: Write single register
	S7 CPU input address
	 Data type: WORD
	– Number: 1

Note

Changing the MODBUS output

The function codes are interlocked with certain data types and their number in the S7 CPU input address.

Note the following conditions when switching over the function codes:

• Multiple Coils ↔ Single Coil

If you select the number 1, you can switch over between single coil and multiple coils by changing the data type from BYTE to BOOL and vice versa.

• Multiple Registers ↔ Single Register

If you select the data type WORD and the number 1, you can change over between single register and multiple registers.

With the other constellations for changing over the MODBUS output, note the following sequence when changing the parameters.

• Single Register → Single Coil

Conversion sequence:

- Single Register → Multiple Coils
- Data type → BOOL
 - The function code switches automatically to single coil.

• Single Coil → Single Register

Conversion sequence:

– Data type → WORD

The function code changes to multiple coils. It is now possible to change over to single register.

• Multiple Registers → Single Coil

Changeover first to single register (see above) and then to single coil

MODBUS write status

The result of a write job is returned by the MODBUS slave in an acknowledgement message. The result is returned as a hexadecimal word and can be saved as a status in the input area of the CPU.

Name:	MODBUS write status
Memory area:	The following options are available for the address range of the S7 CPU:
	DB: Data block
	Memory bit: Memory bit area
	Input: Process input image (PII)
DB No.:	Specifies the DB number in the CPU if the "data block" memory area (DB) was selected
Address [Byte]:	Input field for the byte number in the selected memory area.
Range of val- ues:	See following table

Table 6-9 Value range of the MODBUS write status

Code	Meaning
0x7002	Job executed without errors
0x8000	Job executed with error
0x8001	Illegal Function
	After this error occurs, the S7 address of this write job is no longer read until the next restart on the TIM.
0x8002	Illegal Data Address
0x8003	Illegal Data Value
0x8004	Slave Device Failure
0x8005	Message transferred but slave device busy with a different process (Acknowledge)
0x8006	Slave Device Busy with other process
0x8008	Memory Parity Error
0x800C	Wrong CRC check value in the response message of the slave
0x800D	Wrong net data in the response message of the slave
0x800E	Wrong slave address in the response message of the slave
	After this error occurs, the S7 address of this write job is no longer read until the next restart on the TIM.
0x800F	Wrong function code in the response message of the slave
0x8010	No response (send timeout exceeded)

6.6.14.3 The "ModbusRead" object

The "ModbusRead" object

To map the data to be read between the MODBUS slaves and S7 CPU, the "ModbusRead" object is available. A separate "ModbusRead" object is configured for each MODBUS slave.

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MODBUS input

The register address on the MODBUS slave from which the data is read is specified here.

Name: Register ad- dress:	MODBUS input Specifies the register address. You will find the permitted address ranges in the documentation of your MODBUS slave.					
Range of val- ues:	065535					
Function code:	Specifies the MODBUS data type. The following MODBUS data types are available:					
	Read coils					
	(read 1 value, 1 bit)Read discrete inputs					
	(read multiple input values,1 bit)Read holding register					
	(read 1 parameter,16 bits)Read input register					

(read multiple values,16 bits)

Note

Changing the MODBUS input

The function codes are interlocked with certain data types and their number in the S7 CPU output address.

Note the following conditions when switching over the function codes:

- Coils / Discrete Inputs → Holding Register / Input Register Conversion:
 - Data type → WORD

The conversion is now possible.

• Holding Register / Input Register → Coils / Discrete Inputs

Conversion:

– Data type → WORD

The changeover of the function code to coils or discrete inputs followed by the changeover of the data type to BOOL is now possible.

S7 CPU output address

Data read from the MODBUS slaves by TD7onTIM is saved in the output address area of the CPU. Only the specified address areas can be written by TD7onTIM. Data for other areas, for example analog values output via peripheral output words (PQW) must be mapped via the bit memory or data block area by the user program.

Name: Output address

Memory area: The following options are available for the destination address:

- DB: Data block
- Memory bit: Memory bit area
- Output: Process output image (PIQ)
- Data type: By specifying the data type, you specify the data type with which the data is transferred from the MODBUS slaves to the S7 CPU. The drop-down list offers the following data types for the three memory areas: BOOL, BYTE, CHAR, WORD, DWORD, INT, DINT, REAL
- DB No.: Specifies the DB number in the CPU if the data block memory area (DB) was selected
- Address [Byte]: Input field for the byte number in the selected memory area. For data types involving more than 1 byte (WORD, DWORD, ...), the least significant byte number must be entered as in STEP 7.
- Number: Number of double words included in the array (maximum 100).

MODBUS read status

The result of a read job is returned by the MODBUS slave in an acknowledgement message. The result is returned as a hexadecimal word and can be saved as a status in the output area of the CPU.

Name: MODBUS read status

Memory area: The following options are available for the address range of the S7 CPU:

- DB: Data block
- Memory bit: Memory bit area
- Input: Process input image (PII)
- DB No.: Specifies the DB number in the CPU if the "data block" memory area (DB) was selected

Address [Byte]: Input field for the byte number in the selected memory area.

Range of val- See following table ues:

Code	Meaning
0x7002	Job executed without errors
0x8000	Job executed with error
0x8001	Illegal Function
	After this error has occurred, the read job is blocked until the TIM restarts and is no longer sent to the slave.
0x8002	Illegal Data Address
0x8003	Illegal Data Value
0x8004	Slave Device Failure
0x8005	Message transferred but slave device busy with a different process (Acknowledge)
0x8006	Slave Device Busy with other process. The query should be repeated by the mas- ter.
0x8008	Memory Parity Error
0x800C	Wrong CRC check value in the response message of the slave
0x800D	Wrong net data in the response message of the slave
0x800E	Wrong slave address in the response message of the slave
	After this error has occurred, the read job is blocked until the TIM restarts and is no longer sent to the slave.
0x800F	Wrong function code in the response message of the slave
0x8010	No response (send timeout exceeded)

Table 6-10 Range of values of the MODBUS read status

6.7 Saving and generating system data

6.7.1 Saving subscriber data

You save the data from subscriber administration using the Save button in the toolbar or with the SINAUT / Save menu. The Options dialog opens in which you specify the scope of the system data to be saved, processed and prepared.

tions		
Subscriber administration		
Print		
<u>D</u> verview format		
C Details		
Generation / Compilation options		
Generate System data blocks for TIMs and CPUs		
Generate SINAUT TD7 source files for CPUs		
Compile SINAUT TD7 source files for CPUs		
Generation / Compilation of TD7 source files will be done		
for all CPUs		
C for selected <u>C</u> PUs		
Subscriber number as comment for stations, CPUs and TIMs		
SMS configuration		
Check character set of SMS message strings		
ОК	Cancel	Help

Image 6-23 The Options dialog after selecting the Save function

The Options dialog provides the following convenient functions in the Generation / Compilation options area:

- Generate System data blocks for TIMs and CPUs
- Generate SINAUT TD7 source files for CPUs

(With DNP3, no TD7 source files are generated for CPUs.)

6.7 Saving and generating system data

The other options relate to the scope of system data generation

- for all CPUs or
- for selected CPUs (selected in the subscriber list)

The third option relates to generating the

subscriber number as comment for stations, CPUs and TIMs

The convenient functions described below represent the automation of several operator control steps in the STEP 7 system. These functions always relate to all networked subscribers; in other words, to subscribers involved in at least one telecontrol connection.

Regardless of the selected generation options, the internal data is saved and a consistent version is always available later.

After saving the internal data, a consistency check determines whether the user data is free of errors. If this is the case, the required functions are executed.

If problems are detected during the consistency check, the convenient functions are not executed. An error list is displayed as well as a message indicating the functions that have not been executed.

As soon as the generation has been completed successfully, this is indicated by a status dialog.

Info - Gene	ration / Compilation	
AII SINAUT	configuration data have been saved successfully.	
State of op	tional generation / compilation functions:	
- General	tion of System data blocks for TIMs and CPUs:	ОК
- General	tion of SINAUT TD7 source files for CPUs:	ОК
- Compila	tion of SINAUT TD7 source files for CPUs:	ОК
- Generat	ion of comment for stations, CPUs and TIMs:	ОК
	Attention ! Please note that the state of the compilation of SI does not include the result of the compiler run. For safety reasons the output messages of the ST should always be checked.	
OK.		Help

Image 6-24 Status dialog after saving and generating the system data

6.7.2 Generating system data blocks

All the parameters of the TIM module from the hardware setting to information on communication partners or local connections are packed in system data blocks (SDBs). SDBs with numbers starting at 1000 are used.

If S7-homogeneous connections (communication block connections) are used for communication between TIM and CPU, their data is packed in SDBs starting at no. 700.

If the Generate System data blocks for TIMS and CPUs option is selected in the Options dialog, this system data is saved for all existing and networked TIM and CPU modules in the subscriber list and saved in the offline data management.

Note

The SDBs must be transferred to the modules either in the SIMATIC Manager or using the SINAUT diagnostics and service tool.

6.7.3 Creating subscriber numbers as comments

To make the subscriber numbers that are important for communication visible in the SIMATIC Manager or in the hardware configuration, subscriber administration allows you to enter the subscriber number of networked components in the comment field of the properties.

The function is activated by selecting the option Subscriber number as comment for stations, CPUs and TIMs in the Options dialog when you call the Save function in the Options dialog.

With the following networked subscribers, the subscriber number is entered in the comment bar of the SIMATIC Manager:

- Stations:
- CPU modules
- TIM modules
- Third-party stations

The comments are visible in the SIMATIC Manager when you select the "View / Details" menu. The TIM modules are visible after expanding the tree structure and selecting a station.

Note

Creating the subscriber number when generating the system data overwrites comments previously entered in the network configuration without any possibility of restoring them.

6.7 Saving and generating system data

6.7.4 Consistency check

The consistency check is always started automatically before you use the generate/compile functions in subscriber administration to prevent SDBs or DBs being created with inconsistent data.

The consistency check can also be started as a separate function using the *SINAUT / Check consistency...* menu in subscriber administration.

Errors detected during the consistency check are displayed to the user in an error list.

No.		Error / Warning
STOP	1	Error: subscriber '1004', module 'TIM 34', station 'Station 2 (ST7)', node type 'station'
		In ST1 mode the WAN network address (1) of the TIM must match the subscriber no. of a local CPU (current subscriber no.: 3).
		Please correct either the address in the WAN net or the subscriber number (using the SINAUT ST1 configuration overview).
STOP	2	Error: subscriber '1002', module 'TIM 34', station 'Station 3 (ST7)', node type 'station'
		In ST1 mode the WAN network address (1) of the TIM must match the subscriber no. of a local CPU (current subscriber no.: 4).
		Please correct either the address in the WAN net or the subscriber number (using the SINAUT ST1 configuration overview).
Σs	bum	Found 2 errors and 0 warnings.

Image 6-25 Example of an error list after running the consistency check

If inconsistent connections are found, the error list indicates that cause will be diagnosed in the connection configuration in the *Invalid connections* dialog.

After eliminating an error, you must save prior to the next consistency check otherwise be eliminated error will still be reported.

6.7.5 Generating system data after changing the configuration of an existing system

Generating system data after changing the configuration of an existing system

Changes to an existing system made in *NetPro* or in *HW Config* are stored there. The new system data blocks, on the other hand, can be generated in various configuration tools.

In the following situations, after changes have been made to the project configuration, the SINAUT configuration tool should be started to generate the system data blocks (SDBs) in the *Subscriber Administration*:

- After changing the configuration of a TIM module
- After changing the configuration of a configured connection to a subscriber
- After changing communications parameters of a DNP3 master station

After changing or adding new subscribers or connections, the connection configuration and then the subscriber administration must be called in the SINAUT configuration tool to generate the SDBs there.

The activities required following a configuration change are summarized in the section Changing the configuration (Page 237).

6.8 Changing the configuration

Changing the configuration

This section describes the required follow-up actions after typical operator activities in the SINAUT configuration software.

Object affected	Action in the SINAUT configu- ration tool	u- Necessary follow-up action				
Station	Adding a station	-				
Station	Renaming a station	-				
Station	Changing the parameter set- tings of a station	-				
Station	Deleting a station	All telecontrol connections running via a module in this station are then invalid and are removed the next time you open the connection configuration. When necessary, these must be re- placed by alternative connections. The SDBs or DBs of all mod- ules that were involved in these deleted connections must be regenerated in the subscriber administration.				
TIM module	Adding a TIM module	-				
TIM module	Renaming a TIM module	-				
TIM module	Changing the parameter set- tings of a TIM module	If the parameter settings of a TIM module are changed, the SDBs only need to be regenerated in the subscriber administra- tion for this TIM.				
		Exception: If parameters are changed in the "WAN Access" tab, this has effects on all telecontrol connections running via the modified WAN driver.				
TIM module	Deleting a TIM module	All telecontrol connections running via this module are then invalid and are removed the next time you open the connection configuration. When necessary, these must be replaced by alternative connections. The SDBs or DBs of all modules that were involved in these deleted connections must be regenerat- ed in the subscriber administration.				
Network	Adding a network	-				
Network	Renaming a network	-				
Network	Changing the parameter set- tings of a network	The SDBs of all the modules connected to this network must be regenerated in the subscriber administration. In WAN networks, these are only TIM modules, in LANs all connected modules.				
Network	Deleting a network	All telecontrol connections running via this network are then invalid and are removed the next time you open the connection configuration. When necessary, these must be replaced by alternative connections. The SDBs or DBs of all modules that were involved in these deleted connections must be regenerat- ed in the subscriber administration.				
Network nodes	Adding a network node	-				
Network nodes	Renaming a network node	-				

Table 6- 11 Change matrix

6.8 Changing the configuration

Object affected Action in the SINAUT configu- ration tool		Necessary follow-up action			
Network nodes Changing the parameter set- tings of a network node		The SDBs of the module that contains this network node must be regenerated.			
Network nodes	Networking a network node	-			
Network nodes	Deleting a network node	All telecontrol connections running via this network node are then invalid and are removed the next time you open the con- nection configuration. When necessary, these must be replaced by alternative connections. The SDBs or DBs of all modules that were involved in these deleted connections must be regenerat- ed in the subscriber administration.			
Network nodes Canceling the networking of a network node		All telecontrol connections running via this network node are then invalid and are removed the next time you open the con- nection configuration. When necessary, these must be replaced by alternative connections. The SDBs or DBs of all modules that were involved in these deleted connections must be regenerat- ed in the subscriber administration.			
Telecontrol connection	Adding a telecontrol connec- tion	The SDBs or DBs of all subscribers over which this connection runs must be regenerated in the subscriber administration.			
Telecontrol connection	Deleting a telecontrol connec- tion	The SDBs or DBs of all subscribers over which the deleted connection runs must be regenerated in the subscriber administration.			
Telecontrol subscriber	Changing the parameter set- tings of a subscriber	The SDBs or DBs of all connections that run over this subscriber must be regenerated in the subscriber administration.			
Destination subscriber properties of TD7onTIM	Changing the parameter set- tings of the destination sub- scriber properties of a destination subscriber of TD7onTIM	The SDBs of all TIMs with TD7onTIM that communicate with this destination subscriber must be regenerated in subscriber administration.			

6.9 Downloading

6.9.1 Downloading data blocks to the CPU

To download data blocks to the CPU module, you use the STEP 7 SIMATIC Manager standard tool. This allows you to copy blocks using drag-and-drop or a menu either in an online window (configured online access) or in the window with the accessible nodes (non-configured online access).

Note

When you download blocks to the automation system by dragging and dropping, you yourself are responsible for ensuring that the blocks are copied to the correct online object (in other words, the object with the correct MPI address). The STEP 7 tool does not check this.

For more detailed information on these activities, refer to the online help of the SIMATIC Manager.

6.9.2 Downloading system data blocks to the TIM

You should only download system data blocks (SDBs) to the TIM in the SIMATIC Manager or in the SINAUT diagnostics and service tool.

Note

When downloading system data blocks in *hardware configuration*, make sure that *no* connection SDBs (SDB7xx) are downloaded. If SDBs of this type need to be downloaded to the TIM module, you must use the SIMATIC Manager or the SINAUT diagnostics and service tool.

SDBs can also be downloaded in *network configuration*. Creating SDBs during network configuration is a different procedure from that in the SIMATIC Manager and hardware configuration and is not suitable for the TIM module. Copying SDBs to TIM modules should therefore only be done in the SIMATIC Manager or SINAUT diagnostics and service tool.

In the SIMATIC Manager, all SDBs of a module are indicated by a symbol with the name *System data*. This means that you can only ever manipulate all SDBs of a module as a single unit. Otherwise, the same applies as for data blocks.

In the hardware configuration, it is possible to download the SDBs of individual modules or entire stations.

In both cases, the function is followed by a dialog in which you are asked whether you want to restart the TIM module. This dialog must be exited with *Yes* to restart the TIM and activate the new SDBs.

6.9 Downloading

6.9.3 Uploading stations with the Upload Station to PG function

The STEP 7 function "PLC" > Upload station to PG" allows the configuration of a connected station to be adopted. In conjunction with TIM modules, this function can only be used with the following restriction.

Note

Restrictions regarding the "Upload Station to PG" function

- If station to be uploaded is a TIM rack (the rack contains only one standalone TIM), it is not possible to upload the station. The "Upload Station to PG" function can only be used in racks with CPU modules.
- If there is a 300 CPU in the rack, the configuration can be uploaded but the TIM module shown afterwards in the rack is not fully initialized and not suitable for further configuration. It must be replaced by a new module from the catalog in HW Config.
 If you continue configuration with TIM modules uploaded in this way, then problems, particularly in communication and in handling the module can occur.

6.9.4 Changing the MPI address of the CPU

In hardware configuration, it is possible to change the MPI address of the CPU. If TIM modules are installed in the same rack, when downloading the SDBs ,**it is necessary** that the download is performed in two steps.

- 1. Download SDBs only to the CPU not to the TIM. Once the CPU module has received its new MPI address, the TIM modules go through a reset.
- 2. Download the SDBs to the TIM modules when they have completed the restart.

Diagnostics and upkeep

7.1 Diagnostics options

The following diagnostics options are available:

LEDs of the module

For information on the LED displays, refer to the following sections:

LEDs of the TIM 3V-IE DNP3 (Page 52)

LEDs of the TIM 4R-IE DNP3 (Page 56)

The SINAUT diagnostics and service tool

The SINAUT diagnostics and service tool provides you with the diagnostics options of STEP 7 and other functions for communication with the TIM modules in telecontrol networks.

For a more detailed description, refer to the following sections.

7.2 Updating firmware

New firmware versions of the TIM

If a new firmware version is available for the module, you will find this on the Internet pages of Siemens Industry Online Support under the following ID:

89372872 (http://support.automation.siemens.com/WW/view/en/89372872)

On the Internet page, select the "Entry list" tab and the "Download" entry type.

The firmware of the TIM is in 2 parts:

1. Firmware driver package

You load the driver package using the SINAUT diagnostics and service tool. You will find the description in the section Loading new firmware (Page 276).

2. Firmware basic package

You load the basic package using the NCM S7 firmware loader supplied with STEP 7 You will find the description in the following section.

The two parts of the firmware must be loaded one after the other in the order shown.

As a requirement for loading new firmware, you require a PG with the STEP 7 project of your installation.

You will find information on the interfaces of the PG in the two sections on loading the firmware packages.

Loading the firmware basic package

You can only load a new firmware driver package via the Ethernet interface of the TIM.

To load firmware, you require an Industrial Ethernet CP module in the PG/PC (for example, CP 1613) or a normal Ethernet module with the "Softnet" software package.

On your PG, set the S7-ONLINE interface to the "ISO - Industrial Ethernet" protocol. It is not possible to download using TCP/IP (and therefore not to other networks).

Follow these steps:

- 1. Connect the PG to the TIM.
- 2. Open the NCM S7 firmware loader on the PG.
- 3. First press the RESET button of the TIM briefly to bring it to a loadable status.

The TIM restarts and turns on all LEDs for 5 seconds.

4. During these 5 seconds during which all LEDs are lit, press the RESET button again until the "RUN" LED starts to flash.

As soon as the "RUN" LED flashes you can release the button.

The TIM is in a loadable status.

5. Now start the loading of the firmware basic package using the NCM S7 firmware loader.

You will find detailed information on this topic in the online help of the firmware loader.

When loading begins, the "STOP" LED of the TIM starts to flash and continues until the procedure is completed.

After loading the TIM restarts.

7.3 SINAUT diagnostics and service tool

7.3.1 Overview of functions and operation

Introduction

The SINAUT diagnostics and service tool provides the user with functions for checking connections, interfaces and communication as well as the firmware and software components of the network subscribers of a DNP3 installation. The most important functions are as follows:

- Reading the diagnostic data from a TIM or CPU module
- Reading the diagnostic buffer
- Checking and setting the module time
- Reading the module parameter assignment
- Activating a message trace

- Firmware update of TIM modules
- Downloading a new parameter assignment to the TIM modules

Note

Diagnostics functions that are also available in the SIMATIC Manager are described here with the emphasis on diagnostics of TIM modules.

7.3.1.1 Starting the program and types of access

Opening the SINAUT diagnostics and service tool

The SINAUT diagnostics and service tool is opened in the Windows start menu *SIMATIC / SINAUT ST7 / Diagnostics and Service*.

You can access the module-specific diagnostic information alternatively over:

- Accessible nodes
- the SINAUT subscriber list of the STEP 7 project

Note

Regardless of whether you access this information using *Accessible nodes* or the *SINAUT subscriber list*, unless you activate the PG routing function, you can only access subscribers of the subnet of the local MPI bus to which the PG is connected.

Access using Accessible Nodes

To access the diagnostic data using *Accessible Nodes*, follow the steps outlined below:

- Click on the Accessible Nodes button or click on the Project / Accessible Nodes menu. The Accessible Nodes dialog opens.
- 2. In the *Selectable Nodes* dialog, select the required subscriber from the list of MPI addresses by clicking on it with the mouse.

Access using the SINAUT subscriber list of a STEP 7 project

To open the STEP 7 project in the diagnostics and service tool and to access the diagnostic data using the *SINAUT subscriber list*, follow the steps outlined below:

- 1. Click on the *Open Project* button in the toolbar or select the *Project / Open* menu. The *Open* dialog is displayed.
- 2. Select the STEP 7 project in the *User Projects* tab of the *Open* dialog and click on the *OK* button. The project window with the *SINAUT subscriber list* of the relevant project opens.
- 3. If the required project is not displayed in the *Open* dialog, click the *Browse* button. In the Browse dialog that opens, you can search for other projects and include them in the

project list.

