SIEMENS

SIMATIC HMI

Communication for Windows-based Systems

User's Guide

Part 1

This documentation is a component part of the Communication for Windows-based Systems User's Guide, and has order number

Order No.: 6AV6596-1MA06-0AB0.

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We have checked the content of this publication for compliance with the described hardware and software. However, discrepancies cannot be excluded, with the result that we cannot guarantee total compliance. The information in this publication is, however, checked regularly, and any necessary corrections are included in the following editions. We welcome any suggestions for improvement.

Preface

The Communication for Windows-based Systems User's Guide applies for SIEMENS operating units which are configured with the ProTool configuration software.

The user's guide is divided into Parts 1 and 2. This guide, Part 1, provides descriptions on:

- connection to the SIMATIC S5 PLC,
- connection to the SIMATIC S7 PLC,
- connection to the SIMATIC WinAC PLC,
- connection to the SIMATIC 505 PLC,
- connection to the SIMOTION PLC.

Part 2 contains descriptions of the connections to PLCs from other controller manufacturers.

Purpose

The purpose of the "Communication for Windows-based Systems" User's Guide is to explain:

- which communication protocols can be used for the communication between a SIEMENS operating unit and a PLC,
- which SIEMENS operating units can be used for the communication,
- which PLCs can be connected to selected SIEMENS operating units,
- which settings are necessary in the PLC program for the connection, and
- which user data areas can be set for the communication.

  To do this, certain chapters describe the scope, structure and function of the user data areas and explain the area pointers assigned.

History

Refer to the following table for information on the various editions of the Communication for Windows-based Systems User's Guide.

Edition	Comments
07/98	First edition of the guide
01/99	Addition of PROFIBUS-DP connection for the SIMATIC S5 and SIMATIC 505 PLCs. Addition of the driver for WinAC. SIMATIC 505 with NITP and Allen Bradley DF1 have new configuration parameters and support different data types than previously. Inclusion of the MP 270 operating unit.
01/00	Addition of the drivers for the Telemecanique, Mitsubishi FX and Allen Bradley PLCs. Addition of the TP 170A, FI 25/45 and Panel PC operating units.
09/00	Addition of the drivers for the Lucky Goldstar and Modicon PLCs. Inclusion of the TP 170B and OP 170B operating units.
12/01	Addition of the integration of a configuration in SIMATIC iMap. Addition of the SIMOTION PLC. Addition of the PLCs from OMRON and GE Fanuc Automation. Addition of the Allen Bradley and Mitsubishi PLCs for the DH485 and Protocol 4 protocols. Inclusion of the MP 370, MP 270B, TP 270 and OP 270 operating units. This edition of the "Communication for Windows-based Systems" User's Guide s divided into Part 1 and Part 2.

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- ProTool®, ProTool/Lite®, ProTool/Pro®, ProAgent®

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Notation

The following notation is used throughout this manual:

VAR_23	Screen texts, such as commands, file names, entries in dialog boxes and system messages, are displayed in this font.
Tag	Dialog box names and the fields and buttons contained in them appear in this font.
File → Edit	Menu items are linked by arrows and are displayed in this font. The full path from the initial menu to the menu item required is always shown.
F1	The names of keys are displayed in this font.

Contents

Part V Connection to SIMATIC 505

Part VI Integration in SIMATIC iMap

Part VII Connection to SIMOTION

Part VIII Appendix

Part I Introduction

Introduction

1

This chapter contains an overview of the communication protocols (subsequently referred to as protocols) which can be used following connection of a SIEMENS operating unit to a PLC.

Connection here relates to the connection required for data exchange between the operating unit and PLC.

Detailed information on the main features of the connection and the PLCs with which they can be used, as well as connection-specific configuration notes, are provided in the chapters titled “Communication with …” in this user’s guide.

Note

The operating units belonging to the Panel PC range as well as the FI 25, FI 45 and OP 37/Pro, are subsequently referred to under the general term ’Panel PC’.

This general definition of terms is only deviated from when absolutely necessary. In such cases, the operating units are referred to individually.

1.1 Connections and Protocols

Function of the operating unit

Messages and tags are read in, displayed, stored and recorded on the operating units. The operating units can also be used to intervene in the process.

The term *operating unit* is used throughout this guide when settings are described which apply to all the following units:

- Panel PC
- Standard PC
- MP 370
- MP 270, MP 270B
- TP 270, OP 270
- TP 170B, OP 170B
- TP 170A

Data Exchange

A condition for the operating and monitoring functions is the connection of the operating unit to a PLC. The exchange of data between the operating unit and the PLC is controlled by a connection-specific protocol. Each connection requires its own protocol.

Criteria for selecting the type of connection

Criteria for selecting the type of connection between operating unit and PLC include:

- the type of PLC
- the CPU in the PLC
- the type of operating unit
- the number of operating units per PLC
- the structure and, if applicable, the bus system used, by an existing installation,
- the work and expense involved in any additional components required.

Protocols

Protocols are available for the following PLCs:

- **SIMATIC S5**
  - AS 511
  - PROFIBUS-DP
- **SIMATIC S7**
  - MPI
  - PPI
  - PROFIBUS-DP

- **SIMATIC 500/505**
  - NITP
  - PROFIBUS-DP
- **SIMATIC WinAC**
  - SIMATIC S7-300/400
- **SIMOTION**
  - PROFIBUS-DP
- **OPC**
  - DCOM
- **Allen Bradley PLC series SLC500, SLC501, SLC502, SLC503, SLC504, SLC505, PLC5/20 and MicroLogix**
  - DF1
  - DH+ via DF1
  - DH485 via DF1
  - DH485
- **GE Fanuc Automation PLC series 70 and 90-Micro**
  - SNP/SNPX
- **LG Industrial Systems (Lucky Goldstar)/IMO – PLC series GLOFA-GM or G4, G6 and G7M**
  - Dedicated communication
- **Mitsubishi Electric PLC series MELSEC FX and MELSEC FX0**
  - FX

  Mitsubishi Melsec PLC series FX, A, AnS, Q and QnAS
  - Protocol 4
- **OMRON PLC series SYSMAC C, SYSMAC CV, SYSMAC CS1, SYSMAC alpha and CP**
  - HostLink/MultiLink
- **Schneider Automation (Modicon) – PLC series Modicon 984, TSX Quantum and TSX Compact**
  - Modicon Modbus
- **Schneider Automation (Telemecanique) – PLC series Micro, Premium and TSX 7 and TSX 17**
  - Uni-Telway

1.2 Operating Unit and Possible Protocols

Selection criteria

Table 1-1 provides an overview of the operating units which can be used. The decisive factors in making the correct choice of connection are the type of PLC used and the network configuration which exists.