As an alternative, you can open a current project with the *Project / Recently Used* menu.

4. Select the subscribers you require for the subsequent diagnostic functions in the *SINAUT subscriber list* by clicking on them with the mouse.

Project 'DNP3', Path 'C:\Program Files\Siemens\Step7\s7proj\Dnp3'								
INAUT subscriber list:								
Subscriber no.	Subscriber type	Name	Station	SINAUT con	nnected	SINAUT	library	TIM firmware
= 1	Other Station	DNP3-Zentrale		yes				
Sg 2	CPU 312	CPU 312	Station 1	yes				
Sg 3	CPU 312	CPU 312	Station 3	yes				
Sg 4	CPU 312	CPU 312	Station 2	yes				
Ŝ∰ 5	CPU 312	CPU 312	Station 4	yes				
Sg 6	CPU 312	CPU 312	Station 5	yes				
* 1001	SINAUT TIM	TIM 3V-IE DNP3	Station 1	yes				
📲 1002	SINAUT TIM	TIM 3V-IE DNP3	Station 2	yes				
📲 1003	SINAUT TIM	TIM 3V-IE DNP3	Station 3	yes				
1004	SINAUT TIM	TIM 4R-IE DNP3	Station 4	yes				
ﷺ 1005	SINAUT TIM	TIM 4R-IE DNP3	Station 5	yes				

Image 7-1 The SINAUT subscriber list of a sample project

Note

Attempting to access a remote subscriber using the *SINAUT subscriber list* of a STEP 7 project can lead to "misunderstandings" if the subscriber is not connected to the local MPI bus and the PG routing function is not activated. With functions involving access to the module, the remote subscriber is displayed in the *Path* field of the diagnostics dialog, however the diagnostic data is that of the locally connected subscriber.

The SINAUT subscriber list displays the following entries for each subscriber:

- Subscriber no.: The subscriber number of the SINAUT subscriber that is unique throughout the project
- **Red. Subscriber no.**: The *redundant subscriber number* parameter is used only when there is a redundant partner for the subscriber in question. The number specifies the common subscriber number under which the redundant system can be addressed by other subscribers.
- Subscriber no. of red. Partner: The *Subscriber number of the redundant partner* parameter is used only when there is a redundant partner for this subscriber. The parameter specifies which of the subscribers belong to a redundant relationship.
- **Subscriber type**: The *subscriber type* specifies the class of subscriber involved. The subscriber type cannot be set by the user.

- Name: The module, application or PC/PG name. This can be changed in the configuration. As default, this is the name of the module type or the application as specified in the configuration.
- Station: Name of the station specified by the user in the configuration using NetPro.
- **SINAUT connected**: Specifies whether a SINAUT connection was configured for the subscriber.
- TD7 library version: SINAUT system library for the TD7 software blocks

Nothing is displayed here for DNP3 CPUs because TD7onTIM is used.

• TIM firmware version: With TIM modules, the version of the TIM firmware is displayed.

PG Routing

If you connect a programming device (PG) or a PC to access the diagnostic data, you only have access to the local network. The diagnostic data of remote subscribers in other subnets is not accessible.

To access subscribers in other subnets, you can use PG Routing. If you access data in a subordinate subnet after activating PG Routing, remember that you can only access subordinate subnets and not subnets higher in the network hierarchy. The prerequisites, functions and activation of PG routing are described in a separate chapter.

The PG Routing function is possible only when using the *SINAUT subscriber list*, PG Routing is not possible when using *Accessible Nodes*.

7.3.1.2 Access to subscribers and working with the diagnostics dialogs

Activating diagnostic functions

The diagnostic functions are activated as follows:

- 1. Select a subscriber by clicking on it with the mouse in *Accessible Nodes* or in the *SINAUT subscriber list* of a STEP 7 project.
- 2. Start the required diagnostic functions with one of the following alternatives:
 - Clicking on the corresponding button in the toolbar
 - Selecting the function in the Project, STEP 7 Diagnostics or SINAUT menus
 - Pressing the relevant function key
 - Right-clicking on the subscriber in Access of Nodes or in the SINAUT subscriber list. After clicking on the subscriber, select the required function with the right mouse button in the displayed context menu.
- 3. The dialog belonging to the selected diagnostic function is displayed.

Working with the dialogs

The graphic user interface of the SINAUT diagnostics and service tool is designed based on Windows technology. To use diagnostic functions, you must generally first select a particular subscriber or a component from a list in the Windows and dialogs and the function will then be executed and the diagnostic data displayed for this subscriber or component. The function is then activated from a menu or by selecting a button and a dialog for the specific diagnostic function then opens.

When *selecting* a menu, a subscriber, or object is described, this involves clicking on the object once within the left mouse button.

Buttons found in many of the diagnostics dialogs are explained here and not in each subsection. These include the buttons:

- Print: Starts a printout of the currently open dialog.
- Update:

Updates the content of the dialog with the current diagnostic data of the selected subscriber.

Save:

Saves the content of the open dialog in a file. You can select any directory and file name in the *Save* dialog.

Load:

Loads the diagnostic data relevant to the current dialog content from a previously saved file into the open dialog. The loaded diagnostic data is displayed in the dialog.

Note

When *loading* data from a file, the current project data in the dialog is overwritten by the data from the file. To display the data of the connected subscriber again, the dialog must be closed and reopened, in some cases, the display can be updated with the data of the connected subscriber again using the *Update* button.

• Close:

Closes the current dialog. You return to the Accessible Nodes or SINAUT subscriber list.

- *Help:* Opens the online help function for the currently selected diagnostic function.
- OK: Confirms the entries made and closes the dialog.
- *Cancel:* Discards the entries made and closes the dialog.

7.3.1.3 Functions of the SINAUT diagnostics and service tool

Overview of the diagnostic and service functions

The diagnostic functions of the SINAUT diagnostics and service tool can be grouped together as follows:

- STEP 7 diagnostics
- SINAUT diagnostics (TIM status information and TD7 software diagnostics)
- Message protocol diagnostics
- Service functions

The following table shows the diagnostic and service functions and all the menus in which the functions of the SINAUT diagnostics and service tool can be called.

The two right-hand columns in the table indicate that the scope of information when using the *SINAUT subscriber list* of a STEP 7 project is greater than when using *accessible nodes*.

Function group, diagnostic function (remarks)	Subscriber type relevant for diag- nostics	Called in menu	Access over STEP 7 project	Access us- ing Accessi- ble Nodes
STEP 7 diagnostics		STEP 7 diagnostics		
CPU messages	CPU, TIM	-	Х	Х
Module information (including mes- sages in diagnostic buffer)	CPU, TIM	-	Х	Х
Operating mode	CPU, TIM		х	Х
Setting the time	CPU, TIM	"	Х	Х
SINAUT				
SINAUT diagnostics		SINAUT		
TIM Diagnostics	ТІМ	"	х	Х
TIM subscriber diagnostics	ТІМ		х	Х
TIM diagnostic messages	ТІМ		Х	
TIM Message Monitor	ТІМ		х	
TD7 software diagnostics		SINAUT		
TD7 CPU diagnostics (TD7 messages in diagnostics buffer)	CPU	"	X	Х
TD7 block structure (configured data)	CPU	"	Х	
TD7 block structure for all CPUs (configured data)	CPU	"	Х	
TD7 CPU program comparison (configured data)	CPU	"	X	

 Table 7-1
 Overview of the diagnostic and service functions of the SINAUT diagnostics and service tool

Function group, diagnostic function (remarks)	Subscriber type relevant for diag- nostics	Called in menu	Access over STEP 7 project	Access us- ing Accessi- ble Nodes
TD7 communication configuration check (configured data)	CPU	"	x	
TD7onTIM diagnostics	ТІМ	"	X	
SDB Viewer	CPU, TIM	"	x	х
Service functions		SINAUT		
Download SDB	ТІМ	"	X	
Firmware update	ТІМ	"	x	
Repair	ТІМ	"	x	
Message protocol diagnostics		Project		
TIM message protocol	TIM	"	Х	Х

The diagnostic information is displayed only for SIMATIC CPU modules and SINAUT TIM modules.

7.3.2 STEP 7 diagnostics

Introduction

STEP 7 diagnostics involves the standard diagnostic functions of SIMATIC STEP 7. Over and above SIMATIC installations, the STEP 7 diagnostics in the SINAUT diagnostics and service tool provides information not only on the CPU modules but also information on the TIM modules of a project. The functions in the SINAUT diagnostics and service tool that are implemented on the TIM module:

- CPU messages
- Module information
- Operating mode
- Setting the time

7.3.2.1 CPU messages

Description of the functions

The *CPU messages* function is used to archive diagnostic messages entered by a CPU or TIM module in its diagnostic buffer. Without archiving, messages in the ring buffer of the CPU or TIM would be successively overwritten once the buffer is full.

The *CPU messages* function registers the PG used for diagnostics with one or more modules. The modules then transfer all newly generated diagnostic messages to the registered PG. The diagnostic messages of one or more modules are archive in a common list on the PG. The archive is designed as a ring buffer. The oldest messages are overwritten by newly arriving messages once the archive is full.

CPU Messages			
File Edit PLC View	Options Help		
e 1 e			
W A Module			
	Teilnehmer\MPI = 3		
	Nodes\MPI = 2		
Date/time	ID Message text		Status
12.10.04 01:53:14:694	Message-Update End.		0
Module: Source:	Accessible Nodes\MPI = 2 PG/PC		
12.10.04 01:53:19:668	Message for 'W' (diagnostic events):	Activated	
	Messages for 'A' (process and system error):	Deactivated	
Module: Source:	Accessible Nodes\MPI = 2 PG/PC		
12.10.04 01:53:22:068	Message for "W" (diagnostic events):	Deactivated	
	Messages for 'A' (process and system error):	Deactivated	
Module: Source:	Accessible Nodes\MPI = 2 PG/PC		
12.10.04 01:53:30:363	Message for "W" (diagnostic events):	Deactivated	
	Messages for 'A' (process and system error):	Deactivated	
Module: Source:	Erreichbare Teilnehmer\MPI = 3 PG/PC		
12.10.04 01:53:32:569	Message for 'W' (diagnostic events):	Activated	
	Messages for 'A' (process and system error):	Deactivated	
Module: Source:	Accessible Nodes\MPI = 2 PG/PC		
Archive Alarm /			
Ready	Message 30	Message 300 of 300 preselected NUM	

Image 7-2 CPU Messages dialog

The messages for diagnostic events are entered at the bottom of the dialog in the *Archive* tab of the message list.

From the menu of the dialog or using the buttons of the toolbar, various user-specific settings can be made for message output such as emptying the archive, processing messages, the view of the message window, the settings for the archive size and saving the PG connections to the registered modules for the next time the *CP messages* function is called.

Operator activities

- 1. Select a subscriber by clicking on it in the *SINAUT subscriber list* of the open project or in *Accessible Nodes*.
- Open the CPU Messages dialog by selecting the STEP 7 Diagnostics / CPU Messages menu.
- 3. To register the PG/PC for the *CPU Messages* function, select the module in the *W* column of the module list at the top of the dialog. After the registration, the connection option (check box) of the module is selected in the *W* column. All the generated diagnostic messages of the module are then displayed in chronological order in the *Archive* tab of the message list at the bottom of the dialog. If no connection can be established to the subscriber, a symbol is displayed in the first column of the module list indicating that the connection is interrupted.

- 4. Click on the relevant field for the module in the *W* column of the module list again to deactivate archiving of the diagnostic messages.
- 5. Select the menu or the button of the dialog to change the settings.
- 6. Close the *CPU Messages* dialog by clicking on the *close dialog* button (x) in the title bar or double-clicking on the dialog name in the title bar of the dialog.

Closing the dialog deactivates the CPU Messages function.

7.3.2.2 Module information

Description of the functions

The *module information* function reads diagnostic data from the module of the connected station. The diagnostic data is displayed for the specific module in a series of tabs:

- *General* tab List of hardware and firmware components with their versions and information on the status of the CPU module
- Diagnostic Buffer tab
 List of diagnostic messages
- *Memory* tab Information on the utilization of the load and work memory.
- *Time System* tab Information on the data, time, time system and time synchronization as well as on the operating hours counter of CPU modules
- Performance Data tab Lists of the organization blocks, system blocks and address ranges
- *Communication* tab Information on transmission speeds, connection resources and cycle load caused by a communication

Further tabs are displayed for CPU modules:

- Cycle Time tab Set and measured cycle times of CPU modules
- Stacks tab Information on the content of the block stack (B stack), interrupt stack (I stack) and local data stack (L stack) of CPU modules

Operator activities

- 1. Select a local subscriber in the *SINAUT subscriber list* of the open project or in *Accessible Nodes*.
- 2. Open the dialog by selecting the STEP 7 Diagnostics / Module Information menu.
- 3. Select the individual tabs with the mouse.

General tab

The *General* tab displays the operating mode of the local CPU module and the operating mode and status of the connected module if this is selected for outputs of diagnostic data. The *Status* text box displays information on the status of the connected module from the perspective of the local CPU module. The following possible statuses are distinguished:

- Status OK: Module exists, access possible
- Status *Error*: Problem, access to module not possible (parameter assignment or access error)

Information on the module name and system identification is also display and in the *Version* output box, you will see a list of hardware and firmware components of the module with their order numbers or the name and version.

This is followed by information on the rack, address and slot of the CPU module.

Diagnostic Buffer tab

The *Diagnostic Buffer* tab displays the content of the diagnostic buffer of the module with information on the message number, time of day, date and event. The entries are sorted in descending chronological order; in other words, the latest message is at the top.

For the TIM, the last 200 entries of the diagnostic buffer are displayed, for a CPU normally the last 10 diagnostic messages.

For TIMs, or diagnostic messages are displayed in plain language.

For CPUs, the system diagnostic messages are displayed as plain language and the TD7 diagnostic messages (in other words the messages created by the SINAUT user program) are displayed in hexadecimal format.

The station number (STA no.) listed with some messages in the *Details on Event* text box is the WAN network address of the relevant SINAUT network.

Note

If you have selected a CPU and want to see the plain text equivalent of TD7 diagnostic messages displayed in hexadecimal format in the *Diagnostic Buffer* tab, select the *TD7 CPU Diagnostics* function for the same CPU.

You will then see the same TD7 diagnostic messages

- in the Module Information / Diagnostic Buffer dialog in hexadecimal format and
- in the TD7 CPU Diagnostics dialog as plain text.

To change the settings and select the event types of the message display in the *Diagnostic Buffer* tab, follow the steps outlined below:

- 1. Select the *Settings* button to open the *Setting for Display Diagnostic Buffer* dialog. The default number of entries can be changed either for CPUs or TIMs.
- 2. In the *Display Events* box, select or deselect the event types for message output. The selection is displayed or hidden.

- 3. In the lower part of the dialog, select the following options if necessary:
 - Output event information in hexadecimal format
 - Update display during operating mode transition
 - Save settings for this dialog box
- 4. Confirm your settings by clicking on the *OK* button or to discard the settings, click on *Cancel*. You then return to the *Diagnostic Buffer* tab.

Memory tab

The *Memory* tab displays information on the utilization of the free and assigned load memory and work memory.

The work memory utilization of a TIM of approximately 90% is normal and adequate for the TIM to function.

Time System tab

The *Time System* tab provides information on the time system of the module in three boxes:

- The current state and time of the module, its resolution and the existence of a real-time clock
- Time-of-day synchronization (CPU only)
- Run-time meter (CPU only)

Performance Data tab

The *Performance Data* tab does not contain any diagnostic information relevant to TIM modules. For CPU modules, information is displayed on organization blocks (OB), system blocks (SFC, SFB) and address ranges.

Communication tab

The *Communication* tab displays the following information:

- Maximum and unused connection resources for
 - PG communication
 - OP communication
 - S7 basic communication
- Configured cycle load due to communication. For a TIM, this is 100%.

Information on a communication relates only to the CPU.

IP Parameter tab

The IP Parameters tab displays the most important IP parameters of an Ethernet TIM:

- 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.
- IP settings: Indicates where the module obtained the IP parameters from.

Note

With a TIM 4R-IE DNP3, only information on the first Ethernet port P1 is displayed. For an overview of the status and parameters of both Ethernet ports of the module, refer to SINAUT Diagnostics, *IP Parameters* tab.

Network Connection tab

The *Network Connection* tab for an Ethernet TIM displays the MAC address of the module and information on the status and settings of the Ethernet port:

- Link Status: Indicates whether or not a physical connection to Ethernet exists.
- Settings: Shows the setting for detecting network settings, here: "Automatic" (Autosensing)
- Mode: Indicates the transmission speed and duplexity on Ethernet.

Note

With a TIM 4R-IE DNP3, only information on the first Ethernet port P1 is displayed. For an overview of the status and parameters of both Ethernet ports of the module, refer to SINAUT Diagnostics, *IP Parameters* tab.

Statistics tab

The *Statistics* tab contains transmission statistics for the Ethernet ports. 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. This time time is displayed as module time in the tab. The statistical values can be reset to zero with the *Reset* button.

7.3.2.3 Operating mode

Description of the functions

With the *Operating mode* function, you can change the operating mode of TIM and CPU modules. Apart from the operating mode, the current keyswitch setting and the last operating mode are displayed for CPU modules.

With TIM and CPU modules, the operating mode can be changed from *Run* to *Stop* or from *Stop* to *Run*. Changing the operating mode from *Stop* to *Run* triggers a restart on the TIM module.

Operator activities

- 1. Select a subscriber in the *SINAUT subscriber list* of the open project or in *Accessible Nodes*.
- 2. Open the dialog by selecting the STEP 7 Diagnostics / Operating Mode menu.
- 3. Click on the *Stop* button to stop the module.
- Click on the *Warm Restart* button to restart the module. A TIM goes through a warm restart after approximately 10 seconds.

7.3.2.4 Setting the time

Description of the functions

The *Set Time of Day* function is used to display and set the date and time of a module. It is possible to set the module time to the PG/PC time or to set an edited time.

CPU modules have a hardware clock. TIM modules have a software clock in the operating system of the module.

Operator activities

- 1. Select a subscriber in the *SINAUT subscriber list* of the open project or in *Accessible Nodes*.
- 2. Open the dialog by selecting the STEP 7 Diagnostics / Set Time of Day menu.
- 3. To set the module time manually, click in the date or time display with the mouse, change the data and/or time using the keyboard and confirm by clicking the *Apply* button or or select the *Apply from PG/PC* option in the *Module time* field and confirm by clicking the *Apply* button.

7.3.3 SINAUT diagnostics

7.3.3.1 TIM Diagnostics

Description of the functions

The *TIM Diagnostics* function 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 on the RAM disk of the TIM

Operator activities

- 1. Select a subscriber in the *SINAUT subscriber list* of the open project or in *Accessible Nodes*.
- 2. Open the dialog by selecting the SINAUT / TIM Diagnostics menu.
- 3. Select the individual tabs with the mouse.
- 4. To display the interface-specific diagnostic data in the *Communication* and *Time Synchronization* tabs, select the name of an interface. The information on the relevant interface is displayed in the fields in the lower part of the two tabs.
 - In the Communication tab: Select an interface in the Communication drivers list box.
 - In the *Time Synchronization* tab: Select an interface in the *Communication interfaces for time synchronization* list box

Memory tab

The *Memory* tab displays current diagnostic data on the memory configuration on the TIM:

- In the *Memory configuration* field:
 - 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 adequate, a checkmark 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 DNP3 event.
 - Number of stored events
- In the *Disc configuration* field:
 - Storage space, used and free storage capacity of the flash or RAM disk.

Message buffer tab

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 contains the buffer area for data messages, divided up according to destination subscribers (destination subscriber buffer)

The *Message buffer* diagnostic function analyzes the buffer areas of the destination subscribers in which the DNP3 events are stored.

The *Total* output box provides the following information:

• Size (blocks):

Total size of the message buffer. The value indicates the total number of storable DNP3 events. 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 made in the network configuration in *NetPro* in the *Properties* dialog, *Options* tab, *Global message memory* field.

• Free (blocks):

Free area of the message buffer. The value indicates the number of free memory blocks.

- Free (%): Free area of the message buffer as a percentage
- Image blocks: Number of events stored in the message memory of the TIM.

The *Buffers* box shows the currently stored events for the various communication partners with the following information:

- from: DNP3 subscriber number of the TIM module
- *to*: Subscriber number of the DNP3 master station
- no. of messages: Number of stored events for the relevant TIM module and DNP3 master station

If a message buffer is selected on the left with the mouse in the *Buffers* field, the following detailed information is displayed in the *Buffer info* list:

- from. DNP3 subscriber number of the TIM module
- *to*: Subscriber number of the DNP3 master station
- Type:
 - = 2: Buffer for organizational messages and handshake messages
- no. of messages: Total number of stored events for the TIM module named above and DNP3 master station
- no. of uncond. messages: Number of stored messages to be sent unconditionally and spontaneously (not relevant for DNP3).

- no. of prio. messages: Number of stored messages to be sent with high priority (not relevant for DNP3).
 - *Status:* The status is a hexadecimal value that codes the buffer information following it into binary.
- *Forced image mode*: If events are not sent unsolicited, all events are processed in forced image mode
- data brake:

The sending of messages 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 (not relevant for DNP3).

- blocked: Reserved for future functions. Nothing is currently displayed.
- Overflow warning: If more than 90% of the event buffer is occupied, an overflow warning is set.
- XGA:

Reserved for future functions. Nothing is currently displayed.

• *uncond. messages:* Reserved for future functions. Nothing is currently displayed.

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.

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.

Time tab

The *Time* tab displays the data and current module time of the TIM on the left in the *Current time* area.

On the right in the *Clock status* area, information on the validity of the time, daylight saving/standard time and the changeover from daylight saving to standard time is displayed. If the "Time is valid" option is set, the time was set by one of the connected DNP3 master stations. The DNP3 protocol uses Greenwich Mean Time or UTC. There is no distinction between standard and daylight saving time at the protocol level. The "Standard time" entry is always set.

Filesystem tab

The *Filesystem* town displays all the system data blocks and files of the individual firmware components installed on the flash file system.

This data is stored on the RAM disc of the module and can be transferred to the connected programming device using the "File System" dialog.

7.3.3.2 TIM subscriber diagnostics

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 availability of the partners, on connections or connection disruptions and data communication
- *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 extern* (optional): Dial-up service and command of the connected TIM module

Not relevant for DNP3.

The colored symbols in the selection list of known subscribers indicate the availability of the individual subscriber and have the following meaning:

Symbol	Status
Ý	Subscriber is available, all connections OK
•	Subscriber is available, at least one connection is disrupted
×	Subscriber is not available

Table 7-2 Symbols indicating subscriber availability in subscriber diagnostics

Operator activities

- 1. Select a TIM module in the *SINAUT subscriber list* of the open project or in *Accessible Nodes*.
- 2. Open the dialog by selecting the SINAUT / TIM Subscriber Diagnostics menu.
- 3. Select a subscriber in the selection list of the known subscribers on the left in the dialog.
- 4. To display the information on Status or Partner, click on the relevant tab.

Status tab

The *Status* 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:
 - Availability of the known subscriber. Entries indicating problems are highlighted.
 - 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 polling
 - Status of data communication

Note

Media redundancy

With connections with redundant media, only one of the two connections is ever active. As a result, in this dialog one of the two possible connections is displayed as being not available.

• In the Special field:

Not relevant for DNP3

Partner tab

The *Partner* tab displays the following no partners with their subscriber number, name and station in the *List of partners* area:

- 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 partners*.

Not relevant for DNP3

7.3.3.3 TIM diagnostic messages

Description of the functions

With the "TIM Diagnostic Messages" function, extended diagnostic messages are activated or deactivated at selected levels for various components of the TIM firmware. The extended diagnostic messages are intended for the Siemens hotline.

The extended diagnostic messages contain detailed information on subfunctions of individual firmware components and are entered in the diagnostic buffer of the TIM. The extended diagnostic messages are displayed in hexadecimal format. The display of extended diagnostic messages can be selected for various firmware components and some functions (diagnostic areas).

Operator activities

- 1. Select a subscriber in the SINAUT subscriber list of the open project.
- 2. First open the *Module Information / Diagnostic Buffer tab* by selecting the *STEP 7 Diagnostics/ Module Information / Diagnostic Buffer tab* and click on the *Settings* button.
- 3. Make sure that the *Update display during operating mode transition* option is deselected (no check mark) at the bottom of the *Settings for Display Diagnostic Buffer* dialog and confirm with *OK*. You can leave the *Module Information* dialog open.
- 4. Change to the SINAUT diagnostics and service tool and open the *TIM Extended Diagnostics* dialog by selecting the *SINAUT / TIM Diagnostics* menu.
- 5. Select the *required function* in the field on the left of the dialog.
- 6. Then select the following in the Firmware module and diagnostics level area
 - The required firmware component in the *Module* list box and
 - The required level (area) in the Level list box.
- 7. Confirm your entries by clicking on the *Activate* button. A dialog *Loading* opens briefly and indicates that the activation information for extended diagnostics is being sent to the module by displaying a progress bar. Once the information has been sent successful, the *Loading* and *TIM Extended Diagnostics* dialogs are closed.

Any diagnostic messages are activated on the selected module and displayed in the active diagnostic buffer.

If multiple extended diagnostic messages are activated, you must confirm the activation of the message output for each individual firmware component and level with *Activate*.

- Change back to the *Module Information / Diagnostic Buffer tab* that is still open and click on *Update*, if necessary, several times. Extended diagnostic messages are displayed in hexadecimal code.
 If necessary, save the diagnostic messages as a text file as described for the *Module Information* function.
- 9. To disable the output of extended diagnostic messages for an individual level, select the *deactivate selected level* option in the *TIM Extended Diagnostics* dialog and close the dialog with the *Activate* button.
- 10. To disable the output of all extended diagnostic messages for all firmware components and all levels of the selected subscriber, select the *deactivate all extended levels* option in the *TIM Extended Diagnostics* dialog and close the dialog with the *Activate* button.

7.3.3.4 TIM Message Monitor

Description of the functions

The *TIM Message Monitor* function is used to specify the settings for message monitoring of a selected TIM and starts the monitoring.

In TIM message monitoring, the messages received and sent by the TIM are recorded. As soon as the monitoring function is activated, copies of every message are stored in a buffer created specifically for this function. The messages are read out of the buffer of the TIM and saved in a monitoring file.

To start to message monitoring, you must set the following:

- · the output file in which the recorded messages are saved and
- the stop action for the monitoring, either
 - manual for
 - continuous sampling (reading out the buffer at 5 second intervals) or
 - read data once after stop of monitor,
 - fill buffer only once or
 - time-limited reading by specifying the elapsed time.

Reading the data once after stopping monitoring is set if the messages are to be monitored following any intervention, for example turning off the TIM.

If the message buffer of the TIM is read once without any time limitation, the entire saved SINAUT data traffic of the relevant TIM is read out. With the fixed buffer size of the TIM, this involves 400 messages.

Monitoring is always started manually in the *TIM Message Monitor* dialog. When monitoring is started, the *TIM Message Monitor* progress bar is displayed and the group error LED of the TIM flashes while monitoring is active.

If the *manual* stop option is selected, monitoring is also stopped in the *TIM Message Monitor* progress bar.

Operator activities

- 1. Select a subscriber in the *SINAUT subscriber list* of the open project.
- 2. Open the *TIM Message Monitor* dialog by selecting the *SINAUT / TIM Message Monitor* menu.
- 3. In the *Output file* box, enter the name of a file of the type *.*7dt*, in which your recorded TIM messages will be saved or browse for the directory of the 7dt file in the file tree using the square button.
- 4. In the *TIM Message Monitor* dialog, in the *Monitor stop action* area, select one of the three options for starting message monitoring. If you select manual, you must decide whether the recorded messages are read by continuous sampling or after stopping monitoring.
- 5. Start monitoring with the *Start Monitor* button. The *TIM Message Monitor* progress dialog opens and displays information on the acquisition mode and the progress of the message recording over time indicating the elapsed and remaining time. The amount of data read and data remaining is also displayed.
- 6. Click on the *End Monitor* button in the *TIM Message Monitor* dialog to stop monitoring manually.
- 7. In the next dialog, decide whether you want to read the monitored messages immediately (the *TIM Message protocol* window opens) or whether you want to read the monitored messages at a later point in time (you return to the SINAUT subscriber list).

Note

You can open and evaluate the TIM message protocol later using the TIM message protocol (Page 265) function of the diagnostics and service tool.

7.3.3.5 TD7onTIM diagnostics

Description of the functions

Note

The *TD7onTIM Diagnostics* function is available only for TD7onTIM-compliant TIM modules on which parameters were set for the *TD7onTIM* software (for example TIM 3V-IE DNP3).

TD7onTIM Diagnostics provides information on the status of the data transmission of the *TD7onTIM* software of the TIM module selected in the SINAUT subscriber list.

In keeping with the parameter assignment of *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 area 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 area 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* area.

Operator activities

- 1. Select a TD7onTIM-compliant module in the SINAUT subscriber list of the open project.
- Open the dialog by selecting the SINAUT / TD7onTIM Diagnostics menu. The dialog opens.
- 3. Expand the directory tree in the TD7onTIM Configuration area.
- 4. Select a SINAUT object or a send or receive channel in the opened directory tree. The relevant parameters are displayed in the *Properties* area.

7.3.3.6 SDB Viewer

Description of the functions

The *SDB Viewer* function lists the content of the system data blocks (SDBs) of a previously selected CPU or TIM module.

For TIM modules, the following SDB classes can be selected for display:

- SDB0
- WAN data
- Subscriber data
- Connection data
- LAN connections
- TD7onTIM data (only TIM modules on which parameters have been set for TD7onTIM)
- Ethernet data (only TIM modules that are connected to Ethernet)
- Routing data
- Connection data (PBC)

Apart from SDB0, the representation of the SDB data for the TIM modules is in plain text (as default), you can, however, change to hexadecimal display. The CPU DBs are always displayed in hexadecimal and the corresponding button cannot be deactivated here.

When accessing the subscriber using the *SINAUT* subscriber list, you have the option of displaying the system data blocks from the module (*online*) or from the project (*offline*). There may be differences between online and offline access.

The content of all system data blocks can be saved as a text file.

Operator activities

- 1. Select a subscriber in the *SINAUT subscriber list* of the open project or in *Accessible Nodes*.
- 2. Open the SDB Viewer dialog by selecting the SINAUT / SDB Viewer menu.
- 3. To access data online on the connected module (instead of the project data), deselect the *offline* option on the right to the dialog. The data display is updated immediately with the current module data.
- 4. Select the required system block class (SDB0, WAN data etc.) in the *System data blocks* list box.
- 5. Click on the Save button to save the content of all system data blocks as a text file.

7.3.4 Message protocol diagnostics

Introduction

To read out messages, SINAUT DNP3 provides you with the option of recording and archiving transferred messages on the TIM as a storable TIM message log.

the TIM message log (protocol) is used to record messages received and sent by a TIM module.

The message protocols are displayed in a message list in the form of a table.

Note

The functions of *message protocol diagnostics* are used only for the analysis of already stored message protocols.

TIM message logging is activated as follows:

• In the "TIM Message Monitor" function of the SINAUT diagnostics and service tool

7.3.4.1 TIM message protocol

Description of the functions

The recording of the TIM messages is started with the *TIM Message Monitor* of the SINAUT diagnostics and service tool. The messages received and sent by the routing server of the TIM are recorded.

The *TIM message protocol* function is used only to open a TIM message protocol for subsequent evaluation.

Operator activities

- 1. Open the TIM message protocol by selecting the *Project / TIM Message Protocol* menu. The *Open* dialog is displayed.
- 2. In the file tree, select the directory and the *7DT* file of the required TIM message protocol and confirm with the *Open* button. The TIM message protocol is opened in a separate window.

Note

You activate and deactivate recording of the TIM message protocol and specify the name and storage location of the message protocol file using the *TIM Message Monitor* function of the diagnostics and service tool.

7.3.4.2 Diagnostics of the TIM message protocol

Structure of the TIM message protocol

The upper part of the TIM message protocol dialog summarizes the following information:

- Total number of messages,
- Number of messages shown,
- Source and path of the protocol file

Below this, there is the list of TIM messages, that has nine columns as default and provides the following information on every message:

- A symbol for incoming and outgoing messages
- Message number
- Source: number of the open message protocols in ascending order
- msec: (No entry for DNP3)
- Block: Number of the message block
- Subscriber number of message source and destination
- Object number (no entry for DNP3)
- Index no.: (no entry for DNP3
-)- Organizational information (no entry for DNP3
-)- User data

The net data is output in hexadecimal code.

ource	s: 1-0	C:\Tim4.7	7dt	
No.	source	block	Subscriber (source / destinati	on) Net Data
⊳ 1	1	1	130 -> 120	96 0c [063] Hex
2	1	2	120 -> 130	8c 57 d0 c1 01 3c 02 06 3c 03 06 3c 04 06 3c 01 06 95 6c [06]
3 3	1	3	120 -> 130	08 26 (063) Hex
• 4	1	4	130 -> 120	3c ae c5 c1 81 00 00 0a 02 00 00 21 01 01 01 01 01 01 5e 3b 01
] 5	1	5	120 -> 130	89 a6 d1 c2 03 0c 01 28 01 00 01 00 03 01 64 00 00 0e 4c 64
•6	1	6	130 -> 120	74 d7 c6 c2 81 00 00 0c 01 28 01 00 01 00 03 01 64 00 14 ff 00 i
7	1	7	120 -> 130	89 a6 d2 c3 04 0c 01 28 01 00 01 00 03 01 64 00 00 00 52 4c 64
8	1	8	130 -> 120	74 d7 c7 c3 81 00 00 0c 01 28 01 00 01 00 03 01 64 00 80 dc 00
9 9	1	9	120 -> 130	8c 57 d3 c4 01 3c 02 06 3c 03 06 3c 04 06 0a 00 06 21 d3 (06:
10	1	10	130 -> 120	a3 44 c8 c4 81 00 00 0a 02 00 00 21 01 01 01 01 01 01 08 60 01
11	1	11	120 -> 130	55 3c d4 c5 03 29 02 28 01 00 01 00 00 00 c7 61 [063] Hex

Image 7-3 The TIM Message Protocol dialog

Functions of the TIM message protocol

Further functions are available with the right mouse button in a context menu. These can be grouped as follows:

- Presentation of the messages
- Details (of the message content)

- Statistics
- Filter functions
- Exporting protocol files

Working with the message list

After opening the *TIM message protocol* with the *Project / TIM Message Protocol* menu, the following options are available in the open dialog:

- 1. If you click on the header of any column, the message list will be sorted according to this criterion instead of the consecutive number.
- 2. Right-click (cursor within the protocol window) to activate further functions. A context menu opens with other functions.
- 3. Select the required function with the left mouse button in the context menu. Each function opens a dialog.

Presentation of the messages

Add new columns

With this function, you can add extra columns in the TIM message list with further message information.

After starting the *Add New Columns* function, the *Add Column* dialog opens in which you can select the properties with the mouse. The selected message properties are displayed as additional columns in the message list.

Delete additional columns

This function deletes all previously added columns. No further dialog is displayed.

Details

The *Details* function provides you with detailed information on the content of the individual messages.

To open the *Details* dialog, you must first select a message. As an alternative to using the right mouse button, the *Details* dialog can also be opened by double-clicking on a message in the list.

In the upper part of the *Details* dialog, you can see the path of the protocol file and five tabs containing further information.

To page to other messages within the *Details* dialog, click on the << or >> button. In each tab, the dialog view switches to the previous or next message.

- The *Message Header* tab displays a table containing three columns with the following data from the message header of the selected message:
 - Variable name or short name of the message
 - Value of the individual variables
 - Variable name

C:\Tim4.7	'dt	
essage Header 🛛 N	let Data TIM	Routing Infos Hex Source/Destination/Time stamp
Variable:	Value:	Comment:
🙂 Length	11	Message length
🙂 мс	0	Message counter (0-7)
🙂 cc	0	Control code
🙂 FS	0	Function selection
🙂 AE	0	Address extension
🙂 d B	0	Direction bit
🙂 sst	0	Message from substation
🙂 нр	0	High Priority
🙂 AHV	0	Standby flag for archive operation
Ξx	0	Message will not be stored
🙂 Pack	0	Pack parameter for ST1 protocol with AE = 1
🙂 S7	0	S7 message / ST7 message
<u>.</u> мт	0	Message type
🖲 D	0	Data object disabled
<u>.</u> т	0	Message with time stamp
<u>.</u> Р	0	Permanent transmission
🖲 ບ	0	Unconditional spontaneous transmission
Ā.c	n	Conditional apontaneous transmission

Image 7-4 Details dialog, Message Header tab

 The Net Data tab shows the net data of the message. With the message type 0 and 1 (organizational messages), the data is displayed as plain text.

with message type 2 and 3 (data messages), the values are displayed.

Note that when analog and counted values are selected, the data in this tab is displayed as raw values in STEP 7 format and not in DNP3 format.

Details - Message No.: 5	<u> </u>
Path: C:\Tim4.7dt	
Message Header Net Data TIM Routing Infos Hex Source/Destination/Time stamp	1
Display mode: ST7/ST1 message	
1: 10001001 2: 1010010 3: 11010001 4: 1100010 5: 0000001 6: 0000100 7: 00000001 8: 00101000 9: 00000001 10: 00000000 11: 00000000 13: 0000001 14: 00000001 15: 01100100 16: 00000000 17: 00000000	
Close Update Print Save < >>	Help

Image 7-5 Details dialog, Net Data tab

- The TIM Routing Infos tab shows the following:
 - At the top in the *Message* area:
 - the internal task ID
 - the complete message length [bytes]
 - Below in the Address infos area:
 - the device ID as a number and in plain text (for example MPI bus)
 - the CN ID
 - the station address

Details - Message No.: 4	<u> </u>
Path: C:\Tim4.7dt	
Message Header Net Data TIM Routing Infos Hex Source/Destination/Time stamp	
Variable: Value: Comment:	
Contraction And And And And And And And And And An	
Length 148	
CN-ID 10 Connection identifier	
Q STA 2	
Q Device-ID 5 WAN interface 2	
000 00 82 59 04 00 05 0a 02 01 00 b8 3fY? 00c 8d 02 00 94	
Close Update Print Save << >>	Help

Image 7-6 Details dialog, TIM Routing Infos tab

- The Hex tab shows the following in hexadecimal format:
 - In the complete buffer box, the content of the entire message

The 1st block of numbers in each line is the byte number and data begins with the second block of numbers. Before the net data, there are other blocks of numbers from the message header, for example the message length etc.

- In the net data box, only the net data of the message

The 1st block of numbers in each line is the byte number and the net data begins with the second block of numbers.

De	tails -	Mes	sag	e No	.: 15	j														_ 🗆 🗙
Pa	ath:	D	:\z_9	SINA	UT :	ST7	Diag	nose	und	Ser	vice	tool\	Tim	Msg_0	2.06.	04.70	lt			
	Messag	e Hea	ader	Ne	et Da	ita	ТІМ	Rou	ting	Infos	; H	lex	s	ource	/Dest	inatio	on/Ti	me sta	mp	
	comple																			
	000 00c 018	7f		00	00	04	12 06 01													*
	net dat	a:																		
	000	00	04	00	03	00	01							•••	•••••					Ă
	Close	•		Up	odate	e		Pŗi	nt			<u>S</u> av	e		<<	>	>			Help

Image 7-7 Details dialog, Hex tab

- The Source/Destination/Time stamp tab provides information in its three boxes on the source, and destination and time stamp of the message. The fields provide the following information:
 - Source: Information on the subscriber number, name, type name, station name, object number and index number
 - *Destination*: Information on the subscriber number, name, type name, station name and object number
 - *Time stamp*: Information on the date, time, status, status info.

Details - Message No.: 1	X
Path: C:\Tim4.7dt	
Message Header Net Data TIM Routing Infos	Hex Source/Destination/Time stamp
Source	Destination
Subscriber No.: 130	Subscriber No.: 120
Name:	Name:
Type name:	Type name:
Station name:	Station name:
Object No.: 0	Object No.: 0
Index No.: 0	
Time stamp	
Date:	
Time:	ms
Time status / Status info:	
Close Update Print	Save << >> Help

Image 7-8 Details dialog, Source/Destination/Time stamp tab

Statistics

The *Statistics* function provides a statistical evaluation of the entire message protocol in terms of numbers, types, and throughput of messages of the subscribers involved are sorted according to

- All messages
- Data messages
- Organizational messages

With the aid of the statistics, you can, for example recognize particular concentrations of certain message types with individual subscribers allowing you to decide whether normal or acceptable message traffic is possible in the particular installation.

The *Statistics* dialog displays the statistical data of the TIM message protocol in three tabs. In each tab, the sampling period of message recalling is displayed at the top. The three tabs of the dialog list the messages as tables sorted according to the following:

- The *Counters* tab provides information on the total number of messages and the number of different sent and received message types.
- The *Message flow* tab provides information on the amount of message traffic per minute. It shows the total number of messages and the number of different sent and received message types per minute.
- The *Subscriber* tab displays a table with the number of different message types per subscriber. With the list box at the top right, you can sort the messages according to subscriber number or message type.

With message types, only the following are relevant:

- Column C (requested organizational and data messages)

Data messages are included in the organizational messages with DNP3.

- Column D (sent organizational and data messages)

Data messages are included in the organizational messages with DNP3.

Statistics	<u> </u>
Path: C:\Tim4.7dt	
Counters Message flow Subscriber	
Sampling period: 00:00:42 0 ms C = Spontaneous org messages sent	•
Subscriber No. Total C D	
56797 44 0 0 0 44 0 0 0 0	
Signature 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
<u>Close</u> <u>U</u> pdate P <u>rint</u> <u>S</u> ave	Help

Image 7-9

Statistics dialog, Subscriber tab

Filter functions

Delete list

If you select the *Delete list* function with the mouse, the TIM messages displayed in the list view are *deleted*. This deletion can be reversed. The messages can be inserted in the list view again using the to functions *Selection* and *Show all messages*.

Selection

The *Selection* function is used to select certain message types to be displayed again after they were deleted from the list view. Messages can be selected, for example, according to individual subscribers, direction, message header entries etc. This function allows you to reduce the number of messages to make the list view clearer.

Show all messages

The *Show all messages* function insert or messages of the TIM message protocol in the list view that were previously deleted completely with the *Delete list* function or selectively with the *Selection* function.

Exporting protocol files

Save current list

The *Save current list* function is used to save the currently open list with all data of the current list view in a CSV file. The CSV file can then be read in MS EXCEL.

If you activate the function, an input box opens in which you have the option of entering a comment on the protocol you are saving. This comment is then included in the top rows of the CS the saved file. You then specify the directory and file name of the CSV file.

Export complete list

The *Export complete list* function is used to save the entire country open list with *all* available data in an MS EXCEL-compatible CSV file.

If you activate the *Export complete list* function, an input box opens in which you have the option of entering a comment on the protocol you are saving. This comment is then included in the top rows of the CS the saved file. You then specify the directory and file name of the CSV file.

Note

You can open the CSV file created with the *Save current list* or *Export current list* functions in MS EXCEL by selecting the *File / Open...* menu, so that the data from the individual columns of the list view of the TIM message protocol are shown in separate columns in EXCEL. If you open the CSV file by double-clicking in the Explorer, the data is shown with separators but nevertheless in one single column.

7.3.5 Service functions

7.3.5.1 Download SDB

Description of the functions

The *Download SDB* function downloads the system data blocks of a TIM module from the program directory of the SIMATIC Manager to the module. This is the same procedure as the *Download Module* function in the SIMATIC Manager.

To activate newly downloaded SDBs on a TIM module, the TIM must be restarted.

Note

When a TIM module is restarted after downloading new SDBs, the connection between the TIM and other SINAUT partners (SINAUT connections) is terminated. This leads to error messages on the partners of the TIM module.

When downloading SDBs to TIM modules, you should therefore note the following points:

- Before you transfer the SDBs, you should give the TIM the opportunity of transferring any messages stored on it.
- After restarting the TIM, the SINAUT connections are established again automatically, the connection between the PG and the TIM must, however, be activated by the user on the PG if it is required.

For more detailed information, refer to section Configuration in STEP 7 (Page 77).

Operator activities

- 1. Select a TIM module in the SINAUT subscriber list of the open project.
- Start the function by selecting the SINAUT / Download SDB menu. The Open dialog is displayed.
 Follow the instructions in the subsequent dialogs. When personally you can cancel the

Follow the instructions in the subsequent dialogs. When necessary, you can cancel the procedure in these dialogs.