Table 1-1 Operating unit and possible protocols

Siemens PLC or manufacturer	Protocol	Panel PC 670 Panel PC 870 Panel PC IL	Standard PC	FI 25 FI 45	OP37/Pro
SIMATIC S5	AS511	x	x	x	x
	PROFIBUS-DP	x	x	x	x
SIMATIC S7	MPI	[1]	[1]	[1]	[1]
	PPI	x	x	x	x
	PROFIBUS-DP	x	x	x	x
SIMATIC 500/505	NITP	x	x	x	x
	PROFIBUS-DP	x	x	x	x
SIMATIC WinAC	SIMATIC S7-300/400	x	x	x	x
	SIMATIC S7 - WinAC	x	x	x	–
SIMOTION	PROFIBUS-DP	x	x	x	x
OPC	DCOM[3]	x	x	x	–
Allen Bradley	DF1[5], DH+[4]	x	x	x	x
	DH485[6]	[2]	[2]	[2]	x
GE-Fanuc Automation	SNP/SNPX	x	x	x	x
LG Industrial Systems/IMO	Dedicated communication	x	x	x	x
Mitsubishi Electric	FX	x	x	x	x
Mitsubishi Melsec	Protocol 4	x	x	x	x
Omron	HostLink/MultiLink	x	x	x	x
Schneider Automation (Modicon)	Modicon Modbus	x	x	x	x
Schneider Automation (Telemecanique)	Uni-Telway	x	x	x	x

x Possible
– Not possible

1 Not possible with connection to S7-212
2 DH485 restricted by Windows NT ad Windows 2000 operating systems on PC
3 Valid for Windows NT with SP 5 and Windows 2000
4 Valid for SLC500, PLC5/20, MicroLogix PLCs
5 Valid for SLC500, PLC5/20 PLCs via DF1
6 Valid for SLC500, MicroLogix PLCs

Table 1-2 Operating unit and possible protocols

Siemens PLC or manufacturer	Protocol	MP 370	MP 270 MP 270B	TP 270 OP 270	TP 170B OP 170B	TP 170A
SIMATIC S5	AS511	x	x	x	x	x
	PROFIBUS-DP	x	x	x	x	–
SIMATIC S7	MPI	[1]	[1]	[1]	[1]	[1]
	PPI	x	x	x	x	x
	PROFIBUS-DP	x	x	x	x	x
SIMATIC 500/505	NITP	x	x	x	x	x
	PROFIBUS-DP	x	x	x	x	–
SIMATIC WinAC	SIMATIC S7-300/400	x	x	x	x	x
	SIMATIC S7 - WinAC	–	–	–	–	–
SIMOTION	PROFIBUS-DP	x	x	x	x	–
OPC	DCOM[2]	–	–	–	–	–
Allen Bradley	DF1[3], DH+[4]	x	x	x	x	x
	DH485[5]	x	x	x	x	x
GE-Fanuc Automation	SNP/SNPX	x	x	x	x	x
LG Industrial Systems/IMO	Dedicated communication	x	x	x	x	x
Mitsubishi Electric	FX	x	x	x	x	x
Mitsubishi Melsec	Protocol 4	x	x	x	x	x
Omron	HostLink/ MultiLink	x	x	x	x	x
Schneider Automation (Modicon)	Modicon Modbus	x	x	x	x	x
Schneider Automation (Telemecanique)	Uni-Telway	x	x	x	x	x

x Possible
– Not possible

1 Not possible with connection to S7-212
2 Valid for Windows NT with SP 5 and Windows 2000
3 Valid for SLC500, PLC5/20, MicroLogix PLCs
4 Valid for SLC500, PLC5/20 PLCs via DF1
5 Valid for SLC500, MicroLogix PLCs

1.3 Conversion on Changing PLCs

Changing the PLC

If the PLC is changed in a configuration, ProTool cannot convert the data formats used by the old PLC for the new one. For this reason, the connection of the tags to the PLC are disconnected following a warning. If a tag is then called, the symbolic name – `No PLC` – is specified in the field *PLC*. This does not happen using ProTool when implementing a newer version of the PLC driver or when changing to a PLC within the same PLC family.

Changing within the same PLC range

ProTool retains connection of the tags to the PLC when changing to a PLC in the same unit family. If data types are used for the change which are not relevant for the new PLC, they are identified as invalid data formats. The invalid data types can be modified. This concerns the following PLCs:

- Changing the CPU using the SIMATIC S5 when different data formats are supported,
- Changing from Allen Bradley SLC500 to PLC5/20 and vice versa,

  The Allen Bradley SLC500 and Allen Bradley PLC5/20 PLCs have various drivers for the connection of an operating unit with ProTool installed. During the conversion between the two PLCs, **all** the tags are identified as invalid or the connection is disconnected.
- Changing from SIMATIC S7-300/400 to WinAC and vice versa.

Modifying data formats

Call in the dialog box for the tag with a double click. The old, invalid data format is displayed. Change the data format to a valid one.

Part II Connection to SIMATIC S5

Communication Management with SIMATIC S5

2

This chapter describes the communication between the operating unit and SIMATIC S5.

Programmable logic controllers

Connection using AS 511 and PROFIBUS-DP is supported by the following PLCs:

PLC	AS 511	PROFIBUS-DP
PLC 90U	x	–
PLC 95U	x	–
AG 95U DP Master	x	x
AG 100U (CPU 100, CPU 102, CPU 103)	x	–
AG 115U (CPU 941, CPU 942, CPU 943, CPU 944, CPU 945)	x	x
AG 135U (CPU 922, CPU 928A, CPU 928B)	x	x
AG 155U (CPU 946/947, CPU 948)	x	x

Operating units

The following operating units can be connected to a SIMATIC S5 PLC:

- Panel PC
- Standard PC
- MP 370
- MP 270, MP 270B
- TP 270, OP 270
- TP 170B, OP 170B
- TP 170A

Installation

The drivers for the connection to a SIMATIC S5 PLC are a component part of the ProTool configuration software and are installed automatically.

The parameters defining the connection to the PLC can be set in ProTool. Please refer to Chapters 3 and 4 for information regarding which parameters are necessary on the PLC side to connect the operating unit.

Function blocks

Function blocks FB 158 and FB 159 are necessary for the connection to PROFIBUS-DP and are supplied with ProTool. These function blocks are examples and support linear P-addressing. The function blocks can be adapted for individual requirements at any time.

The function blocks are located in directory `PROTOOL\PLCPROG\SIMATICS5`. The function blocks to be implemented are dependent on the PLC. Table 2-1 lists the directories for the various PLCs. Copy all the files from the relevant directory in your STEP 5 program.

Table 2-1 PLC-dependent directories for function blocks

PLC	Directory
AG 95U DP Master	*AG95DP*
PLC 115U	*AG115U\CPU941_4* for CPU 941 to 944 *AG115U\CPU945* for CPU 945
PLC 135U	*AG135U*
PLC 155U	*AG155U*

Compatibility of ProTool V5.0x to newer versions

Newer versions of ProTool do not support exactly the same data formats as ProTool V5.0x for some PLCs. However, it is still possible to used your configuration. After calling in the configuration using a newer version of ProTool, the configuration window item object type *Tags* displays “invalid data format”. The configuration can be edited but not created. This concerns PLCs connected to PROFIBUS-DP.

Call in the dialog box for the tag with a double click. The old, invalid data format is displayed. Change the data format to a valid one.

2.1 Data Types

When configuring tags and area pointers, the data types listed in Table 2-2 are available for use.

Table 2-2 Data types for the operating unit

Data type	Addressed by	Format
Data block – word	DB DW	KF, KH, KM, KY, KC, KT, KZ, Bit
Data block – double word	DB DD	DF, DH, KC, KG, Bit
Extended data block – word[1]	DX DW	KF, KH, KM, KY, KC, KT, KZ, Bit
Extended data block – double word[1]	DX DD	DF, DH, KC, KG, Bit
Input word	IW	KF, KH, KM, KY, KC, KT, KZ, Bit[2)]
Input double word	ID	DF, DH, KC, KG, Bit[2)]
Output word	OW	KF, KH, KM, KY, KC, KT, KZ, Bit[2)]
Output double word	OD	DF, DH, KC, KG, Bit[2)]
Flag word	MW	KF, KH, KM, KY, KC, KT, KZ, Bit[2)]
Flag double word	fD	DF, DH, KC, KG, Bit[2)]
Timer	T	KT, KH, KM
Counter	Z	KZ, KH, KM
SFlagWord[1)]	S	KF, KH, KM, KY, KC, KT, KZ, Bit
SFlagDWord[1)]	SD	DF, DH, KC, KG, Bit

1 This data format is not supported by all CPUs and is not possible using PROFIBUS-DP.
2 This data format is not supported by all CPUs.

2.2 Optimization

Acquisition cycle and update time

The acquisition cycles defined in the configuration software for the area pointers and the acquisition cycles for the tags are major factors in respect of the real update times which are achieved.

The update time is the acquisition cycle plus transmission time plus processing time.

In order to achieve optimum update times, the following points should be observed during configuration:

- When setting up the individual data areas, make them as large as necessary but as small as possible.
- Define data areas that belong together as contiguous areas. The real update time is improved by setting up one large are area instead of several small areas.
- Setting acquisition cycles which are too short unnecessarily impairs overall performance. Set the acquisition cycle to correspond to the modification time of the process values. The rate of change of temperature of a furnace, for example, is considerably slower than the acceleration curve of an electric motor.

  Guideline value for the acquisition cycle: 1 second
- If necessary, dispense with cyclic transmission of user data areas (acquisition cycle = 0) in order to improve the update time. Instead, use PLC jobs to transfer the user data areas at random times.
- Store the tags for a message or a screen in a contiguous data area.
- In order that changes on the PLC are reliably detected, they must occur during the actual acquisition cycle at least.
- Set the baud rate to the highest possible value.

Screens

The real screen updating rate which can be achieved is dependent on the type and quantity of data to be displayed.

In order to achieve short updating times, ensure that short acquisition cycles are only defined in the configuration for those objects which actually need to be updated quickly.

Trends

If, in the case of bit-triggered trends, the communication bit is set in the “trend transfer area”, the operating unit always updates all the trends whose bit is set in that area. It resets the bits afterwards.

The communication bit in the PLC program can only be set again after all the bits have been reset by the operating unit.

PLC jobs

If large numbers of PLC jobs are sent to the operating unit in quick succession, communication between the operating unit and PLC may become overloaded.

If the operating unit enters the value 0 in the first data word of the job mailbox, it signifies that the operating unit has accepted the job. It then processes the job, for which it requires a certain amount of time. If a new PLC job is then immediately entered in the job mailbox, it may take some time before the operating unit executes the next PLC job. The next PLC job is only accepted when sufficient computer performance is available.

Read DB address list cyclically (AS 511 only)

It is only necessary to read the DB address list for each access to the PLC if, for example, new data areas are set up during the start-up phase. For subsequent operation, this function should be deactivated for performance reasons.

2.3 Error Prevention

Data block modification

Danger

Modification of data blocks is not permitted when the system is in operation.

Neither is it permitted to compress the internal program memory of the AG (PU function “Compress”, integrated FB COMPR) when an operating unit is connected!

The compressing process alters the absolute addresses of the blocks in the program memory. Since the operating unit only reads the address list during startup, it does not detect any address modifications and subsequently accesses the wrong memory areas.

If compression during normal operation cannot be avoided, the operating unit must be switched off before compression takes place.

Danger

In potentially explosive areas, always disconnect the operating unit from the power supply before disconnecting connectors.

Operating unit connected to SI2 of the CPU

If both CPU interfaces are used for communication via the AS 511, the second interface is operated with a lower priority. A possible configuration is, e.g.: PU on SI1 and operating unit on SI2. In this case, error messages may occur on the operating unit relating to a communication fault. This behavior only occurs in the extreme in the case of the 928B CPU.

3 AS 511 Connection to SIMATIC S5

This chapter describes the communication between the operating unit and SIMATIC S5 PLC using the AS 511 connection.

Installation

The drivers for the connection to a SIMATIC S5 PLC are a component part of the ProTool configuration software and are installed automatically.

Connection of the operating unit to the PLC is basically restricted to the physical connection of the operating unit. Special function blocks for connection to the PLC are not required.

Connection

The operating unit is connected directly to the CPU. Please refer to Table 3-1 for information concerning the connection cables to be used.

The CPU interface SI1 with the TTY physical characteristics should be used, preferably. The CPU interface SI2 with the TTY physical characteristics can also be used, if available. In the case of the SI2 interface, however, performance limitations must be taken into account.

Details of which interface to use on the operating unit are provided in the relevant equipment manual.

Table 3-1 Applicable connection cables (refer to Appendix, Part C Interface Assignment)

Operating unit	Connection cable[2]
Panel PC 670 (COM 1, COM 2) Panel PC 870 (COM 1, COM 2)	COM 1: 6ES5 734-2B_ _ _
Panel PC IL (COM 1, COM 2)[1]	6ES5 734-1BD20
Standard PC (COM 1, COM 2)	6ES5 734-1BD20
FI 25, FI 45 (COM 1, COM 2)	COM 1: 6ES5 734-2B_ _ _
OP37/Pro	6XV1 440-2A_ _ _
MP 370, MP 270	6XV1 440-2A_ _ _
MP 270B + V.24/TTY converter	6ES5 734-1BD20
TP 270 + V.24/TTY converter	6ES5 734-1BD20
OP 270 + V.24/TTY converter	6ES5 734-1BD20
TP 170B + V.24/TTY converter	6ES5 734-1BD20

Table 3-1 Applicable connection cables (refer to Appendix, Part C Interface Assignment)

Operating unit	Connection cable[2]
OP 170B + V.24/TTY converter	6ES5 734-1BD20
TP 170A + V.24/TTY converter	6ES5 734-1BD20

'_' Enter length code
1 The COM 2 interface is assigned internally by the TFT display.
2 The connection cables fit all CPUs in the SIMATIC S5 PLCs.

3.1 Basic Functioning Method

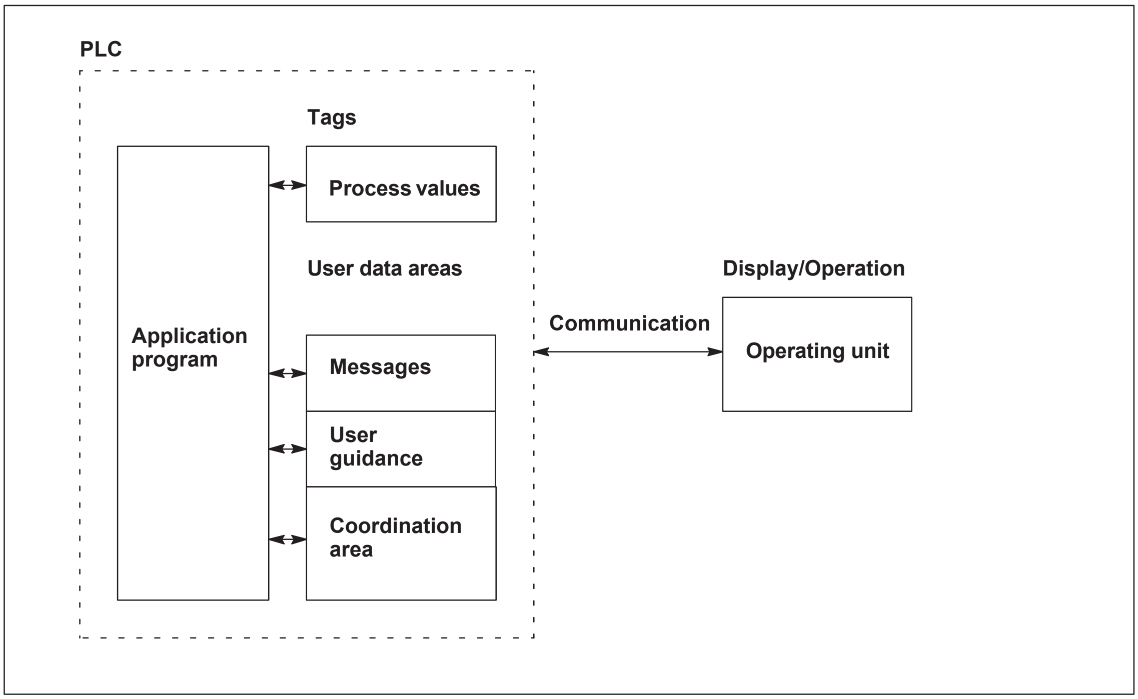


Figure 3-1 Communication structure

Task of the tags

The general exchange of data between the PLC and operating unit is performed by means of the process values. To do this, tags must be specified in the configuration which point to an address in the PLC. The operating unit reads the value from the specified address and displays it. In the same way, the operator can enter a value on the operating unit, which is then written to the address in the PLC.