- 3. After downloading SDBs, the *Open* message dialog asks you when you want to start the module again. To activate the downloaded SDBs, you must restart the module.
- 4. Click on *Yes* to restart module. A message is displayed indicating that the SDBs were successfully loaded.
- 5. Confirm this message by clicking on OK.

7.3.5.2 Loading new firmware

Firmware update

The "Firmware Update" function allows you to load a new firmware version of the firmware driver package on a TIM module.

Note

You can read out the version of the operating system of a TIM using the "Module Information" function > "General" tab.

To use this function, the firmware must have been installed on the computer using the setup. If the firmware is not installed on the PG or is incomplete, a message is displayed.

By clicking the "Update details" button in the Firmware Update dialog, you open the "Update details" dialog. This displays the firmware version installed on the TIM and the version on your computer.

After loading, the TIM is automatically reset to activate the new firmware.

The configuration data of the TIM is not affected by loading firmware.

Note

Loading the firmware on the TIM can take several minutes.

Loading the firmware driver package

You can load a new firmware driver package on the TIM module as follows:

Via the MPI interface of the CPU

On your PG, set the S7-ONLINE interface to "MPI".

• Via the Ethernet interface of the TIM

On your PG, set the S7-ONLINE interface to "Ethernet...TCPIP.Auto".

Follow these steps:

- 1. Connect the PG to the device of the station.
- 2. In the project window of the SINAUT diagnostics and service tool. select the relevant TIM.
- 3. Select the "SINAUT" > "Firmware update" menu.

After confirming the dialog the loading of the driver package starts on the TIM. This may take several minutes. During this time do not turn off the power supply and do not unplug the MPI or Ethernet cable.

After loading the TIM restarts.

Operator activities

Note

Make sure that you select the correct TIM module in your project. The station and module name must match and the configured module must be of the same type as the module to which you are downloading.

If this is not the case, a dialog will inform you of this at regular intervals during the update. The display of this message interrupts the update until the dialog is acknowledged by clicking on *OK*.

- 1. Select the relevant TIM in the SINAUT subscriber list of the open project.
- 2. Start the function by selecting the *SINAUT / Firmware Update* menu. The *Firmware Update* dialog opens.
- 3. Click on the *Update details* button if you require a detailed information on the firmware update. The *Update details* dialog opens.
- 4. Click on the *Update* button in the *Firmware Update* dialog to start the firmware update. The following dialog *Loading* informs you of the current progress of the update.
- 5. On completion of the firmware update, a dialog appears with a message to this effect. Confirm the message with *OK*.

Update details dialog

The *Update details* dialog that can be opened from the *Firmware Update* dialog displays detailed information on the firmware update. The function and version of each firmware component on the TIM module and on the PG is shown and you can see whether the relevant component is copied, replaced, ignored, or deleted during the firmware update.

The various actions have the following significance:

- copy: The file is copied from the PG to the TIM module.
- replace: The file on the TIM module is replaced by the file on the PG.

- **ignore**: The file is not affected by the firmware update.
- **delete**: There is no newer version for the file. The existing file is no longer required and is deleted during the firmware update.

driver	function	action	date of file (PG)	date of file (TIM)	
🗅 diagnose.exe	diagnostics server	replace	21/11/03 07.21.14	15/10/04 11.46.58	
🗅 install.exe	install task	replace	04/11/03 03.25.22	15/10/04 13.14.58	
🗅 routing.exe	routing server	replace	20/11/03 14.38.40	08/10/04 14.11.58	
🗅 uhrzeit.exe	time server	replace	24/10/03 08.52.22	24/10/03 10.52.22	
🗅 wandrv00.exe	WAN dedicated line	replace	20/11/03 11.22.16	21/10/04 15.10.22	
🗅 wandrv02.exe	WAN dial-up network	replace	12/11/03 23.31.06	15/10/04 13.14.42	
📄 wandrv04.exe	WAN TIM bus	ignore			
📄 wandrv03.exe	WAN multi-master network	ignore	19/11/03 06.52.08		
🗋 wandrv01.exe	WAN spontaneous network	ignore			
🗋 log.dat		ignore			
🗋 sdbsrv.exe	SDB server	ignore			

Image 7-10 Update details dialog of the Firmware Update function

7.3.5.3 Repair

Description of the functions

The *Repair* function allows you to restore TIM modules with a defective flash disk. The *Firmware Update* function is available for loading firmware on a functioning TIM module.

The Repair function runs a completely new installation of the firmware on a TIM module.

Note

The Repair function should not be used without consulting the offline.

Note

After downloading the firmware, the module is automatically reset to activate the new firmware.

Requirements

- To use this function, the firmware must have been installed on the computer using the setup. If the firmware is not installed on the PG or is incomplete, a message is displayed.
- By clicking the *Installation details* button, you open the *Update details* dialog that displays the firmware version installed on the TIM module and the version on your computer.
- You can read out the required version of the operating system of a TIM using the *Module Information* function / *General* tab.

Steps in repairing

Repairing involves the following steps:

- The flash disk of the TIM module is formatted. After formatting, the TIM module runs a reset.
- This is followed by a default startup.
- Once the wait time for the default startup has elapsed, the firmware version installed on the computer is downloaded to the TIM.
- Following this, the system data blocks are transferred to the TIM module.
- The module is then reset and resumes operation with its full functionality.

Note

You can download the new firmware via Ethernet or the MPI interface.

If you download the firmware using the MPI interface (TIM as a CP in the S7-300), then during the new installation of the firmware, the TIM module uses MPI address 3. Make sure that this address is free on the MPI bus to which the TIM module is connected.

Operator activities

Note

Make sure that you select the correct TIM module in your project. The station and module name must match and the configured module must be of the same type as the module to which you are downloading.

If this is not the case, a dialog will inform you of this at regular intervals during the update. The display of this message interrupts the update until the dialog is acknowledged by clicking on *OK*.

- 1. Make sure that MPI address 3 is either free or is occupied by the module on which you want to install.
- 2. Select the TIM you want to repair in the SINAUT subscriber list of the open project.
- 3. Start the function by selecting the *SINAUT / Repair* menu and then *Complete reinstallation* in the context menu. The *Firmware Install* dialog opens. The version installed on the PG is displayed. If the firmware on the PG is incomplete, a message to this effect is also displayed.

- 4. Click on the *Update details* button if you require a detailed information on the firmware update. The *Installation details* dialog opens.
- 5. Click on the *Start Installation* button in the *Firmware Install* dialog to start the repair. The following dialog *Download* informs you of the current progress of the procedure.
- 6. On completion of the repair, a dialog opens with a message to this effect. Confirm the message with *OK*.

Installation details dialog

The *Installation details* dialog that can be opened from the *Firmware Install* dialog displays detailed information on the repair. For each firmware component, the function and version on the TIM module and on the PG are shown and you can also see whether the component will be copied, replaced, ignored or deleted during the repair.

The various actions have the following significance:

- copy: The file is copied from the PG to the TIM module.
- replace: The file on the TIM module is replaced by the file on the PG.
- **ignore**: The file is not affected by the repair.
- **delete**: There is no newer version for the file. The existing file is no longer required and is deleted during the repair.

7.3.6 Messages in the diagnostic buffer of the TIM

7.3.6.1 Introduction

Introduction

In much the same way as on and S7 CPU, a diagnostic buffer is also maintained on the TIM. The TIM stores its specific diagnostic messages in this buffer. The diagnostic messages of the TIM module are read out in the same way as those of a CPU.

Note

If there is no text file with the diagnostic texts of the TIM events on the PG with which the diagnostic buffer is read out, the events are displayed in hexadecimal format.

7.3.6.2 Diagnostic messages of the TIM

Classification of TIM messages

The TIM uses a reserved area within the event class F, namely Fx60, known as the event ID. All TIM diagnostics messages start with Fx60 in the hexadecimal representation, where x a digit is the placeholder for an identifier that allows a global classification of the message:

ID x	Resulting event ID	Classification
2	F260	Event message, exiting state
3	F360	Event message, entering state
4	F460	Event message, internal error, exiting state
5	F560	Event message, internal error, entering state
8	F860	Event message, external error, exiting state
9	F960	Event message, external error, entering state

Table 7-3 Global classification of the TIM diagnostic messages

The event ID Fx60 is followed by the actual message, the detailed event. This occupies the numeric range from 0000h to 0FFFh. Depending on the message, there may be additional information under *Additional info 1/2/3* or *Additional info 4/5*.

The diagnostic messages of the TIM in hexadecimal and plain text format

The following table lists all the TIM diagnostic messages in ascending order of the detailed event in hexadecimal format.

To complete the picture, the corresponding event ID is also listed. The event ID is used only to classify the message and has no relevance for the order.

Event ID (hex)	Detailed event (hex)	Meaning
General me	ssages	
F560	0001	Entering state: Heap memory overflow.
F460		Exiting state: Heap memory overflow eliminated.
Init task me	ssages	
F360	0060	DNP3 installation started.
F560	0061	Error creating the message queue of the INIT task.
F360	0062	Archive was created.
F560	0063	Error installing the DNA interrupt service routine.
F560	0064	Error installing the interrupt service routine for the external interface.
F560	0065	Error installing the interrupt service routine for the internal interface.
F560	0066	Error installing the TIMER interrupt service routine.
F560	0067	Structure of the interface administration could not be entered in the catalog.

Table 7-4Diagnostic messages of the TIM

Event ID (hex)	Detailed event (hex)	Meaning
F560	0068	Dongle flag not found in catalog.
F560	0069	EXE loader not found in catalog.
F360	006A	Internal / external WAN interface: Driver not released.
F560	006B	Internal / external WAN interface: Error sending the load job for a driver.
F560	006C	Internal / external WAN interface: Error loading the basic task of a driver.
F560	006D	Internal / external WAN interface: Error creating the basic task of a driver.
F560	006E	Internal / external WAN interface: Error receiving the task ID of a driver.
F560	006F	Internal / external WAN interface: Error starting the basic task of a driver.
F560	0070	WAN SDB could not be opened.
F560	0071	WAN SDB could not be found.
F560	0072	Error sending the load job for the clock driver.
F560	0073	Error loading the basic task of the clock driver.
F560	0074	Error creating the basic task of the clock driver.
F560	0075	Error receiving the task ID of the clock driver.
F560	0076	Error starting the basic task of the clock driver.
F560	0077	WAN SDB does not start with the <i>TIM</i> parameter block.
F560	0078	Not enough memory available.
F560	0079	Error creating the global message memory.
F560	007A	Error sending the load job for the routing program.
F560	007B	Error loading the basic task of the routing program.
F560	007C	Error creating the basic task of the routing program.
F560	007D	Error receiving the task ID of the routing program.
F560	007E	Error creating the main task of the routing program.
F560	007F	Routing tables were not created within the specified time.
F560	0080	WAN driver was not installed within the specified time.
F560	0081	Unknown parameter block in WAN SDB.
F360	0082	Startup of module completed.
F560	0083	Flag group unknown.
F360	0084	RAM drive was created.
F560	0085	Error creating RAM drive.
F560	0086	Error in memory analysis in HEAP.
F560	0087	Error installing the clock driver. No message received at end of installation.
F360	0088	Message of the message and HEAP memory initialized on the TIM.
F360	0089	Routing SDB could not be found.
F560	008A	Routing SDB could not be opened.
F560	008B	Routing SDB starts with incorrect subnet block ID.
F560	008C	No memory available for routing function.
F560	008D	Incorrect block ID detected in routing SDB.
F560	008E	Error sending a job to the LAN task.
F560	008F	Installation of the routing function was aborted.

Detailed event (hex)	Meaning
0090	DNP3 installation started.
0091	Wrong TIM firmware loaded.
0092	Installation error in the Start manager
0100	Module startup: Installation error
ges	
0101	Installation of the AMPLUS-L emulation aborted.
0103	LAN communication: Error sending a message.
0104	LAN communication: Error receiving a message or ID unknown.
0105	LAN communication: Unknown job.
0106	LAN communication: Connection could not be entered in routing table.
0107	LAN communication: Connection could not be deleted in routing table.
0108	LAN communication: Error in a connection SDB.
0109	LAN communication: No resources available for connection.
010A	LAN communication: PBC connection could not be established. Reference number unknown.
010B	LAN communication: PBC connection could not be established. Reference number unknown.
010C	Entering state: LAN communication: Connection down.
	Exiting state: LAN communication: Connection OK.
010D	Entering state: LAN communication: Threat of send queue overflow for a connection.
	Exiting state: LAN communication: Threatening send queue overflow for a connection elimi- nated.
010E	Entering state: LAN communication: Send queue overflow for a connection.
	Exiting state: LAN communication: Send queue overflow for a connection eliminated.
010F	Entering state: Disruption of MPI/party line interface (SPC/2) detected.
	Exiting state: Disruption of MPI/party line interface (SPC/2) eliminated.
0110	LAN communication: Error reading the LAN SDB.
0111	LAN communication: Error occurred during PBC send.
0112	LAN communication: Error in SDB0 – bad MPI parameter.
0113	LAN communication: A negative acknowledgment was sent.
	Byte 6 of the message codes the error class (ERRCLS) and byte 7 codes the error code (ERRCOD). For the meaning of ERRCLS and ERRCOD, see section Meaning of ERRCLS and ERRCOD (Page 296).
0114	No Ethernet SDB.
0115	Ethernet SDB could not be opened.
0116	Ethernet SDB with bad block ID received.
0117	Error creating a socket.
0118	Error linking a socket.
0119	Invalid socket.
011A	Error listening on a socket.
011B	Ethernet port: RFC1006 has received a packet whose length exceeds the maximum.
011C	Bad RFC1006 PDU header.
011D	Undefined PDU received.
	event (hex) 0090 0091 0092 0100 0101 0103 0104 0105 0104 0105 0106 0107 0108 0109 0108 0109 0100 0100 0100 0100 0100 0100 0100 0100 0100 0100 0100 0100 0100 0100 0100 0100 0100 0100 0110 0111 0112 0113 0114 0115 0116 0117 0118 01118 01110

Event ID (hex)	Detailed event (box)	Meaning
F560	(hex) 011E	Bad TCP/IP packet.
F560	011E	Error setting a socket.
F560	0120	Error in ACCEPT socket.
F560	0120	TCP/IP connection termination by partner.
F560	0121	TCP/IP reception error.
F560	0122	TCP/IP send error.
F560	0123	TCP/IP connection number invalid.
F560	0124	Error receiving a CR-PDU.
F560	0125	Illegal access over TCP/IP.
F560	0120	Invalid PDU length.
F560	0127	KEEPALIVE expired.
F560	0128	
	0129	Entering state: Connection information: Ethernet port problem.
F460		Exiting state: Connection information: Ethernet port OK.
F560	012A	Error in socket CONNECT job.
F560	012B	Error receiving a CC-PDU.
F560	012C	Unknown error code.
F560	012D	Maximum number of S7 connections exceeded.
WAN mess		
F560	0300	Internal / external WAN interface: Installation of the WAN driver was aborted.
F360	0301	Internal / external WAN interface: WAN driver is installed.
F360	0302	Internal / external WAN interface: Connection to a subscriber established (incoming call; sub- scriber number identified).
F560	0303	Bad organizational message from routing task.
F360	0304	Entering state: Internal / external WAN interface: Send buffer changed over to image.
F260		Exiting state: Internal / external WAN interface: Send buffer changed back from image.
F360	0305	Entering state: Internal / external WAN interface: Send buffer overflow occurred.
F260		Exiting state: Internal / external WAN interface: Send buffer overflow eliminated.
F960	0306	Bad message: max. number of destination subscribers exceeded.
F960	0307	Bad message: Unknown source subscriber number.
F960	0308	Bad message: S7 PDU not with AE ID = 2.
F960	0309	Entering state: Internal / external WAN interface: CTS disturbance occurred on modem.
F860		Exiting state: Internal / external WAN interface: CTS disturbance eliminated on modem.
F560	030A	Entering state: Internal / external WAN interface: USART error occurred.
F460		Exiting state: Internal / external WAN interface: USART error eliminated.
F360	030B	Entering state: Subscriber failed.
F260		Exiting state: Subscriber OK.
F360	030C	Entering state: Internal / external WAN interface: WAN driver disabled.
F260		Exiting state: Internal / external WAN interface: WAN driver enabled.
F360	030D	Entering state: Internal / external WAN interface: Subscriber call disabled.
F260		Exiting state: Internal / external WAN interface: Subscriber call enabled.
F360	030E	Entering state: Internal / external WAN interface: Subscriber call in subcycle.

Diagnostics and upkeep

Event ID (hex)	Detailed event (hex)	Meaning
F260		Exiting state: Internal / external WAN interface: Subscriber call in main cycle.
F360	030F	Entering state: Internal / external WAN interface: Permanent call to a subscriber enabled.
F260		Exiting state: Internal / external WAN interface: Permanent call to a subscriber ended.
F360	0310	Entering state: Internal / external WAN interface: Lack of resources on a subscriber.
F260		Exiting state: Internal / external WAN interface: Lack of resources on a subscriber eliminated.
F360	0311	Entering state: Internal / external WAN interface: Alternative path changeover on.
F260		Exiting state: Internal / external WAN interface: Alternative path changeover off.
F560	0312	Internal / external WAN interface: No message memory available for new image element.
F560	0313	Internal / external WAN interface: Image element too large for image memory.
F560	0314	Internal / external WAN interface: Set number of subscribers exceeded in image.
F560	0316	Internal / external WAN interface: 'List of Active Stations' (LAS) not available.
F560	0317	Internal / external WAN interface: Error receiving a message.
F560	0318	Internal / external WAN interface: Error enabling message memory.
F560	0319	Entering state: Internal / external WAN interface: Communication with AMPLUS-L task dis- rupted.
F460		Exiting state: Internal / external WAN interface: Communication with AMPLUS-L task OK.
F560	031A	Entering state: Internal / external WAN interface: Communication with clock driver disrupted.
F460		Exiting state: Internal / external WAN interface: Communication with clock driver OK.
F560	031B	Entering state: Internal / external WAN interface: Communication with routing task disrupted.
F460		Exiting state: Internal / external WAN interface: Communication with routing task OK.
F560	031C	Internal / external WAN interface: Modem command invalid.
F560	031D	Internal / external WAN interface: Invalid dialing string or bad call number transferred to mo- dem when calling a subscriber.
F960	031E	Internal / external WAN interface: Incorrect handshake PDU received from a subscriber.
F360	031F	Internal / external WAN interface: Own telephone connection occupied.
F960	0320	Internal / external WAN interface: Modem not replying.
F960	0321	Internal / external WAN interface: Access to called subscriber not permitted.
F960	0322	Internal / external WAN interface: No answer tone received from modem of called subscriber.
F960	0323	Internal / external WAN interface: Called subscriber is not operational.
F960	0324	Internal / external WAN interface: Modem of called subscriber has no power.
F960	0325	Internal / external WAN interface: Telephone line is disrupted.
F360	0326	Internal / external WAN interface: Supervision time exceeded. Repetition starting.
F360	0327	Internal / external WAN interface: All attempts to dial a subscriber were executed. No connection was established.
F360	0328	Entering state: Internal / external WAN interface: Telephone number list with telephone num- ber(s) of a subscriber deactivated.
F260		Exiting state: Internal / external WAN interface: Telephone number list with telephone num- ber(s) of a subscriber activated.
F560	0329	Internal / external WAN interface: Telephone number list with telephone number(s) of a sub- scriber is invalid or disrupted.
F360	032A	Internal / external WAN interface: Telephone number of a subscriber temporarily disabled.
F360	032B	Internal / external WAN interface: Telephone number of a subscriber was changed.

Event ID (hex)	Detailed event (hex)	Meaning
F560	032C	Internal / external WAN interface: STA number not found in telephone number list.
F360	032D	Entering state: Internal / external WAN interface: Permanent connection established to a subscriber.
F260		Exiting state: Internal / external WAN interface: Permanent connection to a subscriber was terminated.
F360	032E	Entering state: Internal / external WAN interface: Permanent connection to a subscriber was registered.
F260		Exiting state: Internal / external WAN interface: Permanent connection to a subscriber was deregistered.
F560	032F	Internal / external WAN interface: Permanent connection to a subscriber was aborted.
F360	0330	Entering state: Internal / external WAN interface: Incoming call disabled.
F260		Exiting state: Internal / external WAN interface: Incoming call enabled.
F360	0331	Internal / external WAN interface: Establishing connection to a subscriber.
F360	0332	Internal / external WAN interface: Connection to a subscriber established (outgoing call).
F360	0333	Internal / external WAN interface: Connection to a subscriber established (incoming call; sub- scriber number not yet identified).
F360	0334	Internal / external WAN interface: Connection to a subscriber was terminated.
F560	0335	Internal / external WAN interface: Connection to a subscriber was aborted.
F360	0336	Internal / external WAN interface: Connection to a subscriber is already terminated.
F360	0337	Internal / external WAN interface: Supervision time exceeded. No repetition.
F360	0338	Internal / external WAN interface: Send buffer was deleted.
F360	0339	Internal / external WAN interface: Image memory and send buffer were deleted.
F360	033A	Internal / external WAN interface: No telephone number in modem memory.
F960	033B	Internal / external WAN interface: PDU received with unknown STA number.
F360	033C	Entering state: Internal / external WAN interface: Driver redundancy - memory management switched over.
F260		Exiting state: Internal / external WAN interface: Driver redundancy - memory management switched back.
F560	033D	Internal / external WAN interface: Incorrect service request to pager (SMS).
F360	033E	Internal / external WAN interface: No entries in the send queue.
F560	033F	Internal / external WAN interface: Unknown message type.
F560	0340	Internal / external WAN interface: Communication with WAN driver disrupted.
F360	0341	Internal / external WAN interface: Incoming call (RING).
F960	0342	Internal / external WAN interface: No connection with incoming call.
F960	0343	Internal / external WAN interface: Call or connection abort.
F960	0344	Internal / external WAN interface: No carrier frequency detected on partner.
F360	0345	Entering state: Internal / external WAN interface: Further dialing attempts were made in the background to a disturbed subscriber.
F260		Exiting state: Internal / external WAN interface: Subscriber is available again. Dialing attempts in the background will be stopped.
F960	0346	Internal / external WAN interface: Incorrect PIN number transferred to GSM module.
F960	0348	Internal / external WAN interface: Error occurred in GSM module.
F960	0349	Internal / external WAN interface: GSM module not responding or not available.