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

User data areas are required, for example, for:

- Trends
- PLC jobs
- Controlling LEDs
- Life bit monitoring

A detailed description of the user data areas is provided in Chapter 5.

3.2 ProTool Configuration for AS 511

When creating a new project, the project assistant requests the definition of the PLC. Select the driver `SIMATIC S5 AS511` and then define the parameters, indicated below, after clicking on the *Parameter* button. For any subsequent parameter modifications, select the item *PLC* in the project window.

Define the following parameters for the PLC:

Table 3-2 PLC parameters

Parameters	**Explanation**
CPU type	Select a SIMATIC S5 CPU.
Interface	Select the interface on the operating unit via which the connection is to be established. The following applies for operating unit interfaces which should be used for communication: Do not use the `Remote` option for the download. This is the `IF1A` interface in the case of the MP 270. This can be interface COM `1` or COM `2` in the case of a PC.
Type Data bits Parity Stop bits Baud rate	These parameters are specifically defined for connection type AS 511.
DB address	If *Read DB Address List Cyclically* is selected, the address list is read in anew in the case of each operating unit read/write access to the PLC. This is important during commissioning if modules are set up, modified or deleted in the PLC. **Note** The *Read DB Address List Cyclically* setting has a direct effect on the performance and should, therefore, not be used when the system is in operation.

4 PROFIBUS-DP Connection to SIMATIC S5

This chapter describes the communication between the operating unit and SIMATIC S5 PLC using the PROFIBUS-DP connection.

Definition

PROFIBUS-DP is a Master-Slave field bus with up to 122 slaves. The PROFIBUS-DP network is normally operated by one master. This master polls all the slaves cyclically. The master is, for example, a PLC with a standard DP-compatible connection module. Each operating unit is a slave and explicitly assigned to a master PLC.

The connection of the PROFIBUS-DP slave is compatible to PROFIBUS-DP Norm EN 50170, Volume 2.

Operating units

The following operating units can be connected to the SIMATIC S5 via the PROFIBUS-DP:

- Panel PC
- Standard PC with communication processor CP 5611 or CP 5511
- MP 370
- MP 270, MP 270B
- TP 270, OP 270
- TP 170B, OP 170B

Further hardware requirements

The following hardware components are required in order to integrate operating units in an existing PROFIBUS-DP network:

- In the PLC:
  - IM 308C
  - CP 5431
  - AG 95U/DP
- For each unit (operating unit or PLC):

  A PROFIBUS-DP bus connector or a different component approved for this installation (except FSK bus terminal, refer to Configuration in SIMATIC HMI Catalog ST80.1).

Software requirements

The following software components are also required for the PROFIBUS-DP connection:

- ProTool configuration software, from V5.1
- COM PROFIBUS from V3.x

Installation

The drivers for the connection to a SIMATIC S5 PLC are a component part of the ProTool configuration software and are installed automatically.

Both the physical connection as well as a function block in the PLC are required for connection of the operating unit to the SIMATIC S5. The function block is supplied with ProTool/Pro.

Second bus master

In special cases, it is possible to connect another PLC with a standard DP-compatible master module to a PROFIBUS-DP network. The operating units can then be distributed between both masters.

System limits

Within a network established via the PROFIBUS-DP, a maximum of 120 of the 122 slaves may be an operating unit. These values are theoretical limits. The real limits are determined by the memory capacity and performance capability of the PLC.

4.1 Basic Functioning Method

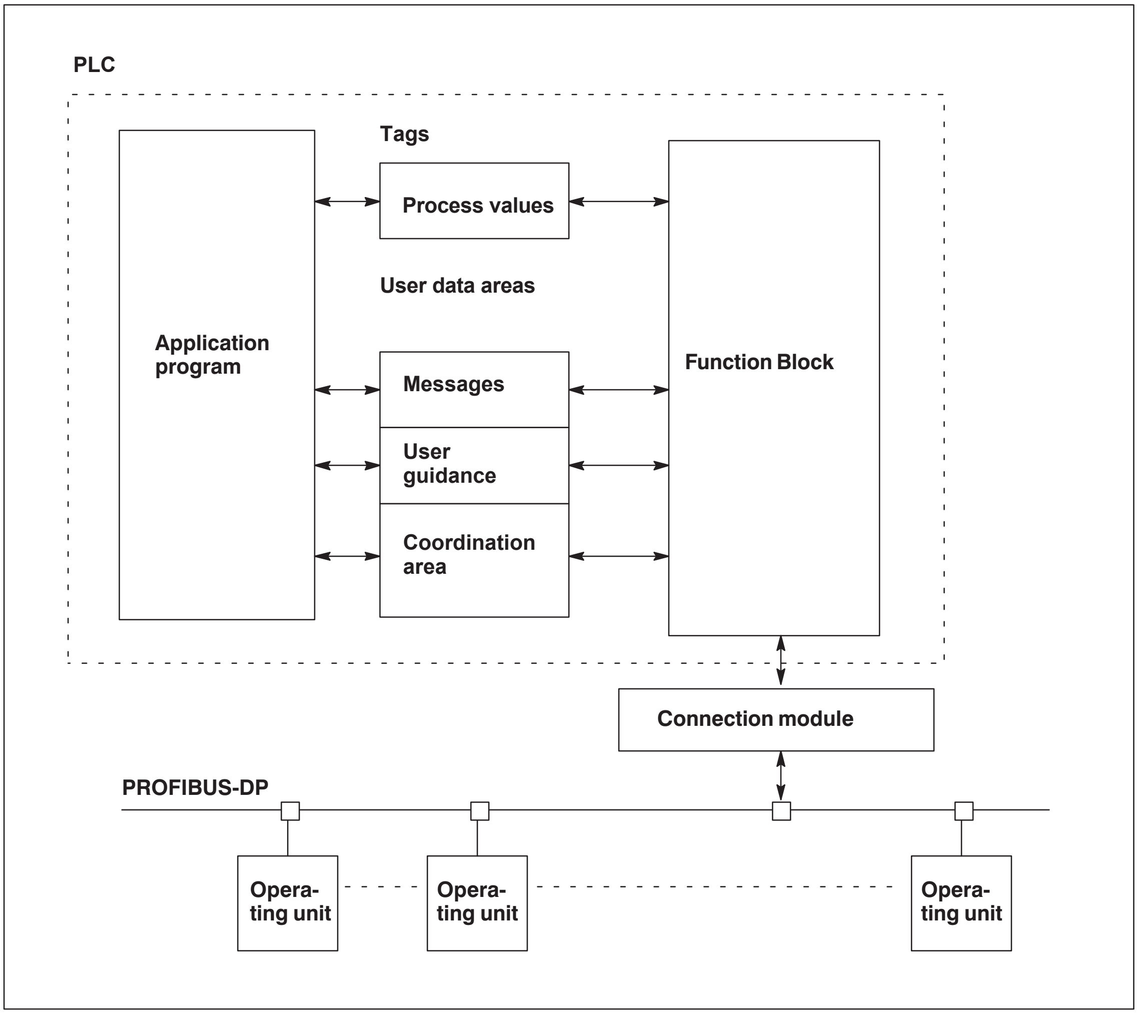


Figure 4-1 Communication structure

Task of the tags

The general exchange of data between the PLC and operating unit is performed by means of the process values. To do this, tags must be specified in the configuration which point to an address in the PLC. The operating unit reads the value from the specified address and displays it. In the same way, the operator can enter a value on the operating unit, which is then written to the address in the PLC.

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

User data areas are required, for example, for:

- Trends
- PLC jobs
- Controlling LEDs
- Life bit monitoring

A detailed description of the user data areas is provided in Chapter 5.

Tasks of the function blocks

The operating unit and PLC communicate via a PROFIBUS-DP master module. The function blocks FB 158 and FB 159 must be installed in the STEP 5 application program. The task of the function blocks is to coordinate the data exchange and to monitor the connection to the operating unit. The FB 158 is responsible for recording the process, the FB 159 reads the data in and out of the memory. The FB 159 should only be available in the PLC and must not be called in by the user.

Setting up the interface

The interface is set up as follows under Windows:
Settings → Control Panel → Set PU/PC interface.

Access point of the application	DPSONLINE
Module configuration used	PROFIBUS DP slave

No settings need to be defined when using units with Windows CE, such as the MP 270.

4.2 Configuring the Function Block

Addressing the function blocks

The function blocks supplied with ProTool are examples and support linear P-addressing. The function blocks can be adapted for individual applications at any time.

The following table explains which modifications are necessary for the respective types of addressing when both function blocks supplied, FB 158 and FB 159, are used.

Type of addressing	Modifications
Linear P-range	Not necessary
Linear Q-range	The P-addresses must be changed to Q-addresses in both the FB 158 and FB 159.
P-page frame	Before calling the FB 158, the page frame number must be entered in the periphery byte. Example: `LKB x TPY 255`
Q-page frame	Before calling the FB 158, the page frame number must be entered in the periphery byte. The P-addresses must be changed to Q-addresses in both the FB 158 and FB 159. Example: `LKB x TQB 255`

The following table indicates the permissible address range, according to the type of addressing, for all PLCs except S5 95U.

Type of addressing	Permissible address range
Linear P-range	128 to 255
Linear Q-range[1)]	0 to 255
P-page frame	192 to 254
Q-page frame[1)]	0 to 254

1 Only possible using S5 115U with CPU 945, S5 135U and S5 155U.

In the case of AG 95U, the permissible address range is between 64 and 191. Since the address 127 physically lies within a range different from address 128, a block may not be set up with overlapping ranges. This results in the address ranges 64 to 127 and 128 to 191.

Calling FB 158

The FB 158 must be called in the cyclic program, e.g. OB 1, with the following parameters:

- **PERA**:

  Periphery start address. It must correspond to the configuration in COM PROFIBUS.

- **BLEN**:

  Block length. (Not with AG 95U, with which only 'tiny' is possible.)

  0: tiny

  1: small

  2: middle

  3: big

  The block length must correspond to the configuration in ProTool (*PLC → Parameters)*.

- **CADB**:

  A free DB is used by the FB 158 as working memory. The FB 158 uses the first 11 words of the DB to buffer data temporarily. From the 11th data word, the DB can be used by the user.

After calling in the FB 158, the number of any error which may have occurred appears in AKKU 1. This error must be analyzed in the STEP 5 program because the error number is reset the next time an FB is called.

Example for calling in FB 158:

```
      :SPA FB 158
NAME  :DPHMI
PERA  :KF 128
BLEN  :KF 0
CADB  :DB 58
```

Multiple calling of FB 158

When using several units, the FB must be called in once for each unit.

Note

The performance is increased considerably when the FB 158 is called in from an Alarm OB and the PLC polling time is greater than the alarm time.

4.3 Configuration of ProTool for PROFIBUS-DP

Parameters

When creating a new project, the project assistant requests the definition of the PLC. Select the driver `SIMATIC S5 AS511` and then define the parameters, indicated below, after clicking on the *Parameter* button. For any subsequent parameter modifications, select the item *PLC* in the project window.

Define the following parameters for the PLC:

Table 4-1 PLC parameters

Parameters	Explanation
OP address	PROFIBUS-DP address of the operating unit. Value range 3 to 125
Interface	Select the interface on the operating unit via which the connection is to be established. In the case of Panel PC, standard PC and FI 25/45, this is `DP/MPI`. In the case of OP 37/Pro, MP 370, MP 270, MP 270B, TP 270, OP 270, TP 170B and OP 170B, this is `IF1B`. In the case of the OP37/Pro, ASPC2 must also be activated in the BIOS. In the *Integrated Peripherals* mask, set the BIOS entry *ASPC2* to `Enabled`.
Baud rate	The baud rate at which communication takes place over the network. The baud rate must be set to the same value for all the units in the network. The following baud rates are possible: – 93.75 kBit/s – 187.5 kBit/s – 500 kBit/s – 1.5 MBit/s (default) – 3 MBit/s – 6 MBit/s – 12 MBit/s
Set configuration	Used to define the I/O area for the communication range between the operating unit and PLC. The size of the I/O area influences the performance. Four different set configurations can be selected: – Class B tiny – Class B small – Class B middle – Class B big Table 4-2 indicates the assignment of the I/O area.

The settings in ProTool must match the configuration specifications of the connection module IM 308C.

Set configuration

The assignment of the I/O areas is defined with the four different settings. Table 4-2 provides details of the I/O area assignment.

Table 4-2 Assignment of the I/O areas for Class B

Class	Inputs (Byte)	Outputs (Byte)
Class B tiny	32	22
Class B small	42	22
Class B middle	64	32
Class B big	122	64

In order to download large quantities of data, it is recommended to set up a large I/O area. This ensures the screen displays on the operating unit are updated more quickly because the data is retrieved in one cycle.

4.3.1 Other SIMATIC S5 PROFIBUS-DP Master Modules

Requirements

The operating units can use PROFIBUS-DP to communicate with all the master modules which support PROFIBUS-DP complying to EN 50170, Volume 2.

Notes on configuration

Please refer to the relevant module description for information on configuration of further PROFIBUS-DP master modules. Observe the following performance data when connecting the operating unit to a PROFIBUS-DP network:

- Configure the operating unit as a PROFIBUS-DP slave, complying to EN 50170, Volume 2.
- The address scope (block size) of the I/O area must be defined for each operating unit.
- Enter the corresponding manufacturer ID of the unit (refer to Table 4-4).
- The modes “SYNC” and “FREEZE” are not supported by the operating unit.
- User-configured data is not possible.

- Only use one of the following operating unit baud rates (disregard any other setting possibilities in the configuration software):
  - 93.75 kBit/s
  - 187.5 kBit/s
  - 500 kBit/s
  - 1.5 Mbit/s
  - 3 MBit/s
  - 6 MBit/s
  - 12 MBit/s
- A time of 3 ms must be set as the “Min. slave-interval” for all operating units.
- Configure the operating unit periphery address area as a combined I/O area with byte consistency. The combined I/O areas have the following identifications:

Class	Identification
Class B tiny	0x3F, 0x35, 0x19
Class B small	0x3F, 0x35, 0x1F, 0x13
Class B middle	0x3F, 0x3F, 0x1F
Class B big	0x3F, 0x3F, 0x3F, 0x3F, 0x1F, 0x1F, 0x1F, 0x19

There are no other consistency requirements.