Event ID (hex)	Detailed event (hex)	Meaning
F960	034A	Internal / external WAN interface: SMS server of the TIM has received an unknown message.
F960	034C	Internal / external WAN interface: Short message (SMS) acknowledgment received from an unknown mobile subscriber.
F360	034E	Internal / external WAN interface: Incoming call detected. Incoming calls are disabled.
F360	034F	Internal / external WAN interface: Incoming call detected. DTR signal was activated.
F360	0350	Internal / external WAN interface: SMS server of the TIM was installed and started.
F360	0351	Internal / external WAN interface: SMS status, global status request/deletion.
F360	0352	Internal / external WAN interface: SMS status, single status request/deletion.
F360	0353	Internal / external WAN interface: Spontaneous SMS status message.
F960	0354	Internal / external WAN interface: Short message (SMS) acknowledgment incorrect. Format or ID no. unknown.
F560	0355	Internal / external WAN interface: No send buffer could be made available for sending a short message (SMS).
F960	0356	Internal / external WAN interface: The GSM module expects the PUC number.
F960	0357	Internal / external WAN interface: Telephone number of the SMS recipient could not be found.
F360	0358	Internal / external WAN interface: The GSM signal strength is xx dBm.
F360	0359	Subscribers cannot be blocked.
F360	035A	Internal / external WAN interface: GSM module detects wrong service ID.
F360	035B	Internal / external WAN interface: GSM module ready to receive.
F360	035C	Internal / external WAN interface: The switchover to the image method for blocked messages was forced.
F360	035D	Internal / external WAN interface: Threat of forced switchover to image method.
F360	035E	Internal / external WAN interface: Threat of forced switchover to image method.
F360	035F	Internal / external WAN interface: Permanent connection already active.
F360	0360	Internal / external WAN interface: Maximum number of messages exceeded.
F360	0361	Entering state: Internal / external WAN interface: The data brake for the connection to a sub- scriber was enabled.
F260		Exiting state: Internal / external WAN interface: The data brake for the connection to a sub- scriber was disabled.
F960	0362	Internal / external WAN interface: After transferring the PIN to the GSM module, no network contact could be established.
Messages (Page 293)		d events 0400 ff. can be found in the section DNP3-specific diagnostics messages of the TIM
Messages	from the routing	g task
F560	0500	Installation of the routing program aborted.
F560	0501	Internal / external WAN interface: Receive task of the WAN driver unknown.
F560	0502	Receive task of the clock driver unknown.
F560	0503	Read time function unknown.
F560	0504	Receive task of the LAN task unknown.
F560	0505	Partner table unknown.
F560	0506	Error occurred receiving a message.
F560	0507	Unknown PDU received.

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Event ID (hex)	Detailed event	Meaning	
	(hex)		
F560	0508	PDU with bad address received. Destination subscriber number not found.	
F560	0509	No WAN driver available.	
F560	050B	Error enabling heap memory.	
F560	050C	Installation of the routing program ended. All routing tables available.	
F560	050D	Error occurred sending a message.	
F560	050E	No resources for creating the destination address table.	
F560	050F	Destination address table not created.	
F560	0510	No resources for PDU copy.	
F560	0511	No resources for copy of partner table.	
F360	0512	Entering state: Internal / external WAN interface: Redundancy function activated.	
F260		Exiting state: Internal / external WAN interface: Redundancy function deactivated.	
F960	0513	Message with incorrect block length received or block length is zero.	
F560	0514	Max. number of messages exceeded.	
F560	0515	Error in time-of-day synchronization over LAN.	
F560	0516	MesA - Error sending a message.	
F560	0517	The partner table/substitute table of a subscriber does not exist.	
F560	0518	Error releasing memory.	
F560	0519	Error in the MesA memory management	
F560	051A	Entering state: MesA - Start of indication of a message memory overflow.	
F460		Exiting state: MesA - End of indication of a message memory overflow.	
F560	051B	Entering state: MesA - Start of indication of a message memory overflow.	
F460		Exiting state: MesA - End of indication of a message memory overflow.	
F560	051C	Message memory overflow occurred.	
F560	051D	Entering state: Start of indication of a message buffer overflow.	
F460		Exiting state: End of indication of a message buffer overflow.	
F560	051E	Entering state: Overflow of message buffer active.	
F460		Exiting state: Overflow of message buffer deactivated.	
F560	051F	Buffer with messages was deleted.	
F560	0520	MesA - Error in the dynamic assignment table.	
F560	0521	MesA - WAN/LAN router: Error sending messages.	
F560	0522	MesA could not send the acknowledgment for an org. 262 PDU to SubA.	
F560	0523	MesA - WAN/LAN router; error sending over WAN/LAN driver.	
F560	0524	Installation error occurred in the MesA.	
F560	0530	MesA - System error occurred.	
F560	0531	MesA - Error in the request for an Org4/14 message.	
F560	0532	MesA - Unknown control command received.	
F560	0533	MesA - Error in MesA system status list query.	
F560	0534	MesA: Bad PDU detected.	
	rom clock driv		
F560	0620	Installation of clock driver aborted.	
Event ID (hex)	Detailed event (hex)	Meaning	
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F360	0621	for error code = 0: Installation of the clock driver completed for error code = 1: Installation of clock driver aborted.	
F560	0622	Entering state: Time synchronization (master) disturbed.	
F460		Exiting state: Time synchronization (master) OK.	
F960	0623	Entering state: Time synchronization (slave) disturbed.	
F860		Exiting state: Time synchronization (slave) OK.	
F560	0624	Error occurred setting the operating system clock.	
F560	0625	Error occurred reading the operating system clock.	
F360	0626	Illegal setting of the operating system clock by <i>Set clock</i> PG service. TIM has onboard DCF77 clock.	
F360	0627	Unknown message received.	
F360	0628	Time synchronization PDU with incorrect ORG number received.	
F360	0629	Bad synchronization PDU received from LAN.	
F560	062A	Entering state: Time synchronization by DCF77 clock disturbed.	
F460		Exiting state: Time synchronization by DCF77 clock OK.	
F960	062B	Entering state: DCF77 clock radio signal disturbed.	
F860		Exiting state: DCF77 clock radio signal OK.	
F360	062C	TIM time OK. Operating system clock set for the first time.	
F360	062D	Entering state: Changeover to daylight saving time.	
F260		Exiting state: Changeover to standard time.	
F360	062E	Entering state: Notification hour for daylight saving/standard time changeover active.	
F260		Exiting state: Notification hour for daylight saving/standard time changeover completed.	
F360	0630	Change in synchronization mode.	
F360	0631	Daylight saving/standard time changeover performed manually.	
F360	0632	Error occurred in manual daylight saving/standard time changeover.	
F560	0633	Error occurred starting the synchronization task.	
F560	0634	Error occurred starting the control task for synchronization.	
F960	0635	Two time masters detected in one network.	
F960	0636	Incorrect synchronization mode on MPI. Master mode expected.	
F960	0637	No further module exists on MPI bus/party line.	
F560	0638	External / internal WAN interface: A subscriber could not be synchronized following restart.	
F360	0639	Error detected in time-of-day synchronization.	
F360	063A	Bad time-of-day message received from DCF77 module.	
F360	063B	Bad time-of-day message received from DCF77 module.	
F360	063C	Time jump occurred.	
F360	063D	Bad time-of-day message received from DCF77 module.	
F560	063E	Error in synchronization request.	
Messages	from diagnostic	c server	
F560	0660	Error occurred installing the diagnostic server.	
F360	0661	Installation of diagnostic server completed.	
F560	0662	Error occurred sending a message.	

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Event ID (hex)	Detailed event	Meaning	
	(hex)		
F560	0663	Entering state: Error occurred receiving a message.	
F460		Exiting state: Error occurred receiving a message.	
F560	0664	Entering state: Heap memory overflow.	
F460		Exiting state: Heap memory overflow eliminated.	
F960	0665	Entering state: Unknown PDU received.	
F860		Exiting state: Unknown PDU received.	
F560	0666	Incorrect firmware version installed on TIM.	
F360	0667	Entering state: All [n] LAN connections are disrupted.	
F260		Exiting state: [x] of [n] LAN connections are OK.	
F360	0668	Message buffer of TIM records was deleted.	
F360	0669	Entering state: DNP3 Message Monitor	
F260		Exiting state: DNP3 Message Monitor off	
F360	066A	Entering state: Extended diagnostics on	
F260		Exiting state: Extended diagnostics off	
F360	066B	Extended diagnostics - modification	
F360	066C	Error occurred in system status list query.	
F560	066D	Wrong firmware.	
Messages f	rom P bus ser	ver	
F560	06B0	Installation of P bus server aborted.	
F360	06B1	Unknown message received from task.	
F560	06B2	Error occurred receiving a message.	
F360	06B3	Entering state: Power outage on P bus.	
F260		Exiting state: Power supply on P bus OK.	
F360	06B4	Entering state: I/O disabled by CPU.	
F260		Exiting state: I/O enabled by CPU.	
F560	06B5	Module on P bus not capable of communication.	
F960	06B6	Parity error in P bus communication.	
F960	06B7	Bit shift error in P bus communication.	
F360	06B8	Diagnostic interrupt cannot be sent. Module is not enabled on P bus.	
F360	06B9	Diagnostic interrupt cannot be sent. Diagnostic interrupt is not enabled on P bus.	
F360	06BA	SDB0 cannot be opened. File overwritten without comparison.	
F360	06BB	SDB0 cannot be created.	
F360	06BC	SDB0 cannot be written.	
F560	06BD	BUS3-ASIC could not be initialized.	
F360	06BE	SDB5 cannot be opened. File overwritten without comparison.	
F360	06BF	SDB5 cannot be created.	
F360	06C0	SDB5 cannot be written.	
Messages f	rom the SDB I	nandler	
F560	06E0	Installation of the SDB handler aborted.	
F560	06E1	SDB could not be copied.	

Event ID (hex)	Detailed event (hex)	Meaning	
F560	06E2	SDB could not be deleted.	
F560	06E3	SDB could not be loaded.	
F560	06E4	SDB information of hierarchy 1 not available.	
F560	06E5	SDB information of hierarchy 2 not available.	
F560	06E6	SDB information of hierarchy 3 not available.	
F560	06E7	Error chaining SDBs.	
F360	06E8	SDB handler: Unknown job.	
F360	06E9	Control instruction unknown.	
F560	06EB	Error occurred during firmware update.	
TD7onTIM			
F560	0700	Entering state: TD7 installation started.	
F460		Exiting state: TD7 installation ready.	
F560	0701	Semaphores not created.	
F560	0702	Semaphores not created.	
F560	0703	SecIntervall task was not started.	
F560	0704	TD7_ObjectAdmin task was not started.	
F560	0705	The path for SDB files could not be opened.	
F560	0706	The TD7 SDB could not be found.	
F560	0707	The TD7 SDB could not be opened.	
F560	0708	Header with incorrect length of block ID.	
F560	0709	TD7-SDB: No TD7 parameters found.	
F560	070A	TD7-SDB: Block not found.	
F560	070B	TD7-SDB: T4T_MAINHDR has incorrect length.	
F560	070C	TD7-SDB: T4T_SUBDATA has incorrect length.	
F560	070E	TD7-SDB: Unknown format in a destination subscriber block.	
F560	0711	TD7-SDB: Number of partner blocks incorrect.	
F560	0712	TD7-SDB: Unknown format in a partner block.	
F560	0713	TD7-SDB: Unknown channel type.	
F560	0715	TD7-Run: Not enough memory for the channel list.	
F560	0716	TD7-SDB: Channel block not found.	
F560	0717	TD7-Run: Not enough memory for a channel object.	
F560	0718	TD7-SDB: The number of data entries is incorrect.	
F560	071B	TD7-SDB: The number of object entries is incorrect.	
F560	071C	TD7-Par: Subscriber object for a partner not found.	
F560	071D	TD7-Par: Unknown partner.	
F560	0721	TD7-Par: Invalid scan cycle ID.	
F560	0722	TD7-Run: Object not in fast cycle.	
F560	0725	TD7-SDB: No objects found in header ID.	
F560	0726	TD7-SDB: Unknown format in an object.	
F560	0729	TD7-Par: Not enough memory for scan cycle job list.	

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Event ID	Detailed	Meaning	
(hex)	event (box)		
F560	(hex) 072A	Basic channel memory assignment error.	
F560	072D	TD7-Par: Wrong channel data type.	
F560	072E	Unknown channel type.	
F560	0730	TD7-Par: Invalid scan cycle ID.	
F560	0731	Memory assignment error creating the object list for the current subscriber.	
F560	0732	TD7-SDB: Number of objects does not match the number of objects in the header.	
F560	0733	A read job to the CPU was not responded to after 1 ms.	
F560	0736	TD7-Com: CPU communication error in object X, channel Y.	
F560	0737	TD7-Com: CPU access error for object X, channel Y.	
F560	073B	Memory assignment error creating the message buffer for a scan cycle.	
F560	073D	A write job to the CPU was not responded to after 1 ms.	
F560	073E	TD7-Com: Negative acknowledgment from LAN communication for job from scan cycle.	
F560	0742	TD7-Run: Error reading an input trigger.	
F560	0744	TD7-Par: Object without channels.	
F560	074A	TD7-Par: Invalid address with trigger signal.	
F560	074B	TD7-Par: Invalid address for net data in object X, channel Y.	
F560	074C	An invalid address was reported for object X in channel Y.	
F560	0752	TD7-SDB: Number of subscriber blocks does not match main header entry.	
F560	0755	Unknown channel type.	
F560	0759	Not enough memory to create the TD7onTIM send job list.	
F560	0760	Initialization of TD7onTIM for source subscriber complete.	
F560	0761	The general request of a subscriber is incomplete.	
F560	0762	Timeout in the general request to a subscriber.	
F560	0763	The general request of object X of a destination subscriber is incomplete.	
F560	0766	Message with unknown source subscriber.	
F560	0767	Unknown start index in received organizational message.	
F560	0768	TD7-Run: Received organizational message not accepted due to invalid length.	
F560	076C	Invalid start index in received data message.	
F560	076D	TD7-Run: Received data too large for destination object.	
F560	076E	TD7-Run: Start index of received data message does not match the receive channel of the destination object.	
F560	0773	TD7-Run: Object without partner or channels.	
F560	0774	TD7-Run: No destination object found.	

Diagnostic messages and activation of the group error LED

If an error occurs during startup, the read group LED (SF) of the TIM lights up and a message to this effect is entered in the diagnostic buffer of the TIM.

If the TIM is installed as a CP in an S7-300 rack, a diagnostic interrupt is sent to the CPU.

The following table contains a summary of all error messages that caused the group error LED (SF) to light up.

Error class	Detailed event (hex) in the diagnostics message
Internal error	0061
	0063, 0064, 0065, 0066, 0067
	0069
	0078, 0079, 0080
	0083
	06B0
External error	0320
No parameter assignment	0070
	0071
	0620
Bad parameter assignment	0077
	0081
	0110
	0112
	0300
	031C
	0500
	0620
RAM error	0085
	0086

Table 7-5 Classification of the messages and activation of the group error LED

7.3.6.3 DNP3-specific diagnostics messages of the TIM

Diagnostic messages

Below you will find a list of the DNP3-specific diagnostics messages sorted according to the detailed event:

Event ID (hex)	Detailed event (hex)	Status message	Meaning
F560	0400	No TD7onTIM configuration exists	TD7onTIM configuration data was not transferred to the module.
F560	0401	Memory error	The available RAM memory on the module is exhausted.
F560	0402	Error receiving message	Internal error
F560	0403	Amount of diagnostics data to high (> 32 767). Diagnostics data of the event buffer cannot be transferred	Diagnostics data relating to message management could not be transferred to the diagnostics tool.
F560	0404	Unknown ORG PDU received	Internal error

Event ID (hex)	Detailed event (hex)	Status message	Meaning	
F560	0405	DNP3 data output locked	No DNP3 communication possible	
F360	0405	DNP3 data output released	DNP3 communication possible	
F560	0406	Unknown control message	Internal error	
F560	0407	Error releasing memory	The available RAM memory on the module is exhausted.	
F560	0408	Time-of-day function not available	Time-of-day synchronization by DNP3 master station not possible	
F560	0409	WAN SDB cannot be interpreted	Inconsistent system data block	
F560	040A	Error creating a task	Internal error	
F560	040B	WAN driver successfully installed.	DNP3 driver loaded	
F960	040C	Modem does not set CTS signal	CTS control signal on the serial interface inactive	
F860	040C	Modem sets CTS signal again	CTS control signal on the serial interface active	
F560	040D	WAN interface disrupted	Serial communication disrupted. Bad data frame, for example due to incorrect baud rate or invalid parity.	
F460	040D	WAN interface OK	Serial communication is OK again.	
F560	040E	WAN driver ready for communication	WAN driver ready	
F560	040F Time synchronization received DNP3 master station has synchronized		DNP3 master station has synchronized system time.	
F560	0410	10 Unsolicited event transmission activated Request to activate of deactivate unsolic or deactivated		
F560	0411	IP connection established	Connection to DNP3 master station was established.	
F360	0411	IP connection terminated	Connection to DNP3 master station was terminated.	
F560	0412	Inconsistent routing table	Inconsistent configuration	
F360	0413	DNP3 connection disrupted	Connection to specified master station disrupted	
F260	0413	DNP3 connection established	Connection to specified master station established	
F560	0414	Size of the process image of the inputs	Highest DNP3 indexes of the input values (received from DNP3 master station) are output.	
F560	0415	Size of the process image of the out- puts	Highest DNP3 indexes of the output values (sent to DNP3 master station) are output.	
F560	0416	TD7 data cannot be interpreted	Internal error	
F560	0417	Unknown DNP3 subscriber address received	DNP3 master station sends unknown address. The re- ceived master station and station address are displayed.	
F560	0418	Command rejected	A command of the DNP3 master station could not be executed. Object group, variation and type of the com- mand are displayed.	
F560	0419	Command not supported	An unknown or unsupported command of the DNP3 master station was received. Object group, variation and type of the command are displayed.	
F560	0420	Installation abort - DNP3 stack has detected an inconsistent parameter assignment.	Configuration error	

Event ID (hex)	Detailed event (hex)	Status message	Meaning
F560	0421	Message incoming: CPU of the station < <i>DNP3 address</i> > (subscriber number) in STOP mode	Note: The message is formed by a DNP3 master TIM when it receives the set internal indication bit "IIN1.6" of the station.
		Message outgoing: CPU of the station < <i>DNP3 address</i> > (subscriber number) in RUN mode	
F560	0422	Message incoming: Messagequeue Mesa full – image method active Message outgoing: Messagequeue Mesa no longer full – image method inactive	With an incoming message: Due to bottlenecks in the message transmission, there is a changeover from the send buffer method to the image method. Values of data points configured as an event are not written to the send buffer but to the image. If the status remains, the firmware nevertheless attempts to enter intermediate values of the data points configured as an event in the send buffer.
			With an outgoing message: There is a changeover back to the send buffer method.

7.3.6.4 MODBUS-specific diagnostics messages of the TIM

Diagnostics messages

Below you will find a list of the MODBUS-specific diagnostics messages sorted according to the detailed event:

Event ID (hex)	Detailed event (hex)	Status message	Meaning / remark
F560	0800	Modbus gateway installation error	
F360	0801	Modbus gateway installation successful	
F560	0802	Error releasing memory	
F560	0803	No memory in heap	Heap memory overflow
F560	0804	Error when reading or writing to a MODBUS slave	
F560	0805	Error sending a message	
F560	0806	Error receiving a message or ID un- known.	
F560	0807	Unknown message type received	
F560	0808	Message queue overflow (incoming)	Meaning in byte 5 of the diagnostics message:
			• 1 = LAN COM
			• 2 = S7 adapter
			• 3 = Modbus adapter

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Event ID (hex)	Detailed event (hex)	Status message	Meaning / remark
F460	0808	Message queue overflow (outgoing)	 Meaning in byte 5 of the diagnostics message: 1 = LAN COM 2 = S7 adapter 3 = Modbus adapter
F960	0809	CTS error (incoming)	
F860	0809	CTS error (outgoing)	
F560	080A	UART error (incoming)	
F460	080A	UART error (outgoing)	
F360	080B	Status change of the MODBUS slave (incoming)	MODBUS slave not accessible
F260	080B	Status change of the MODBUS slave (outgoing)	MODBUS slave accessible
F560	080C	Negative S7 acknowledgement re- ceived (message only incoming)	Byte 6 of the message codes the error class (ERRCLS) and byte 7 codes the error code (ERRCOD). For the meaning of ERRCLS and ERRCOD, see Meaning of ERRCLS and ERRCOD (Page 296).
F560	080D	Negative S7 access result received (message only incoming)	 Bytes 6 and 7 of the message code the access result (hex) with the following meaning: FF = success 01 = hardware error 02 = temporary lack of resources 03 = object access not permitted 05 = invalid address 06 = type not supported 07 = type inconsistent 0A = object does not exist 0EEF: Reserved FE = data unchanged since last access

7.3.6.5 Meaning of ERRCLS and ERRCOD

Meaning of ERRCLS and ERRCOD in messages 0113 and 080C

Table 7- 6	Meaning of ERRCLS and ERRCOD (hex)
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ERRCLS	ERRCOD	Meaning	
FF	01	The LAN connection via which the frame is to be sent is not established. The message is deleted.	
FF	02	The queue of the LAN connection via which the frame is to be sent has overflowed. The mes- sage is deleted.	