CP 5430 TF and CP 5431 FMS

The configuration user interface PROFIBUS-NCM is required to configure the communication processors CP 5430 TF (from version 2) and CP 5431 FMS (from version 1). The notes on configuration on Page 4-8 apply. Only the special features for the CP 5430/5431 are described here.

Please refer to the relevant module description for information on configuration of the communication processors using PROFIBUS-NCM.

We recommend setting the following parameters according to Table 4-3:

Table 4-3 Recommended parameters for PROFIBUS-NCM

Parameters	Setting
Bus parameter data	Apply "calculated parameters"
DP operating mode	Free running
Trigger monitoring	"No" applicable for operating unit
Polling cycle time	Min. 5 ms; as small as possible
Largest min. slave interval	3 ms

Only linear P-addressing is permissible for type of addressing.

FB-SYNCHRON must be called in the start-up organization modules OB 20, OB 21 and OB 22:

Example call for SIMATIC S5-115U:

```
      :SPA FB 249       Call in HTB SYNCHRON
NAME  :SYNCHRON
SSNR  :KY 0.8           Interface no. (page frame no.)
BLGR  :KY 0.5           Block size
PAFE  :MB 255           HTB error messages
```

4.4 Configuring the PROFIBUS-DP Network

Connection module IM 308C

The COM PROFIBUS configuration packet is necessary in order to configure the IM 308C. The GSD files for the operating unit slaves are supplied with ProTool. These GSD files are located in the directory `\PROTOOL\PLCPROG\GSD`.

Different GSD files are required according to the various operating units. Table 4-4 indicates the assignment.

Table 4-4 Assignment of GSD files and operating units

GSD files	Manufacturer ID	Operating unit
SIEM8076.GSD	0x8076	Panel PC, standard PC, FI 25/45
SIEM8077.GSD	0x8077	OP37/Pro
SIEM80BE.GSD	0x80BE	MP 370
SIEM8078.GSD	0x8078	MP270
SIEM80E4.GSD	0x80E4	MP 270B, OP 270, TP 270
SIEM80B3.GSD	0x80B3	TP 170B, OP 170B

If the GSD files in the COM PROFIBUS directory `\PROTOOL\PLCPROG\GSD` are older than the GSD files supplied with ProTool, or the COM PROFIBUS does not support a new operating unit, copy the files from ProTool to COM PROFIBUS. Then restart the COM PROFIBUS and select `Read GSD files`.

If a COM PROFIBUS configuration was created previously with an older file but the new GSD files are now required for use, the configuration must be recreated.

Note

A master system must be configured for the connection module IM 308C.

Parameters

In order that the IM 308C and operating unit can communicate with each other, the following parameters must be set in COM PROFIBUS:

- **Station type**: *HMI*
- **Station number**: 3–125

  The value entered here must correspond with the OP address specified in the operating unit configuration.
- **Set configuration**:

  The set configuration is defined by selecting the class and symbolic name of the configuration. The following set configurations can be set:

  – Class B tiny

  – Class B small

  – Class B middle

  – Class B big

- **Address ID**:

  The address ID is automatically assigned by the set configuration and must not be modified.

- **I and O address**:

  The address must correspond to the FB configuration (refer to Chapter 4.2).

5 User Data Areas for SIMATIC S5

Overview

User data areas are used for data exchange between the PLC and operating unit.

The user data areas are written to and read by the operating unit and the application program alternately during the process of communication. By analyzing the data stored there, the PLC and operating unit reciprocally initiate predefined actions.

This chapter describes the function, layout and special features of the various user data areas.

5.1 User Data Areas Available

Definition

User data areas can be located in data blocks and memory areas in the PLC.

Set up the user data areas both in the ProTool project and in the PLC.

The user data areas can be set up and modified in the ProTool project using the menu items *Insert → Area Pointers*.

Function range

The user data areas available are dependent on the operating unit used. The tables 5-1 and 5-2 provide an overview of the functional range of the individual operating units.

Table 5-1 User data areas available, Part 1

User data areas	Panel PC	Standard PC	MP 370
User version	x	x	x
Job mailbox	x	x	x
Event messages	x	x	x
Screen number	x	x	x
Data mailbox	x	x	x
Date/Time	x	x	x
Date/Time PLC	x	x	x
Coordination	x	x	x
Trend request	x	x	x
Trend transfer 1, 2	x	x	x
LED assignment [1]	x	–	x
OP/PLC acknowledgement	x	x	x
Alarm messages	x	x	x

1 Only possible using operating units with keyboard.

Table 5-2 User data areas available, Part 2

User data areas	MP 270 MP 270B	TP 270 OP 270	TP 170B OP 170B	TP 170A
User version	x	x	x	–
Job mailbox	x	x	x	–
Event messages	x	x	x	x
Screen number	x	x	x	–
Data mailbox	x	x	x	–
Date/Time	x	x	x	–
Date/Time PLC	x	x	x	x
Coordination	x	x	x	–
Trend request	x	x	–	–
Trend transfer 1, 2	x	x	–	–
LED assignment [1]	x	x	x	–
OP/PLC acknowledgement	x	x	x	–
Alarm messages	x	x	x	–

1 Only possible using operating units with keyboard.

Table 5-3 illustrates the way in which the PLC and operating unit access the individual user data areas – Read (R) or Write (W).

Table 5-3 Application of the user data areas

User data areas	Necessary for	Operating unit	PLC
User version	ProTool Runtime checks whether the ProTool project version and the project in the PLC are consistent.	R	W
Job mailbox	Triggering of functions on the operating unit by PLC program	R/W	R/W
Event messages	Bit reporting process arrival and departure of event messages	R	W
Screen number	Evaluation by the PLC as to which screen is currently open	W	R
Data mailbox	Transfer of data records with synchronization	R/W	R/W
Date/Time	Transfer of date and time from the operating unit to the PLC	W	R
PLC date/time	Transfer of date and time from the PLC to the operating unit.	R	W
Coordination	Operating unit status polled by the PLC program	W	R
Trend request	Configured trends with “Triggering via bit” or configured history trends	W	R
Trend transfer 1	Configured trends with “Triggering via bit” or configured history trends	R/W	R/W
Trend transfer area 2	Configured history trend with “switch buffer”	R/W	R/W
LED assignment area	LED triggered by the PLC	R	W
Operating unit acknowledgement	Message from the operating unit to the PLC indicating an alarm message has been acknowledged	W	R
PLC acknowledgement	Alarm message acknowledgement from the PLC	R	W
Alarm messages	Bit reporting process arrival and departure of alarm messages	R	W

The user data areas and their associated area pointers are explained in the following chapters.

5.2 User Data Area, User Version

Usage

When starting up the operating unit, it is possible to check whether the operating unit is connected to the correct PLC. This is important when several operating units are used.

To do this, the operating unit compares a value stored in the PLC with the value defined in the configuration. In this way, the compatibility of the configuration data with the PLC program is ensured. If there is a mismatch, a system message appears on the operating unit and the runtime configuration is terminated.

In order to use this user data area, set up the following during the configuration:

- Specify the configuration version – value between 1 and 255.

  ProTool: *System* → *Settings*
- Data address of the value for the version stored in the PLC:

  ProTool: *Insert* → *Area Pointers*, available types: *User version*

Danger

The user version is only checked while the connection is being established when ProTool Runtime is started. If the PLC is subsequently changed, the user version is not checked.

5.3 User Data Area Job Mailbox

Description

The job mailbox can be used to send PLC jobs to the operating unit, thus initiating actions on the operating unit. These functions include:

- Displaying screens
- Setting date and time

The job mailbox is set up under *Area Pointer* and has a length of four data words.

The first word of the job mailbox contains the job number. Depending on the PLC job in question, up to three parameters can then be specified.

Data Word	Left byte (LB)	Right byte (RB)
n+0	0	Job no.
n+2	Parameter 1	
n+4	Parameter 2	
n+6	Parameter 3	

Figure 5-1 Structure of the user data area, job mailbox

If the first word of the job mailbox is not equal to zero, the operating unit analyzes the PLC job. The operating unit then sets this data word to zero again. For this reason, the parameters must be entered in the job mailbox first and then the job number.

The possible PLC jobs, including job number and parameters, are provided in the “ProTool Online Help” and the Appendix, Part B.

5.4 User Data Area, Event and Alarm Messages and Acknowledgement

Definition

Messages consist of a static text and/or tags. The text and tags can be defined by the user.

Messages are subdivided into event messages and alarm messages. The programmer defines the event message and alarm message.

Event messages

An event message indicates a status, e.g.

- `Motor switched on`
- `PLC in manual mode`

Alarm messages

An alarm message indicates an operational fault, e.g.

- `Valve not opening`
- `Motor temperature too high`

Acknowledgement

Since alarm messages indicate an abnormal operational status, they must be acknowledged. They can be acknowledged either by

- operator input on the operating unit
- setting a bit in the PLC acknowledgement area.

Triggering messages

A message is triggered by setting a bit in one of the message areas on the PLC. The location of the message areas is defined by means of the configuration software. The corresponding area must also be set up in the PLC.

As soon as the bit in the PLC event/alarm message area has been set and that area has been transferred to the operating unit, the operating unit detects that the relevant message has “arrived”.

Conversely, when the same bit is reset on the PLC by the operating unit, the message is registered as having “departed”.

Message areas

Table 5-4 indicates the number of message areas for event and alarm messages, for alarm acknowledgement OP (Operating unit → PLC) and for alarm acknowledgement PLC (PLC → Operating unit) and the number of words for the various operating units.

Table 5-4 Division of message areas

Operating unit	**Event message area, Alarm message area Acknowledgement area OP, Acknowledgement area PLC**	
	Number of data areas, maximum	**Words in data area, total**
Panel PC	8	125
Standard PC	8	125
MP 370	8	125
MP 270, MP 270B	8	125
TP 270, OP 270	8	125
TP 170B, OP 170B	8	125
TP 170A	8	125[1]

1 Only possible for event messages.

Assignment of message bit and message number

A message can be assigned to each bit in the message area configured. The bits are assigned to the message numbers in ascending order.

Example:

The following event message area has been configured in the PLC:

`DB 60        Address 43  Length 5` (in words)

Figure 5-2 shows the assignment of all 80 (5 x 16) message numbers to the individual bit numbers in the PLC event message area. The assignment is performed automatically on the operating unit.

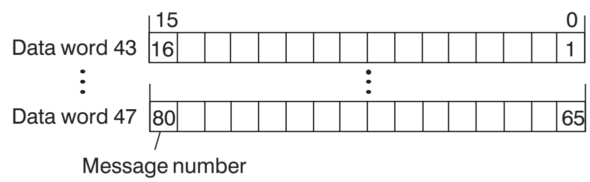


Figure 5-2 Assignment of message bit and message number

User data areas, acknowledgement

If the PLC should be informed of an alarm message acknowledgement on the operating unit or the acknowledgement should be initiated on the PLC itself, the relevant acknowledgement areas must also be set up in the PLC. These acknowledgement areas must also be specified in the ProTool project under *Area Pointers*.

- **Acknowledgement area Operating Unit → PLC**:

  This area is used to inform the PLC when an alarm message has been acknowledged by means of operator input on the operating unit. The “Alarm Ack. OP” area pointer must be created or configured for this.

- **Acknowledgement area PLC → Operating Unit**:

  This area is used when an alarm message is acknowledged by the PLC. In this case, the area pointer “PLC acknowledgement” must be set.

These acknowledgement areas must also be specified in the configuration under *Area Pointers*.

Figure 5-3 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 5-5 and 5-6.

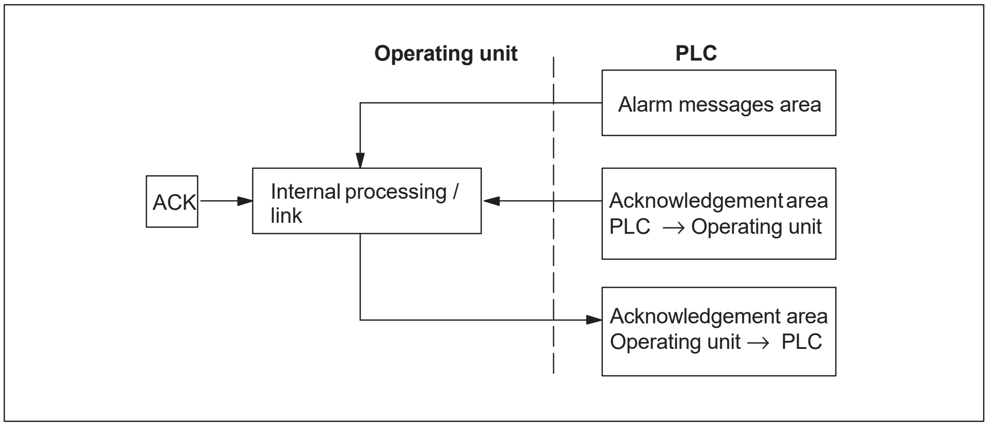


Figure 5-3 Alarm message and acknowledgement areas

Assignment of acknowledgement bit to message number

Each alarm message is assigned a message number. The message number is assigned the same bit number in the alarm messages area as that assigned in the acknowledgement area. Under normal circumstances, the acknowledgement area is the same length as the associated alarm messages area.

If the length of an acknowledgement area is not equal to the overall length of the associated alarm messages area, and there are succeeding alarm messages and acknowledgement areas, the following assignment applies:

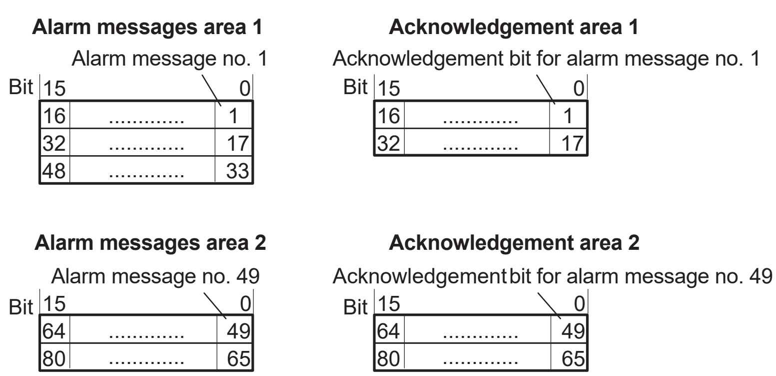


Figure 5-4 Assignment of acknowledgement bit and message number

Acknowledgement area PLC → Operating Unit

A bit set in this area by the PLC initiates the acknowledgement of the corresponding alarm message in the operating unit, thus fulfilling the same function as pressing the ACK button. Reset the bit before setting the bit in the alarm message area again. Figure 5-5 shows the signal diagram.