FF 03 Wrong LAN connection: The connection index is higher than the maximum index limessage is deleted. FF 04 Wrong LAN connection: The send channel was not found. or The addressed connection does not exist. The message is deleted. FF 05 No memory could be reserved for the send job. The message is deleted. FF 06 No memory could be reserved for the send job. The message is deleted. FF 07 No send job exists. The message is deleted. FF 08 The send job is already being used. The message is deleted. FF 09 During the LAN connection establishment, there were still messages in the queue. sages in the queue will be deleted. FF 20 Only with TD7onTIM: The message is generated when a read or write job is transf TD7onTIM to the LAN COM and no acknowledgement is received from the CPU w seconds. The job is returned with a negative acknowledgement to TD7onTIM by th COM. FF 22 Only with TD7onTIM: The message is generated when a read or write job is transf	All mes-
• The send channel was not found. or • The addressed connection does not exist. The message is deleted. FF 05 No memory could be reserved for the send job. The message is deleted. FF 06 No memory could be reserved for the send job. The message is deleted. FF 06 FF 07 No send job exists. The message is deleted. FF 08 FF 08 The send job is already being used. The message is deleted. FF 09 During the LAN connection establishment, there were still messages in the queue. sages in the queue will be deleted. FF 20 Only with TD7onTIM: The message is generated when a read or write job is transf TD7onTIM to the LAN COM and no acknowledgement is received from the CPU w seconds. The job is returned with a negative acknowledgement to TD7onTIM by th COM. FF 22 Only with TD7onTIM: The message is generated when a read or write job is transf	erred by
or • The addressed connection does not exist. The message is deleted. FF 05 No memory could be reserved for the send job. The message is deleted. FF 06 No memory could be reserved for the send job. The message is deleted. FF 07 No send job exists. The message is deleted. FF 07 No send job exists. The message is deleted. FF 08 The send job is already being used. The message is deleted. FF 09 During the LAN connection establishment, there were still messages in the queue. sages in the queue will be deleted. FF 20 Only with TD7onTIM: The message is generated when a read or write job is transf TD7onTIM to the LAN COM and no acknowledgement is received from the CPU w seconds. The job is returned with a negative acknowledgement to TD7onTIM by th COM. FF 22 Only with TD7onTIM: The message is generated when a read or write job is transf	erred by
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FF 06 No memory could be reserved for the send job. The message is deleted. FF 07 No send job exists. The message is deleted. FF 08 The send job is already being used. The message is deleted. FF 09 During the LAN connection establishment, there were still messages in the queue. sages in the queue will be deleted. FF 20 Only with TD7onTIM: The message is generated when a read or write job is transf TD7onTIM to the LAN COM and no acknowledgement is received from the CPU w seconds. The job is returned with a negative acknowledgement to TD7onTIM by th COM. FF 22 Only with TD7onTIM: The message is generated when a read or write job is transf	erred by
FF 07 No send job exists. The message is deleted. FF 08 The send job is already being used. The message is deleted. FF 09 During the LAN connection establishment, there were still messages in the queue. sages in the queue will be deleted. FF 20 Only with TD7onTIM: The message is generated when a read or write job is transf TD7onTIM to the LAN COM and no acknowledgement is received from the CPU w seconds. The job is returned with a negative acknowledgement to TD7onTIM by th COM. FF 22 Only with TD7onTIM: The message is generated when a read or write job is transf	erred by
FF 08 The send job is already being used. The message is deleted. FF 09 During the LAN connection establishment, there were still messages in the queue. sages in the queue will be deleted. FF 20 Only with TD7onTIM: The message is generated when a read or write job is transf TD7onTIM to the LAN COM and no acknowledgement is received from the CPU w seconds. The job is returned with a negative acknowledgement to TD7onTIM by th COM. FF 22 Only with TD7onTIM: The message is generated when a read or write job is transf	erred by
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FF 20 Only with TD7onTIM: The message is generated when a read or write job is transf TD7onTIM to the LAN COM and no acknowledgement is received from the CPU w seconds. The job is returned with a negative acknowledgement to TD7onTIM by th COM. FF 22 Only with TD7onTIM: The message is generated when a read or write job is transf	erred by
TD7onTIM to the LAN COM and no acknowledgement is received from the CPU w seconds. The job is returned with a negative acknowledgement to TD7onTIM by th COM. FF 22 Only with TD7onTIM: The message is generated when a read or write job is transf	
TD7onTIM to the LAN COM and there is no connection (CR connection) to the loc The job is returned with a negative acknowledgement to TD7onTIM by the LAN CO	al CPU.
81 04 Context is not supported:	
Errors in the PDU structure	
or	
Service unknown.	
83 01 No memory can be reserved to forward the received message. The message is ac edged negatively to the sender with result code 0x8301.	knowl-
84 02 The TIM has sent a message and has received a negative acknowledgement from with result code 0x8402 (remote BRcv block is in the incorrect status). The message peated.	
84 04 A message was received via the LAN but could not be forwarded because there w ceive job. The message is acknowledged negatively to the sender with result code	
84 05 The TIM has sent a message and has received a negative acknowledgement from with result code 0x8405 (remote BRcv block is DISABLED). The message is repeated a negative acknowledgement from the set of the transmission of transmission	
85 00 Illegal PDU size:	
Received PDU is larger than the negotiated maximum PDU size.	
or	
 The response does not fit in a PDU of the negotiated maximum PDU size. 	
87 02 A message with an unknown RID was received. The message is discarded and ac edged negatively with event code 0x8702.	knowl-
E0 FF Error coding	

Technical specifications

8.1 Technical specifications of the TIM 3V-IE DNP3

Article number	6NH7803-3BA00-0AA0	
Connection to WAN classic		
Number	1	
Execution	Serial port, 9-pin D-sub male c	onnector
Standard	RS-232	
Maximum permitted cable length	6 m	
Transmission speed	9 600 38 400 bps	
Connection to LAN or IP-based WA	N (Industrial Ethernet)	
Number	1	
Execution	RJ-45 jack	
Properties	10/100BASE-T, IEEE 802, half duplex/full duplex, autocrossover, autonegotiatio autosensing	
Maximum permitted cable length	10 m	
Transmission speed	10 / 100 Mbps	
Permitted cable lengths (Ethernet) -	(Alternative combinations per leng	gth range) *
0 55 m	Max. 55 m IE TP Torsion Cable with IE FC RJ45 Plug 180	
	 Max. 45 m IE TP Torsion C IE FC RJ45 Outlet 	able with IE FC RJ45 + 10 m TP Cord via
0 85 m	Max. 85 m IE FC TP Marin IE FC RJ45 Plug 180	e/Trailing/Flexible/FRNC/Festoon/Food Cable with
	 Max. 75 m IE FC TP Marin 10 m TP Cord via IE FC R. 	e/Trailing/Flexible/FRNC/Festoon/Food Cable + I45 Outlet
0 100 m	Max. 100 m IE FC TP Stan	dard Cable with IE FC RJ45 Plug 180
	• Max. 90 m IE FC TP Stand	ard Cable + 10 m TP Cord via IE FC RJ45 Outlet
Electrical data		
External power supply	Supply voltage	24 VDC
	Permitted range	min. 20.4 V, max. 28.8 V
	Execution	2-pin plug-in terminal strip
Current consumption	From 24 VDC, typical	160 mA
	From 24 VDC, maximum	200 mA
	From backplane bus	200 mA
Power loss at 24 VDC	Typical	5.8 W

Table 8-1 Technical specifications of the TIM 3V-IE DNP3

8.1 Technical specifications of the TIM 3V-IE DNP3

Permitted ambient conditions	/-IE DNP3		
Ambient temperature	During operation with the rack in- stalled horizontally	0 °C to +60 °C	
	During operation with the rack in- stalled vertically	0 °C to +40 °C	
	During storage	-40 °C to +70 °C	
	During transportation	-40 °C to +70 °C	
Relative humidity	During operation	≤ 95 % at 25 °C, no condensation	
Operating altitude	During operation ≤ 2,000 m above sea level at ma ambient temperature		
Contaminant concentration	Acc. to ISA-S71.04 severity level G1,	G2, G3	
Design, dimensions and weight			
Module format	Compact module for S7-300, single w	idth	
Degree of protection	IP20		
Weight	250 g		
Dimensions (W x H x D)	40 x 125 x 120 mm		
Installation options	Installation on a DIN rail		
	 Installation on an S7-300 standard rail 		
	Wall mounting		
	 Mounting in a 19" rack 		
	Switch panel		
Product functions *			
Configuration	Software for PG	SINAUT configuration software for PG	
	Storage of TIM configuration data	on internal TIM flash memory	
		on MMC of the S7-300-CPU	
TIM can be operated in the role	Station	• yes	
	Node station	• yes	
	Master station	• yes	
No. of TIM 3V-IE DNP3 modules per S7-300	1		
Local communication	Via backplane bus with the S7-300 CPU	possible using TD7onTIM	
	Via backplane bus with other TIMs in the rack	Not possible	
	Via MPI interface of the S7-300 CPU with other CPUs, TIMs, and/or PCs	Not possible	
Work memory required on the S7 CPU	TD7onTIM software	Best case, 0 bytes	
Data memory on the TIM	Battery backed	no	
Transmission protocol RS-232	Selectable protocols	DNP3	
	Asynchronous character format (DNP3)	10 bits	
	Hamming distance d (DNP3)	2	

8.2 Technical specifications of the TIM 4R-IE DNP3

Technical specifications of the TIM 3V-IE DNP3		
Transmission protocol Ethernet		
Protocol	DNP3	
Transport protocol	• TCP	
	• UDP	
Communication services	DNP3 using S7 communication	
	PG communication	

* You will find further product characteristics in the section Uses and properties of the TIM (Page 13).

8.2 Technical specifications of the TIM 4R-IE DNP3

Technical specifications of the TIM 4	IR-IE DNP3	
Article number	6NH7803-4BA00-0AA0	
Connection to WAN classic		
Number	2	
Execution	Serial port, 9-pin D-sub male connector	
Standard (can be changed in the	• RS-232	
configuration)	• RS-485	
Maximum permitted cable length	• RS-232 • 6 m	
	• RS-485 • 30 m	
Transmission speed	9 600 115 200 bps	
Connection to LAN or IP-based WA	N (Industrial Ethernet)	
Number	2	
Execution	RJ-45 jack	
Properties	10/100BASE-T, IEEE 802, half duplex/full duplex, autocrossover, autonegotiation,	
	autosensing	
Maximum permitted cable length	10 m	
Permitted cable lengths (Ethernet) -	(Alternative combinations per length range) *	
0 55 m	 Max. 55 m IE TP Torsion Cable with IE FC RJ45 Plug 180 	
	 Max. 45 m IE TP Torsion Cable with IE FC RJ45 + 10 m TP Cord via IE FC RJ45 Outlet 	
0 85 m	Max. 85 m IE FC TP Marine/Trailing/Flexible/FRNC/Festoon/Food Cable with IE FC RJ45 Plug 180	
	 Max. 75 m IE FC TP Marine/Trailing/Flexible/FRNC/Festoon/Food Cable + 10 m TP Cord via IE FC RJ45 Outlet 	
0 100 m	Max. 100 m IE FC TP Standard Cable with IE FC RJ45 Plug 180	
	 Max. 90 m IE FC TP Standard Cable + 10 m TP Cord via IE FC RJ45 Outlet 	

Table 8-2 Technical specifications of the TIM 4R-IE DNP3

8.2 Technical specifications of the TIM 4R-IE DNP3

Exchangeable media		
Slot for exchangeable media	C-PLUG (optional)	
Electrical data		
External power supply	Supply voltage	24 VDC
	Permitted range	min. 20.4 V, max. 28.8 V
	Execution	2-pin plug-in terminal strip
Current consumption	From 24 VDC, typical	150 mA
	From 24 VDC, maximum	170 mA
	From backplane bus, maximum	200 mA
Power loss at 24 VDC	Typical	4.6 W
Backup battery (optional)		
Backup of:	Message memory	
	Hardware clock	
Order number	6ES7 971-0BA00	
Battery type	Lithium battery type Tadiran SL-306, cell type AA	
Capacitance	2.3 Ah	
Voltage (nominal)	3.6 V	
Current consumption during backup	typically 100 μA, max. 160 μA	
Leakage current	typically 15 μA	
Clock	Hardware clock (real-time clock)	• yes
	Backup	• yes, with backup battery (optional)
	Deviation per day	• max. 4 s
Permitted ambient conditions		
Ambient temperature	During operation with the rack in- stalled horizontally	0 °C to +60 °C
	During operation with the rack in- stalled vertically	0 °C to +40 °C
	During storage	-40 °C to +70 °C
	During transportation	-40 °C to +70 °C
Relative humidity	During operation	≤ 95 % at 25 °C, no condensation
Operating altitude	During operation	≤ 2,000 m above sea level at max. 60 °C ambient temperature
Contaminant concentration	Acc. to ISA-S71.04 severity level G1,	G2, G3
Design, dimensions and weight		
Module format	Compact module for S7-300, double	width
Degree of protection	IP20	
Weight	400 g	
Dimensions (W x H x D)	80 x 125 x 120 mm	

Technical specifications of the TIM 4F	R-IE DNP3		
Installation options	 Installation on a DIN rail Installation on an S7-300 standard Wall mounting Mounting in a 19" rack 	l rail	
	Switch panel		
Product functions *			
Configuration	Software for PG	SINAUT configuration software for PG	
	Storage of TIM configuration data	 on internal TIM flash memory on TIM in optional C-PLUG on MMC of the S7-300-CPU (if TIM fitted in S7-300) 	
TIM can be operated in the role	StationNode stationMaster station	yesyesyes	
No. of TIM 3V-IE DNP3 modules per S7-300	1		
Local communication	Via Ethernet interfaceWith CPUs, PCs and further TIMs	 Possible using S7 communication (for PCS 7 and TIMs) 	
	Via backplane busWith local CPUWith further local TIMs	Possible using TD7onTIMNot possible	
	When used in an S7-300 controller		
	Via backplane bus with the S7-300 CPU	Possible using TD7onTIM	
	Via backplane bus with other TIMs in the rack	Possible	
	Via MPI interface of the S7-300 CPU with other CPUs, TIMs, and/or PCs	Possible using S7 communication (for PCS 7 and TIMs)	
Work memory required on the S7 CPU	TD7onTIM software	Best case, 0 bytes	
Data memory on the TIM	Battery backed	yes	
Transmission protocols RS-232/RS-	Selectable protocols	DNP3	
485	Asynchronous character format (DNP3)	10 bits	
	Hamming distance d (DNP3)	2	
Transmission protocol Ethernet	Protocol	DNP3	
	Transport protocol	TCPUDP	
	Communication services	DNP3 using S7 communicationPG communication	

8.3 Current consumption and power loss

* You will find further product characteristics in the section Uses and properties of the TIM (Page 13).

8.3 Current consumption and power loss

Introduction

The DNP3 components obtain the current required for operation from an external power supply. If the communications module TIM 3V-IE DNP3 is installed in an S7-300, it also draws current over the S7-300 backplane bus.

You require the information on current consumption of the DNP3 components from the external load power supply and from the backplane bus, for example, to configure the cabinet for a DNP3 station.

Current consumption and power loss

The following table lists the current consumption and power loss of the DNP3 components TIM and modem.

Table 8-3 Current consumption and power loss of the SINAUT DNP3 TIM and modem components

Short module name	Module order no.	Current consumption from backplane bus (max.)	Current consumption from 24 V load power supply	Power loss (nominal)
TIM 3V-IE DNP3	6NH7 803-3BA00-0AA0	200 mA	200 mA	5.8 W
TIM 4R-IE DNP3	6NH7 803-4BA00-0AA0	200 mA	170 mA	4.6 W

Example

An S7-300 is configured with the following modules:

- 1 power supply PS 307; 2 A
- 1 CPU 314
- 2 digital input modules SM 321; DI 16 x 24 VDC
- 1 relay module SM 322; DO 8 x AC 230 V/5 A
- 1 analog input module SM 331; AI 8 x 12 bits
- 1 analog output module SM 332; AO 2 x 12 bits
- 1 communications module
- 1 modem

8.3 Current consumption and power loss

Calculation of the current and power loss balance

The following table contains the power consumption and loss balance for the S7- 300 configuration described above. This current consumption and power loss balance does not include any actuators connected to the outputs.

Table 8- 4Current consumption and power loss balance

Module	Current consumption from S7-300 backplane bus	Current consumption from 24 V load power supply	Power loss
Power supply PS 307; 2 A	-	-	10 W
CPU 314	-	700 mA	8 W
2 digital input modules SM 321; DI 16 x DC 24 V	(2 x 25 mA) = 50 mA	(2 x 25 mA) = 50 mA	(2 x 3.5 W) = 7 W
1 relay module SM 322; DO 8 x AC 230 V/5 A	40 mA	125 mA	4.2 W
1 analog input module SM 331; AI 8 x 12 bits	60 mA	200 mA	1.3 W
1 analog output module SM 332; AO 2 x 12 bits	60 mA	135 mA	3 W
1 communications module	200 mA	160 mA	4.3 W
1 modem		200mA	4.8 W
Total:	410 mA	1570 mA	42.6 W

Result

The following results can be derived from the table above:

1. Current consumption from the S7--300 backplane bus:

The current consumption of the signal and TIM modules from the backplane bus amounts to a total 410 mA. It does not therefore exceed the 1.2 A that the CPU 314 can supply to the backplane bus.

2. Current consumption from the 24 V load power supply:

The current consumption of the signal, TIM and modem modules from the 24 V load power supply amounts to approx. 1.6 A. All additional loads must also be taken into account. Depending on this, you can then select the PS 307 power supply.

Check whether the assumed PS 307 with 2 A output current is adequate for this example.

3. Power loss:

The power loss of the S7-300 configuration amounts to a total of 42.6 W.

The power loss of all the components used in a cabinet (including the S7-300 configuration with 42.6 W) must not exceed the maximum power that the cabinet can discharge.

Note

When planning the dimensions of the cabinet, make sure that the temperature in the cabinet does not exceed the permitted maximum of 60°C even when the temperature outside the cabinet is high.

8.3 Current consumption and power loss

Approvals

Approvals issued

Note

Issued approvals on the type plate of the device

The specified approvals apply only when the corresponding mark is printed on the product. You can check which of the following approvals have been granted for your product by the markings on the type plate.

Approvals for shipbuilding are not printed on the device type plate.

EC declaration of conformity

CE

The device (the TIM modules) meets the requirements and safety objectives of the following EC directives and it complies with the harmonized European standards (EN) for programmable logic controllers which are published in the official documentation of the European Union.

• 94/9/EC (ATEX explosion protection directive)

Directive of the European Parliament and the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres

• 2004/108/EC (EMC)

EMC directive of the European Parliament and of the Council of December 15, 2004 on the approximation of the laws of the member states relating to electromagnetic compatibility.

• 2011/65/EU (RoHS)

Directive of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

The EC Declaration of Conformity is available for all responsible authorities at:

Siemens Aktiengesellschaft Process Industries and Drives Process Automation DE-76181 Karlsruhe Germany

You will find the EC Declaration of Conformity on the Internet at the following address:

Link: (https://support.industry.siemens.com/cs/ww/en/view/87608462)

> Entry type: "Certificates", certificate type: "EC Declaration of Conformity"

IECEx

The device meets the requirements of explosion protection according to IECEx.

IECEx classification: Ex nA IIC T4 Gc

IECEx certificate: IECEx DEK 14.0086X

The device meets the requirements of the following standards:

• IEC 60079-0

Hazardous areas - Part 0: Equipment - General requirements

IEC 60079-15

Explosive atmospheres - Part 15: Equipment protection by type of protection 'n'

You can see the current versions of the standards in the IECEx certificate that you will find on the Internet at the following address:

Link: (https://support.industry.siemens.com/cs/ww/en/view/109475158)

The conditions must be met for the safe deployment of the product according to the section Notices on use in hazardous areas according to ATEX / IECEx (Page 65).

You should also note the information in the document "Use of subassemblies/modules in a Zone 2 Hazardous Area" that you will find on the Internet at the following address:

Link: (https://support.industry.siemens.com/cs/ww/en/view/78381013)

ATEX

The device meets the requirements of the EC directive 94/9/EC "Equipment and Protective Devices for Use in Potentially Explosive Atmospheres".

Applied standards:

EN 60079-0

Hazardous areas - Part 0: Equipment - General requirements

• EN 60079-15

Explosive atmospheres - Part 15: Equipment protection by type of protection 'n'

The current versions of the standards can be seen in the EC Declaration of Conformity, see above.

ATEX approval: II 3 G Ex nA IIC T4 Gc

Test number: KEMA 03 ATEX1228 X

The conditions must be met for the safe deployment of the device according to the section Notices on use in hazardous areas according to ATEX / IECEx (Page 65).

You should also note the information in the document "Use of subassemblies/modules in a Zone 2 Hazardous Area" that you will find on the Internet at the following address:

Link: (https://support.industry.siemens.com/cs/ww/en/view/78381013)

EMC

The device meets the requirements of the EC Directive:2004/108/EEC "Electromagnetic Compatibility" (EMC directive).

Applied standards:

• EN 61000-6-4

Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments

• EN 61000-6-2

Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments

RoHS

The device meets the requirements of the EU directive 2011/65/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Applied standard:

• EN 50581:2012

c(UL)us



Applied standards:

- Underwriters Laboratories, Inc.: UL 508 Listed (Industrial Control Equipment)
- Canadian Standards Association: CSA C22.2 No. 142 (Process Control Equipment) Report / UL file: E85972 (NRAG, NRAG7)

cULus Hazardous (Classified) Locations



Underwriters Laboratories, Inc.: CULUS Listed 7RA9 IND. CONT. EQ. FOR HAZ. LOC. Approval for the device

Applied standards:

- ANSI ISA 12.12.01
- CSA C22.2 No. 213-M1987

APPROVED for Use in:

- Cl. 1, Div. 2, GP. A, B, C, D T4
- Cl. 1, Zone 2, GP. IIC T4

Ta: Refer to the temperature information on the type plate of the device

Report / UL file: E223122 (NRAG, NRAG7)

Note the conditions for the safe deployment of the device according to the section Notices on use in hazardous areas according to UL HazLoc (Page 66).

FM



Factory Mutual Approval Standard Class Number 3600, 3611, 3810 Class I, Division 2, Group A, B, C, D, T4 or Class I, Zone 2, Group IIC, T4 Ta: Refer to the temperature information on the type plate of the device

Australia - RCM



The device meets the requirements of the AS/NZS 2064 standards (Class A).

Marking for the customs union



EAC (Eurasian Conformity)

Customs union of Russia, Belarus and Kazakhstan

Declaration of the conformity according to the technical regulations of the customs union (TR $\mbox{CU})$

MSIP 요구사항 - For Korea only

Certification Number: MSIP-REM-S49-S7400CP

A급 기기(업무용 방송통신기자재)

이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정 외의 지역에서 사용하는것을 목적으로 합니다.

Current approvals

SIMATIC NET products are regularly submitted to the relevant authorities and approval centers for approvals relating to specific markets and applications.

If you require a list of the current approvals for individual devices, consult your Siemens contact or check the Internet pages of Siemens Industry Online Support:

Link: (https://support.industry.siemens.com/cs/ww/en/ps/15937/cert)

Overview of the approvals for SIMATIC NET products

You will find an overview of the approvals for SIMATIC NET products including approvals for shipbuilding on the Internet pages of Siemens Industry Online Support under the following address:

Link: (https://support.industry.siemens.com/cs/ww/en/view/57337426)

Accessories

A.1 Router SCALANCE M

Routers for IP-based communication

To connect a TIM to IP-based infrastructure networks, the following routers are available:

• SCALANCE M812

ADSL router for wired IP communication via the Internet, 1 RJ-45 Ethernet interface, 1 digital input, 1 digital output ADSL2T or ADSL+, security functions

• SCALANCE M816

ADSL router for wired IP communication via the Internet, 1 RJ-45 Ethernet interface with 4-port switch, 1 digital input, 1 digital output ADSL2T or ADSL+ security functions

• SCALANCE M875

UMTS router for wireless IP communication using UMTS mobile wireless HSDPA and HSUPA;

- 1 RJ-45 Ethernet interface,
- 1 mobile wireless interface,
- 1 digital input, 1 digital output
- security functions

Information on the devices can be found on the Internet pages of Siemens Industry Online Support under the following entry ID:

80046561 (http://support.automation.siemens.com/WW/view/en/80046561)

A.2 Modems

A.2 Modems

The following modem variants are available:

- For dedicated line networks:
 - MD2

Dedicated line modem for multipoint connection, can be tapped. Can also be used as a repeater, max 19200 bps

- For dial-up networks:
 - MD3

Modem for the analog telephone network, max. 33600 bps. Can also be used a dedicated line modem for a point to-point connection.

– MD4

ISDN modem RS-232/RS-485 interface, max. 64000 bps (no longer available)

Information on the devices can be found on the Internet pages of Siemens Industry Online Support under the following entry ID: 89330308 (http://support.automation.siemens.com/WW/view/en/89330308)

These modems can be connected to the serial modem interface of the TIM.

Due to the design, the modems can be installed on an S7-300 standard rail just like the TIM modules. As an alternative, the modems can also be installed on a 35 mm standard mounting rail. In this case, an adapter is required that can be ordered separately.

The following figure shows the modem modules with further details (schematic representation with the covers removed).



Image A-1 Connectors of a SINAUT ST7 modem



Image A-2 Classic SINAUT MD modem

Accessories

Technical specifications of the MD2 dedicated line modem

MD2	
Interfaces	
Attachment to dedicated line	• RJ-12
RS-232 attachment to DTE	9-pin D-sub male connector
RS-485 attachment to DTE	9-pin D-sub female connector
Connection to power supply	4-pin terminal strip
Power supply	24 V DC
Current consumption	
• From 24 V DC	• 100 mA
Power loss	2.4 W
Permitted ambient conditions	
Operating temperature	 0 °C through +60 °C
Transport/storage temperature	 -40 °C through +70 °C
Relative humidity	• Max. 95 % at +25 °C
Construction	
Module format	Compact module for S7-300, double width
• Dimensions (W x H x D) in mm	• 80 x 125 x 120
Weight	• Approx. 300 g
Degree of protection	IP 20
Transmission path	2-wire, 2 x 2-wire or 4-wire, twisted pair, without loading coils or with few
	loading coils
Type of modulation	loading coils Frequency shift keying (FSK)
Type of modulation Transmission speeds	
	Frequency shift keying (FSK)
	Frequency shift keying (FSK)1200 bps
	 Frequency shift keying (FSK) 1200 bps 2400 bps 9600 bps (not for telephone company
	 Frequency shift keying (FSK) 1200 bps 2400 bps 9600 bps (not for telephone company leased lines) 19,200 bps (not for telephone company
Transmission speeds	 Frequency shift keying (FSK) 1200 bps 2400 bps 9600 bps (not for telephone company leased lines) 19,200 bps (not for telephone company
Transmission speeds Mode	 Frequency shift keying (FSK) 1200 bps 2400 bps 9600 bps (not for telephone company leased lines) 19,200 bps (not for telephone company leased lines)
Transmission speeds Mode • With 2-wire or 2 x 2-wire	 Frequency shift keying (FSK) 1200 bps 2400 bps 9600 bps (not for telephone company leased lines) 19,200 bps (not for telephone company leased lines) Half duplex
Transmission speeds Mode • With 2-wire or 2 x 2-wire • With 4-wire	 Frequency shift keying (FSK) 1200 bps 2400 bps 9600 bps (not for telephone company leased lines) 19,200 bps (not for telephone company leased lines) Half duplex Duplex or half duplex
Transmission speeds Mode • With 2-wire or 2 x 2-wire • With 4-wire	 Frequency shift keying (FSK) 1200 bps 2400 bps 9600 bps (not for telephone company leased lines) 19,200 bps (not for telephone company leased lines) Half duplex Duplex or half duplex 0 dB
Transmission speeds Mode • With 2-wire or 2 x 2-wire • With 4-wire	 Frequency shift keying (FSK) 1200 bps 2400 bps 9600 bps (not for telephone company leased lines) 19,200 bps (not for telephone company leased lines) Half duplex Duplex or half duplex 0 dB -6 dB
Transmission speeds Mode • With 2-wire or 2 x 2-wire • With 4-wire	 Frequency shift keying (FSK) 1200 bps 2400 bps 9600 bps (not for telephone company leased lines) 19,200 bps (not for telephone company leased lines) Half duplex Duplex or half duplex 0 dB -6 dB -9 dB (for telephone company leased lines)

A.2 Modems

MD2	
Terminating resistor can be adjusted	
• For 1200 and 2400 bps	• 600 ohms
• For 9600 and 19,200 bps	• 150 ohms
For tapping point	 > 6 kilohms
Ready to send	
• At 1200 bps	After 7 ms
• At 2400 bps	After 4 ms
• At 9600 and 19,200 bps	After 0.5 ms
Lower / upper keying frequency	
• At 1200 bps	• 1300 Hz / 2100 Hz
• At 2400 bps	• 2400 Hz / 3300 Hz
• At 9600 and 19,200 bps	• 20,800 Hz / 33,600 Hz
Asynchronous character format	10 or 11 bits
Floating optical relay output	
Max. connected voltage	• 60 V AC/DC
Max. permitted permanent current	• 400 mA
• Max. Ron	• 3 ohms
Surge withstand capability U _{1.2/50} to DIN VDE 0804 between supply circuit and	
FSK remote line circuits	• 2.5 kV
Optical relay output	• 2.5 kV
Compatible with SINAUT modems	
• MD100	• At 1200 bps
• MD124	• At 1200, 2400 and 19,200 bps
Certifications and approvals	EU approval CE 0682 X

Technical specifications of the MD3 analog dial-up modem

Interfaces	
 Attachment to telephone network or dedicated line RS-232 attachment to DTE RS-485 attachment to DTE Connection to power supply 	 RJ-12 9-pin D-sub male connector 9-pin D-sub female connector 4-pin terminal strip
Power supply	24 V DC
Current consumption	
From 24 V DC	• 200 mA

A.2 Modems

 MD3	
Power loss	4.8 W
Permitted ambient conditions	
Operating temperature	 0 °C through +60 °C
Transport/storage temperature	 -40 °C through +70 °C
Relative humidity	• Max. 95 % at +25 °C
Construction	
Module format	Compact module for S7-300, double width
• Dimensions (W x H x D) in mm	• 80 x 125 x 120
• Weight	• Approx. 300 g
Degree of protection	IP 20
Transmission path	Analog dial-up telephone network Dedicated line, 2-wire twisted pair, without load- ing coils
Available ITU transmission standards in the analog	• V.22 1200 bps, duplex
telephone network	• V.22bis 2400 bps, duplex
	• V.32bis 4800 bps, duplex
	• V.32bis 9600 bps, duplex
	• V.32bis 14,400 bps, duplex
	• V.34bis 19200 bps, duplex
	• V.34bis 33,600 bps, duplex
Error correction	V.42 and MNP4
Data compression	V.42bis and MNP5
Modem control	AT commands
	V.25bis commands
Metering pulse filter can be adjusted to	• 12 kHz
	• 16 kHz
Dialing mode	Tone dialing
	Pulse dialing
Loop power section	Exists, can be switched in or out
Loudspeaker	Exists, can be switched on or off
Line adjustment	• 600 ohms
	• Zr (frequency-dependent)
Transmit level can be set to	• -10 dB
	• -15 dB
Asynchronous character format	10 or 11 bits
•	

MD3					
Standard dedicated line profile	• 300 bps (direct)				
	• 1200 bps (direct)				
	• 2400 bps (direct)				
	• 9600 bps (direct)				
	• 19,200 bps (direct)				
	• 19200 bps (buffered)				
	• 33,600 bps (buffered)				
Compatible with SINAUT modems (as telephone modem)					
• MD125	• V.22 1200 bps, duplex				
	• V.22bis 2400 bps, duplex				
• MDM2425B DX	• V.22bis 2400 bps, duplex				
 MD3 (hardware version < 4) 	• V.22 1200 bps, duplex				
	• V.22bis 2400 bps, duplex				
	• V.32bis 4800 bps, duplex				
	• V.32bis 9600 bps, duplex				
	• V.32bis 14,400 bps, duplex				
Certifications and approvals	Europe				
	• USA				
	• Canada				
Recommended line quality for telephone company	• M1020				
leased lines	• M1025				

Technical specifications of the MD4 ISDN dial-up modem

MD4	
Interfaces	
 Attachment to ISDN dial-up network or ISDN dedicated line 	• RJ-12
RS-232 attachment to DTE	9-pin D-sub male connector
RS-485 attachment to DTE	9-pin D-sub female connector
Connection to power supply	4-pin terminal strip
Power supply	24 V DC
Current consumption	
• From 24 V DC	• 100 mA
Power loss	2.4 W

A.3 Connecting cables

MD4 Permitted ambient conditions						
Operating temperature	 0 °C through +60 °C 					
Transport/storage temperature	 -40 °C through +70 °C 					
Relative humidity	 Max. 95 % at +25 °C 					
Construction						
Module format	Compact module for S7-300, double width					
 Dimensions (W x H x D) in mm 	 80 x 125 x 120 					
Weight	 Approx. 300 g 					
Degree of protection	IP 20					
Transmission path	Digital ISDN network					
	 ISDN dedicated line, for example the ISDN dedicated line products of the German Tele- kom: 					
	 LeasedLink SFV Digital 64S LeasedLink SFV Digital 64S2 LeasedLink SFV Digital TS02 					
Available standard transmission standards	 V.110 1200 bps, duplex V.110 2400 bps, duplex V.110 9600 bps, duplex V.110 19,200 bps, duplex X.75 1200 bps, duplex X.75 2400 bps, duplex X.75 19200 bps, duplex X.75 38,400 bps, duplex 					
Modem control	AT commandsV.25bis commands					
Asynchronous character format	10 or 11 bits					
Certifications and approvals	Europe					
Compatible with SINAUT modems						
• LGM64K	• V.110 9600 bps, duplex					

A.3 Connecting cables

A series of standard connecting cables is available to connect the TIM to a modem or to the WAN network. Some of these connecting cables are supplied along with the hardware components. Other cables can be ordered as necessary

A.3.1 Standard connecting cable for the DNP3-TIMs

A modem or other transmission device can be connected to the 9-pin connector of the serial interface of the TIM. The following standard connecting cables are available for connection to these connectors.

Connecting cables for the DNP3-TIMs

Connecting cables for the serial interface of the TIM

Order no.	Description	Illustration
6NH77701-4AL	Connecting cable for connecting the serial interface of a DNP3 TIM to one of the SINAUT modems MD2 or MD3 (RS-232). Also suitable for linking the modems to a SIMATIC point-to- point CP such as the CP 340, CP 341 or CP 441 with RS- 232 interface. Cable length 1.5 m	
6NH7701-5AN	Cable for connecting the TIM (RS-232) to third-party mo- dems or wireless devices with standard RS-232. Cable length 2.5 m	TIM GSM modem
6NH7701-4BN	Cable with one end without connector for connecting the TIM (RS-232) to a third-party modem or wireless device (RS-232) Cable length 2.5 m	TIM Time TIM Time modem, wireless device
6NH7701-0AR	Test cable. Cable for connecting two TIM modules via their RS-232 interface without modems (null modem). Cable length 6 m	

A.3 Connecting cables

Connecting cable only for the TIM 4R-IE DNP3

 Table A-1
 Connecting cable for the serial interface of the TIM 4R-IE DNP3

Order no.	Description	Illustration
6NH7701-4DL	Cable for connecting a TIM 4R-IE DNP3 (RS-485) with multiple SINAUT DNP3 dedicated line modems of the type MD2 or MD3 (RS-485) connected in parallel. Cable length 1.5 m	

Structure of the connecting cables for WAN attachment

The following figures show the assembly of the connecting cables.

TIM 3V-IE DNP3 / 4R-IE DNP3 (RS232)	Pin no.	Interconnection	Pin no.	Modem MD2, MD3 (RS-232)
9••4	Casing shield 1 2	DCD //	Casing shield 1 2	
•4 3 2 1 • • • • • •	3 4 5	DTR GND DSR	3 4 5	•4 3 2 1 • • 7 6
D-sub, female 9-pin	6 7 8 9	RTS CTS RI/T	6 7 8 9	D-sub, female 9-pin

Image A-3 Assembly of the standard connecting cable 6NH7701-4AL



Image A-4 Assembly of the standard connecting cable 6NH7701-4DL

TIM 3V-IE DNP3 / 4R-IE DNP3 (RS232)	Pin no.	Interconnection	Pin no.	GSM modem MC45/MD720-3 (RS-232)
$ \begin{array}{c} $	Casing shield 1 2 3 4 5 6 7 8	DCD RXD RXD TXD DTR DTR GND DSR RTS CTS	Casing shield 1 2 3 4 5 6 7 8	D-sub, female
D-sub, female 9-pin	9	RI/T	9	9-pin

Image A-5 Assembly of the standard connecting cable 6NH7701-5AN

Accessories

A.3 Connecting cables

TIM 3V-IE DNP3 / 4R-IE DNP3 (RS232)	Pin no.	Interconnection	Pin no.	open cable end
	Casing shield		Casing shield	
	1		1	white
•5	2	RXD	2	brown
4 ● 00 4 ●	3	TXD	3	green
	4	DTR	4	yellow
	5	GND	5	gray
	6	DSR	6	pink
	7	RTS	7	blue
		CTS		
D-sub, female	8	RI/T	8	red
9-pin	9	V	9	black

Image A-6 Assembly of the standard connecting cable 6NH7701-4BN

TIM 3V-IE DNP3 / 4R-IE DNP3 (RS232)	Pin no.	Interconnection					Pin no.	TIM 3V-IE DNP3 / 4R-IE DNP3 (RS232)
\bigcirc	Casing shield 1 2	\cap	RXD		RXD	\bigwedge	Casing shield 1	\bigcirc
5 4 3 2 1 9 8 7 6	3 4 5		TXD DTR GND	\geq	TXD DTR GND		3 4 5	9 ● 5 9 ● 4 8 ● • 3 7 • • 2 6 • 1
	6 7		DSR RTS CTS]	DSR RTS CTS		6 7	\bigcirc
D-sub, female 9-pin	8	V		1		V	8	D-sub, female 9-pin

Image A-7 Assembly of the standard connecting cable 6NH7701-0AR

Connecting cables for connecting to Ethernet

For the Ethernet attachment of the TIM 4R-IE DNP3, you can use the suitable Ethernet connecting cables (for example IE TP Cord) from the SIMATIC NET product range (catalog IK PI).

If a DNP3 TIM is connected to a hub, switch or router, it is advisable to use fully shielded straight-through patch cables with RJ-45 connectors and 1:1 pin assignment. The cable must be suitable for the 10Base-TX or 100Base-TX specification.

Two DNP3 TIMs can also be connected over Ethernet as a point-to-point link using a crossover patch cable with RJ-45 connectors at both ends and the following pinout:
Pin no. / Signal		Interconnection		Pin no. / Signal
TXD (+)	1		1	TXD (+)
TXD (-)	2	\sim	2	TXD (-)
RXD (+)	3	\sim	3	RXD (+)
	4	X	4	
	5		5	
RXD (-)	6		6	RXD (-)
	7		7	
	8		8	

Image A-8 Pinout of a crossover Ethernet RJ-45 cable

The cable must be suitable for the 10Base-TX or 100Base-TX specification.

A.3.2 Connecting cables for WAN attachment with LTOP

A 6NH7700-xxx connecting cable ships with every MD2 / MD3 modem. This can be used to connect the modem to the relevant WAN network.

Order no.	Description	Illustration
6NH7700-2AR60	Connecting cable with 2 x RJ-12 plugs for connection to an MD2 modem (RJ-12) with an LTOP overvoltage protection module (RJ-12). Cable length 6 m	RJ-12
6NH7700-3BR60	Connecting cable with 2 x RJ-12 Western plug and snap- on TAE6N plug to connect an MD3 modem (RJ-12) to a telephone jack (TAE6N) or an LTOP overvoltage protection module (RJ-12) if the MD3 modem is being operated as a dedicated line modem. Cable length 6 m With DNP3, the TAE6N plug is not required.	RJ-12

Table A- 2WAN connecting cables

A.4 Antennas

A.4 Antennas

The ANT794-4MR GSM/GPRS antenna

The following antennas are available for use in GSM/GPRS networks and can be installed both indoors and outdoors. The antennas must be ordered separately.

• Quadband antenna ANT794-4MR

You will find detailed information in the device manual. You will find this on the Internet on the pages of Siemens Industrial Automation Customer Support under the following entry ID:

16518558 (http://support.automation.siemens.com/WW/view/en/16518558)



Image A-9 ANT794-4MR GSM/GPRS antenna

Short name	Order no.	Explanation
ANT794-4MR	6NH9 860-1AA00	Quadband antenna (900, 1800/1900 MHz, UMTS); weatherproof for indoor and outdoor areas; 5 m connecting cable connected permanently to the antenna; SMA connector, including installation bracket, screws, wall plugs

• Flat antenna ANT794-3M



Image A-10 Flat antenna ANT794-3M

Short name	Order no.	Explanation
ANT794-3M	6NH9 870-1AA00	Flat antenna (900, 1800/1900 MHz); weatherproof for indoor and outdoor areas; 1.2 m connecting cable connected permanently to the antenna; SMA con- nector, including adhesive pad, screws mounting possible

A.5 LTOP overvoltage protection modules

A.5.1 Variants and overview of the LTOP overvoltage protection modules

Copper dedicated lines are highly susceptible to electromagnetic interference. The coupling of extraneous voltages can be inductive or capacitive, for example due to the effects of lightning. Direct conductive coupling is also possible due to bad insulation.

The LTOP overvoltage protection modules limit extraneous voltage and overvoltage to a non-critical level. The floating transformer also provides electrical isolation preventing coupling of voltages into other cable sections. An LTOP protects persons and investment and is therefore an indispensable safety element in private dedicated line networks.



Image A-11 LTOP2 overvoltage protection module

The LTOP overvoltage protection module is available in two variants:

LTOP 1

Overvoltage protection module for use at the start or end of a 2-wire dedicated line.

LTOP2

Overvoltage protection module for use at the start or end of a 4-wire dedicated line or in a 2wire tapping point. In a 4-wire tapping point, two LTOP2 modules are required.

Short name	Order no.	Explanation
LTOP1	6NH9821-0BC11	Single line transformer LTOP1, with one OPM over- voltage protection module for use at the start or end of a 2-wire dedicated line
LTOP2	6NH9821-0BC12	Double line Transformer LTOP2, with two OPM overvoltage protection modules for use at the start or end of a 4-wire dedicated line or a 2-wire tapping point
OPM	6NH9821-0BB00	OPM overvoltage protection module for LTOP1 and LTOP2, plug-in (pack of 4)

Table A-3 Overview of the LTOP modules

The two LTOP variants have both screw terminals and an RJ-12 Western jack.

A.5 LTOP overvoltage protection modules

A.5.2 LTOP line transformer with overvoltage protection

Introduction

Copper dedicated lines are highly susceptible to electromagnetic interference. The coupling of extraneous voltages can be inductive or capacitive, for example due to the effects of lightning. Direct conductive coupling is also possible due to bad insulation.

The LTOP (Line Transformer with Overvoltage Protection) limits extraneous voltages and overvoltages to a non-critical level. The floating transformer also provides electrical isolation preventing coupling of voltages into other cable sections.

The protection concept

The protection concept involves a combination of components whose functions supplement each other:

- Overvoltage suppressors filled with inert gas providing protection against high voltage (G1, G2)
- Inductors that limit the rise in current (L1, L2)
- Metal oxide varistors as fine protection (voltage dependent resistance; R1)
- Transformer for electrical isolation (T1)
- Suppressor diode to limit the secondary voltage of the transformer (V1)



Image A-12 Circuit diagram of an LTOP unit



Image A-13 Location of the circuit elements of an LTOP 2 (view from above)

Note

The protection elements in the OPM (Overvoltage Protection Module) undergo high stress during discharge processes and progressively deteriorate. It is therefore recommended that you replace the OPMs approximately once a year. To be on the safe side, in regions with frequent thunderstorms this period should be reduced to approximately 6 months.

Structure of the LTOP variants

The housing contains either one LTOP unit (= LTOP 1) or two LTOP units (= LTOP 2). The following figures show the design of both LTOP variants with their connectors and configuration switches.



X1	Dedicated line (screw terminals 1, 2, 5, 6) Chassis (screw terminals 3, 4)
X2	Modem attachment 2-wire over screw terminals
X2 + X3	Modem attachment 4-wire over screw terminals
X6	Modem attachment 2-wire/4-wire via RJ-12 western plug
S1 + S2	Configuration switches

A.5 LTOP overvoltage protection modules



A.5.3 Technical specifications of the LTOP overvoltage protection module

LTOP				
Transmission paths	Private transmission lines with or without loading coils			
Transmission ratio	1 : 1; ± 5 % (e.g. 600/600 ohms in the voice band)			
Transmission range	300 Hz to 35 kHz			
Frequency-dependent attenuation	Attenuation	Frequency	Transmission speed [bps]	
	[dB]	[Hz]	MD100	MD124
	0.2	1300 3300	1200	1200 2400
	0.8	5200 8400		4800
	0.9	10400 16800		9600
	1.0	20800 30600		19200
Insulation resistance	> 2000 Mohms			
Test voltage	4 kV, 50 Hz, 10 s			
Surge withstand capability	6 kV/2 J to EN 60 099-1			
Normal discharge current isn (8/20 µs)	5 kA			
Output voltage limitation at isn	Approx. 15 \	/		
Telecontrol connector	Screw terminals Cross-section 0.2 – 4 mm ² with rigid cores Cross-section 0.2 – 2.5 mm ² with flexible cores			
Modem connector	Screw terminals (wire cross-section, see telecontrol line attachment) or RJ- 12 jack for Western plug			
Installation location	As close as	As close as possible to where cable enters building		

A.5 LTOP overvoltage protection modules

LTOP		
Permitted ambient conditions		
Operating temperature	 0 °C through +60 °C 	
Transport/storage temperature	 -40 °C through +70 °C 	
Relative humidity	• Max. 95 % at +25 °C	
Construction		
• Dimensions (W x H x D) in mm	• 90 x 75 x 110 mm	
Weight	• LTOP1: 300 g	
	• LTOP2: 320 g	
	• OPM: 10 g	
Degree of protection	IP 20	
Installation	DIN rail TS35 (35 mm; EN 50 022)	

Accessories

A.5 LTOP overvoltage protection modules

PG routing via WAN

B.1 What is PG Routing?

B.1.1 Introduction

In the SIMATIC world, the term routing is defined as follows:

Routing is finding the path for information beyond network boundaries.

In the SIMATIC world at the present time, it is not possible to configure a connection over which data can be transmitted between the two endpoints involved if this connection goes beyond the boundaries of a network.

What is possible, however, is PG routing. Using the PG routing, it is possible to access a programmable module or a module with diagnostic capability beyond network boundaries from a programming device (PG) or computer (PC).

SIMATIC PG routing and SINAUT PG routing

PG routing allows any type of diagnostics with diagnostics-compliant modules. Test, commissioning, and service functions can be executed, such as opening blocks online, monitoring, editing and overwriting or changing the operating mode mode of modules.

• SIMATIC PG routing

SIMATIC PG routing is possible only over network types such as MPI, PROFIBUS, and Ethernet. SIMATIC PG routing was released with STEP 7 V5.0.

• SINAUT PG routing

Expanding SIMATIC PG routing, SINAUT PG routing also works over SINAUT networks; in other words, in WANs.

In terms of functionality, SIMATIC PG routing and SINAUT PG routing are largely identical with the only difference being that SINAUT PG routing also functions beyond the boundaries of SINAUT networks. This gives the user a convenient option of remote programming and remote diagnostics over the company telecontrol network.

Note

In the remainder of this section, the terms "PG routing" and "remote" are used with the following meanings:

• PG Routing

PG routing is PG routing over network types such as MPI, PROFIBUS, and Ethernet as well as SINAUT networks. In SINAUT DNP3 only Ethernet is supported.

Remote

A remote CPU or remote TIM is a module that can be accessed from a PG over SINAUT telecontrol networks.

B.1 What is PG Routing?

B.1.2 Configuration for PG routing

The following figure shows the basic principle of PG routing.

Basic configuration of PG routing

In the basic configuration, a PG in the master station is configured and connected to the Ethernet network. PG routing extends from the PG via Ethernet to a station TIM via which the CPU connected to it can be reached.



Image B-1 Basic configuration of PG routing

B.1.3 Range of functions of PG routing

Range of functions of PG routing

In SINAUT DNP3, PG routing via an Ethernet network is supported. Access to remote TIM and CPU modules is from the PG/PC in the master station to the station.

Table B-1 Communication path of PG routing

Starting point	Target
PG/PC on Ethernet	Station TIM or station CPU

For the routing function, a spontaneous S7 connection is established from the PG.

B.1.4 Properties and restrictions of PG routing

When using PG routing with the SINAUT diagnostics and service tool or the SIMATIC Manager, certain special features and restrictions to the functions must be kept in mind.

Functions of the SINAUT diagnostics and service tool with PG routing

- "TIM Message Monitor" function Activating the TIM message monitor on a remote TIM using PG routing is not possible.
- "Firmware update" function
 When using the firmware update function, remember that large amounts of data are transferred. With remote modules, long processing times of several minutes can occur.
- "Repair" function

The "Repair" function using PG routing is not permitted.

When the "Repair" function executes, the flash disk of the TIM is formatted and the software on the TIM is therefore completely deleted. Following this, the module is no longer accessible over the SINAUT network. Reloading the TIM software is then only possible locally over the MPI bus.

Functions of the SIMATIC Manager with PG routing

• "Display Accessible Nodes" function

The "display accessible nodes" function is available only for subscribers connected to the local MPI bus. This restriction applies to SIMATIC PG routing and therefore also to SINAUT PG routing.

• "Hardware Diagnostics" function

The "hardware diagnostics" function is available only for subscribers connected to the local MPI bus. This restriction applies to SIMATIC PG routing and therefore also to SINAUT PG routing.

• "Download" function

The download of an entire station (CPU 300 plus TIM) leads to a connection abort. Since the TIM system data are downloaded first followed by a restart on the TIM, the second step of the CPU data download is interrupted.

It is possible to repeat the CPU download. We, nevertheless, recommend that you download the block folder of the CPU and the TIM module separately.

• "Upload to PG" function

The "Upload to PG" function is available only for subscribers connected to the local MPI bus. This restriction applies to SIMATIC PG routing and therefore also to SINAUT PG routing.

B.2 System requirements for PG routing

B.2 System requirements for PG routing

Software requirements

To use the PG routing function in the SINAUT telecontrol network with SINAUT DNP3, the following requirements must be met:

• STEP 7 is installed on the PG/PC.

You will find the required version in Preface (Page 3).

• The SINAUT software package is installed on your PG/PC.

You will find the required version in Preface (Page 3).

B.3 Preparations for PG routing

B.3.1 Setting the PG/PC interface and assignment

Before you perform PG routing over the SINAUT telecontrol network with your PG of PC, you must first adapt the properties of the PG/PC interface and set the assignment of the PG/PC in the SINAUT network.

B.3.2 Properties of the PG/PC interface

Adapting the PG/PC interface

- 1. Open the *Control Panel* window by clicking on the *Start / Settings / Control Panel* menu.
- 2. Select the Set PG/PC interface icon.
- 3. In the *Set PG/PC Interface* dialog, set the Ethernet interface in the *Interface parameter assignment used* box.
- 4. Then click on the *Properties* button.
- 5. Confirm the warning dialog with *Yes*. The properties dialog of the interface opens.

- 6. In the "Connection monitoring time" box, set the value "100 sec." for the "Timeout" parameter.
- 7. Close the dialogs with "OK".

This completes the adaptation of the PG/PC interface.

Properties - CP5611(MPI)		×
MPI		
Station Parameters		
G/PC is the <u>o</u> nly master on	the bus	
Address:	0 -	
<u>T</u> imeout:	100 s 💌	
Network Parameters		
Transmission <u>R</u> ate:	187.5 Kbps 💌	
Highest Station Address:	31 💌	
OK <u>D</u> efault	Cancel Help	

Image B-2 Properties dialog of the interface in the Control Panel

B.3.3 Canceling the PG/PC attachment in the network

Canceling the PG/PC assignment

If a PG was assigned in a project and then needs to be used at a different location, for example locally connected directly to a CPU or TIM, the assignment must first be canceled. Follow the steps outlined below:

- 1. Right-click on the PG/PC that is still assigned in the project you have opened in NetPro.
- 2. In the context menu that opens, select Cancel PG/PC Assignment.
- Acknowledge the warning dialog with *OK*. The PG/PC assignment is now canceled, this is indicated as follows in the network image of *NetPro*:
 - The connecting line from the PG/PC to the MPI bus is no longer on a yellow background.
 - The yellow arrow in the PG/PC icon disappears.
- 4. Save your project in NetPro.

B.3 Preparations for PG routing

B.3.4 PG/PC assignment in the network

Before you can use PG routing with a PG/PC over WAN networks, this must be configured and assigned within a project.

Assigning the PG/PC

The PG/PC is assigned in the network using the SIMATIC network configuration tool NetPro.

- 1. Open the project in which you want to use PG routing in the SIMATIC STEP 7 *NetPro* network configuration tool.
- 2. Drag a PG/PC to the network window from the NetPro catalog directory *Stations* and place it at a suitable position.
- 3. Right-click on the PG/PC you have just installed. A context menu opens.
- 4. In the context menu, click on the Assign PG/PC option. The Properties dialog opens.
- 5. Select the Ethernet network to which the configured PG/PC is connected in the *Configured interface* box of the *Properties* dialog.

Properties -PG/PC			×
General Interfaces	Assignment		
┌─ Not Assigned ────			
Configured Interfaces:			
Name	Туре	Subnet	
Ethernet Schnittstelle			
MPI Schnittstelle(2)	MPI	MPI(1)	
Interface Parameter A	ssignments in the PG/I	PC:	
CP1613(ISO)		4	
CP1613(RFC1006) CP5611(MPI)			
CP5611(PROFIBUS)			- Assign
A <u>s</u> signed:			Disconnect
		0.1	
Interface	Parameter assign	Subnet S70nline	<u>.</u>
			S70NLINE Access:
•			Active
ОК			Cancel Help

Image B-3 Properties - PG/PG dialog / Assignment tab in NetPro

- 6. Select the Ethernet interface you want to use in the *Interface Parameter Assignments in the PG/PC*.
- 7. Click on *Assign*. The assigned Ethernet interface is displayed in the *Assigned* box. The interface is now enabled for PG routing access.

- 8. Close the dialog with the *OK* button. The successful assignment of the PG/PC is indicated by an Ethernet connection on a yellow background and a yellow arrow pointing upwards in the PG/PC icon in *NetPro* and in the *SIMATIC Manager*.
- 9. Save your project in NetPro.
- 10.Connect your PG/PC to the Ethernet network to which you assigned your PG/PC in *NetPro*.

Note

As long as you leave your PG/PC connected to the point in the network as you assigned it in *NetPro*, you do not need to cancel the assignment. Not even if you want to turn off the PG/PC. Each time you turn on the PG/PC and open the project, you can use PG routing again immediately. You do not need to make settings or assignments again.

If, on the other hand, your PG/PC is not always at the same location or if you change to different projects on your PG/PC, we strongly recommend that you always cancel the assignment before your PG/PC is turned off or before you change to a different project. This ensures that the PG/PC can be assigned again when used at a different location or in a different project.

PG routing via WAN

B.3 Preparations for PG routing

Glossary

For further terms, go to the reference to the SIMATIC NET glossary in the preface of the manual.

Analog value

An analog value is an analog process variable such as pressure, temperature etc. It is acquired over an analog input as a current or voltage value and converted by this module to a binary-coded value. In total, the converted value occupies 1 word; in other words, 16 bits including sign bit.

COM port

→ *RS-232*

Command

A command it is a setpoint or a switching command from the DNP3 master station. It is sent to a station.

Configuration

During configuration, communication- and connection-specific system settings are made for each device.

Counted value

A counted value (for example amount of flow) is acquired via a digital input as a pulse train and totaled to produce a binary-coded value. A counted value is 2 words (between TIM and CPU): 28 bits for the binary-coded value 4 display bits.

In DNP3, numeric values are transferred between subscribers in WORD format.

CTS

Clear to send

Signal in the data flow control

Data message

The actual transmission of data takes the form of data messages. These contain a specified number of a certain information type.

DNP

Distributed Network Protocol

DNP3 protocol

The DNP3 protocol is a telecontrol protocol that allows the process data of sensors, field devices and RTUs to be connected to operator control and monitoring systems. The protocol was first specified in 1990. In 1993, this specification was released for general use under a public domain license. The protocol is maintained and has been further developed by the DNP user group founded in October 1994. The DNP user group is made up of users and manufacturers of DNP-compliant devices.

Apart from the continuous further development of the DNP specification, the DNP user group provides a test procedure for checking the conformity of DNP products. The certification of the DNP device using this procedure ensures the compatibility of devices from different vendors. The test procedure divides the DNP-compliant devices into different conformity levels according to their range of functions (simple sensors, field devices, complex controllers).

The SIMATIC NET modules TIM 3V-IE DNP3 and TIM 4R-IE DNP3 were certified with this test procedure according to DNP level 2 "outstation".

DNP3 TIM

 $\rightarrow TIM$

Ethernet / Industrial Ethernet

Industrial Ethernet is a powerful communications network complying with the international standard IEEE802.3 (Ethernet) that was optimized to meet the requirements of industrial application. Ethernet is designed with a linear, star or ring topology. The transmission media are shielded coaxial cables, twisted pair, or fiber-optic cables.

Ethernet TIM

 $\rightarrow TIM$

Firewall

A firewall is a network component via which a secure network can be linked with an unsecure network. The task of a firewall is to control data exchange between the networks.

General request

With a general request (GR), subscribers in a SINAUT network can request a current process image from their communications partners. This happens automatically when a disrupted connection has been restored or when a failed partner reports a restart. Apart from the automatic general request, a general request can also be triggered at any time by the user program or from the control center.

TD7onTIM does not support the general request.

Image memory / send buffer

A TIM has a send buffer and an image memory for buffering send messages.

The data of the process image of the CPU configured for transfer by the TIM in the objects of the TD7onTIM is written continuously to the image memory of the TIM.

Before it is forwarded to the communications partner, each message is entered in the send buffer. Once it has been sent, the message is cleared from the send buffer. The size of the send buffer depends on the type of TIM.

A message is transferred either based on the send buffer principle or the image memory principle. The type of transmission is specified during configuration of the objects (data points) using the 'Event' attribute. See also 'Image memory principle' and 'Send buffer principle'.

Image memory principle

A fixed position is reserved in the image memory for each data message transferred to the TIM for transmission. Each newly transferred message always overwrites the old message in the image memory. The image memory therefore contains all data messages with their up-to-date content from the process.

If a send message is entered using the image memory principle, only a reference to the location of the message in the message image memory is entered. If the TIM has not yet been able to transmit the message when the same message is transferred to it again, the message is not entered in the send buffer a second time, but rather the image is simply updated.

At the time of transmission, the message is sent with its up-to-date content from the image memory. Only then can the message be entered in the send buffer again.

Transmission using the image memory principle achieves the following:

- The transmission path has less load. Fewer messages are transferred.
- The send buffer of the TIM is used less. An image memory message is entered a maximum of once in the send buffer.

See also Image memory / send buffer.

LTOP

Line Transformer with Overvoltage Protection

Copper dedicated lines are highly susceptible to electromagnetic interference. The coupling of extraneous voltages can be inductive or capacitive, for example due to the effects of lightning. Direct conductive coupling is also possible due to bad insulation. The LTOP overvoltage protection modules limit extraneous voltage and overvoltage to a non-critical level. The floating transformer also provides electrical isolation preventing coupling of voltages into other cable sections. An LTOP protects persons and investment and is therefore an indispensable safety element in private dedicated line networks.

Master TIM	
	Interface of a TIM set to the "master station" function. Use in control centers and node stations.
Message	
-	The term message generally is used generally for a data message or particularly for data messages of the application layer.
MPI	
	Multi Point Interface
	MPI is the programming device interface of SIMATIC S7. Devices with an MPI interface (for example a TIM), can also communicate with each other (MPI bus).
Node station	
	A node station is a station located between the master station and stations in the hierarchy of a telecontrol network. One or more subordinate stations are connected to a node station. The data traffic between these stations and the master station is handled via the node station. Depending on the connected network type, inter-station communication or direct data exchange between lower-level stations is possible.
Node station TIM	1
	Interface of a TIM in a node station set to the "node station" function.
	On a TIM used in a node station, one interface is set to "node station" for connection to the higher-level master station and one or more interfaces are set to "master station" for one or more lower-level networks.
NTP	
	Network Time Protocol
	Ethernet-based method for synchronizing the time of day.
	SIMATIC NET components that support the "NTP" function use the method without authentication. See also: NTP (secure)
NTP (secure)	
inin (secure)	The secure method NTP (secure) uses authentication with symmetrical keys according to the hash algorithms MD5 or SHA-1.
Object	
,	An object contains the data of one or more process variables such as analog values, commands, calculated values, status information on motors, sliders etc. An object has type-

specific processing functions and change checks assigned to it to minimize the communication traffic in the WAN. Type-specific processing functions include, for example, change checks or smoothing with the object type for analog values. The change check is designed so that a message is generated only when the object data has changed compared with the last time its value was transferred or when the type-specific processing enables generation of a message because the object data is "worth" transferring.

Organizational message

Organizational messages are used to execute organizational system functions.

These include, for example:

- General requests
- Time synchronization
- Counted value storage
- · Coordinated connection establishment and termination in a dial-up network
- · Message indicating station startup and station failure
- Requests for and transmission of subscriber records

Parameter assignment

→ Configuration

PG

Programming device Allows access by the STEP 7 configuration software to the SIMATIC stations.

PG Routing

Using PG routing, it is possible to access programmable modules or modules with diagnostics capability beyond network boundaries from a programming device (PG) or computer (PC).

Polling

→ Polling mode

Polling

→ Polling mode

Polling mode

Polling is a type of data transfer in which a master station polls the stations and controls data exchange in the telecontrol network.

	When a TIM is used as the master station, the master TIM sends a polling message to the connected stations (station TIMs) one after the other instructing them to transmit their stored data messages to the master TIM. If a polled station has not saved any data messages, it replies with an acknowledgment message.	
Protocol		
	A protocol is a set of rules for controlled transfer of data. Protocols, for example, specify the data structure, the structure of data packets and the coding. Protocols can also specify a control mechanisms and hardware and software requirements.	
RJ-12		
1.0-12	This describes a 6-pin connecting cable with a standardized modular (Western) connector.	
RJ-45		
	This describes a 8-pin connecting cable with a standardized modular (Western) connector.	
RS-232		
	RS-232 is a standard for serial (i.e. bit-by bit) data transmission with +12 V and -12 V signals. RS-232 is a Recommended Standard of the Electronic Industries Association. For the RS-232 interface, 9-pin and 25-pin connections with D-sub connectors are normal. These are sub-miniature connectors with a D-shaped face.	
RS-485		
K3-400	RS-485 is a standard for data transmission with 5 V differential signals. The RS-485 interface uses only one pair of wires and is operated in half duplex. The connection is multipoint-compliant; in other words, up to 32 subscribers can be connected.	
RTS		
110	Request to send	
	Signal in the data flow control	
Send buffer		
	→ Image memory / send buffer	
Send buffer principle		
	If a send message is transmitted using the send buffer principle, each time the message is transferred to the TIM, it is entered completely in the send buffer. If the message cannot or should not be transmitted immediately, it may therefore exist more than once in the send	

	See also Image memory / send buffer
Setpoint	
	A setpoint is a selected digital or analog value that is transmitted once after the value has been set. The entered value is recalculated when necessary. A setpoint is always transmitted as 1 word. At the receiving end, the setpoint can either the output directly to the process as an analog signal (for example to an external controller) or the value is made available to the local program for further processing (setpoint for internal controller, limit value, threshold value etc.).
	Setpoint and command input are interlocked for safety reasons; in other words, a setpoint input cannot be made at the same time as a command input. In this case, the acquisition program recognizes an error. Neither the setpoint nor the command are transmitted.
SIMATIC S7	
	Siemens automation system
SINAUT	
	Slemens Network AUTomation
	Telecontrol system based on SIMATIC S7
SINAUT configuration software	
	→ SINAUT engineering software
SINAUT configuration tool	
	→ SINAUT engineering software
SINAUT diagnostics and service tool	
	→ SINAUT engineering software

SINAUT engineering software

Software package for TIM modules consisting of:

- SINAUT configuration and diagnostics software consisting of:
 - SINAUT configuration software
 - SINAUT diagnostics and service tool
- SINAUT TD7 block library (for the CPU cannot be used for the DNP3 TIM)

SINAUT ST7 protocol

This protocol is used in the SINAUT ST7 system for data transmission via classic WAN networks and IP-based networks. It is not compatible with DNP3.

SNAP

Subnetwork Access Protocol

Spontaneous message

Unsolicited messages are generated and transferred if a process value changes or eventdriven.

Spontaneous mode

The unsolicited or spontaneous mode is a type of transmission with which stations send messages on their own initiative without the station being polled by the master station (see "Polling mode"). Unsolicited messages can be sent for data points that are configured as an event.

ST7 protocol

Protocol for transmitting process data over WANs in the SINAUT ST7 system.

Station

In the telecontrol world, the term station includes the entire hardware components of a SIMATIC station required for detection, processing and communication with other stations or a master station. A station can, for example, consist of a modem, a TIM and a programmable controller (in turn consisting of a CPU and I/O modules).

Station TIM

WAN interface of a TIM set to the "station" function. Use in stations.

Status message

A status message is a process status (for example pump on, valve open) or alarm (for example limit value exceeded). This is binary information with the values 0 or 1.

TD7 library

The TD7 software in the stations allows change-driven transmission of process data between the individual CPUs and the control center, for example ST7cc. Failure of connections, CPUs, or the control center are displayed. Once a problem has been corrected or the CPUs or control center have started up, data is updated automatically. When necessary, data messages can be given a time stamp.

The following variants of the TD7 software exist:

• TD7onTIM

This TD7 variant runs on the TIM. It is available for the Ethernet and DNP3 TIMs and can only be used in an S7-300 station.

TD7onTIM can only be used as an alternative to TD7onCPU. Simultaneous use in a station is not possible.

TD7onCPU

If the DNP3 protocol is used, TD7onCPU is not supported.

The SINAUT TD7 library consists of software blocks for the CPU. It can be run both on an S7-300 or an S7-400 CPU (except the S7-400H CPUs). There are only a few blocks intended specifically for the S7-300 or S7-400.

TD7 software

→ TD7 library

TD7onTIM

→ TD7 library

TIM

Telecontrol Interface Module

The TIM transmission processor is a communications module and in the SIMATIC S7-300/400 family, it provides all data transfer functions in telecontrol networks and handles them independently. Depending on the type, the TIM has one or two WAN interfaces, an MPI interface or one or two Ethernet interfaces. Depending on the requirements, a variety of transmission equipment can be connected. The module is supplied in an S7-300 housing. The TIM modules described in this manual are available for the DNP3 protocol. Other TIM modules are available for the SINAUT ST7 protocol.

An Ethernet TIM is a TIM module with one or two Ethernet interfaces.

UART

Universal Asynchronous Receiver Transmitter Hardware interface for sending / receiving data

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SINAUT diagnostics

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