The acknowledgement area PLC → Operating Unit

- must follow on immediately from the associated alarm messages area,
- must have precisely the same polling time and
- may not be any longer than the associated alarm messages area.

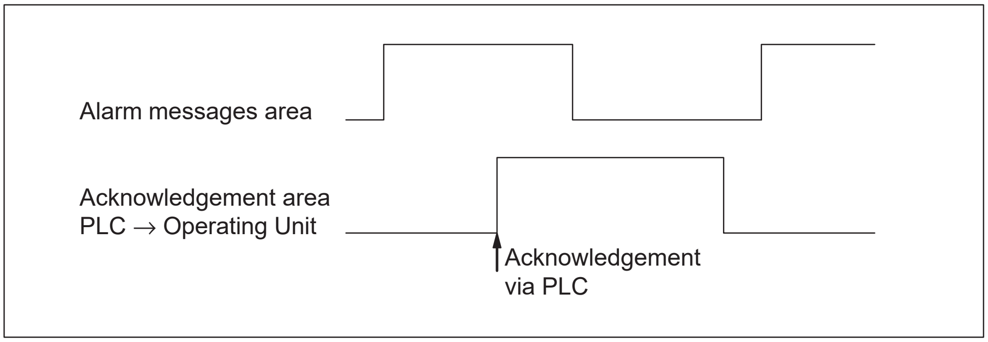


Figure 5-5 Signal diagram for acknowledgement area PLC → Operating Unit

Acknowledgement area Operating Unit → PLC

When a bit is set in the alarm message area, the operating unit resets the associated bit in the acknowledgement area. As a result of processing by the operating unit, the two processes indicate a slight difference with regard to time. If the alarm message is acknowledged on the operating unit, the bit in the acknowledgement area is set. In this way, the PLC can detect that the alarm message has been acknowledged. Figure 5-6 illustrates the signal diagram.

The acknowledgement area Operating Unit → PLC must be no longer than the associated alarm messages area.

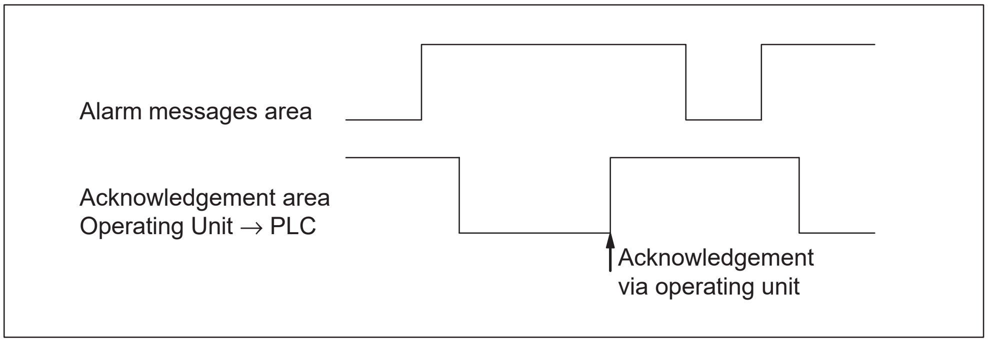


Figure 5-6 Signal diagram for acknowledgement area Operating Unit → PLC

Acknowledgement area size

The acknowledgement areas PLC → Operating Unit and Operating Unit → PLC must not be any longer than the associated alarm message areas. The acknowledgement area, however, can be smaller if the acknowledgement by the PLC is not required for all alarm messages. This is also valid when the acknowledgement need not be detected in the PLC for all alarm messages. Figure 5-7 illustrates such a case.

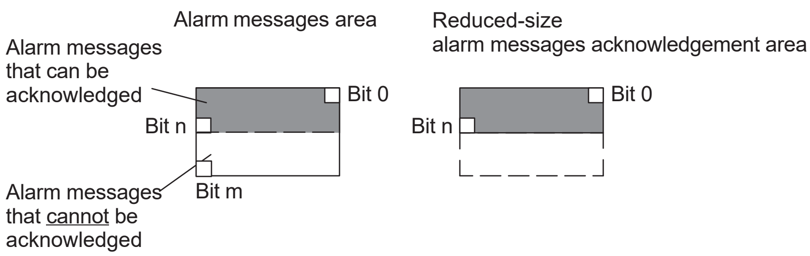


Figure 5-7 Reduced-size acknowledgement area

Note

Place important alarm messages in the alarm messages area starting at Bit 0 in ascending order.

5.5 User Data Area, Screen Numbers

Application

The operating units store information concerning the screen currently open on the unit in the screen number user data area.

This enables the transfer of data regarding the current operating unit display content to the PLC which, in turn, can trigger certain reactions; e.g. call in a different screen.

Condition

If the screen number area should be used, it must be specified in the ProTool project as an *Area Pointer*. It can only be stored in one PLC and only once.

The screen number area is downloaded to the PLC spontaneously, i.e. the transfer is always initiated when a change is selected on the operating unit. Therefore, it is not necessary to configure an acquisition cycle.

Structure

The screen number area is a data area with a fixed length of 5 data words.

The structure of the screen number area in the PLC memory is illustrated below.

	7 0	7 0
1st Word	Current screen type	
2nd Word	Current screen number	
3rd Word	Reserved	
4th Word	Current field number	
5th Word	Reserved	

Entry	Assignment
Current screen type	1 for basic screen or 4 for fixed window
Current screen number	1 to 65535
Current field number	1 to 65535

5.6 User Data Area, Date/Time

Transferring date and time

Transfer of date and time from the operating unit to the PLC can be triggered by PLC job 41. PLC job 41 writes the date and time to the data area Date/Time where they can be analyzed by the PLC program. Figure 5-8 illustrates the structure of the data area. All data is in BCD format.

	DL	DR	
DW	15 8	7 0	
n+0	Reserved	Hour (0–23)	Time
n+1	Minute (0–59)	Second (0–59)	Time
n+2	Reserved		Time
n+3	Reserved	Weekday (1–7, 1=Sun)	Date
n+4	Day (1–31)	Month (1–12)	Date
n+5	Year (80–99/0–29)	Reserved	Date

Figure 5-8 Structure of data area **Time** and **Date**

Note

When entering data in the year data area, please note that the values 80–99 represent 1980 to 1999 and 0–29 the years 2000 to 2029.

5.7 User Data Area, Date/Time PLC

Transfer of date and time to the operating unit

The downloading of date and time to the operating unit is generally useful when the PLC is master for time.

The TP 170A operating unit represents a special case here:

Synchronization with the PLC system time is necessary when a `Single message display` screen object is to be inserted in a ProTool screen. The `Single message display` screen object is the only TP 170A screen object which has access to the unit's system time. This restriction only applies to the TP 170A.

DATE_AND_TIME format (BCD coded)

	DL	DR	
DW	15 8	7	0
n+0	Year (80–99/0–29)	Month (1–12)	
n+1	Day (1–31)	Hour (0–23)	
n+2	Minute (0–59)	Second (0–59)	
n+3	Reserved	Reserved	Weekday (1–7, 1=Sun)

Figure 5-9 Structure of data area Date/Time in DATE_AND_TIME format

Note

When entering data in the year data area, please note that the values 80–99 represent 1980 to 1999 and 0–29 the years 2000 to 2029.

The PLC writes cyclically to the data area, whereby the operating unit reads and synchronizes (refer to the ProTool User's Guide).

Note

In the configuration, do not select too small an acquisition cycle for the Date/Time area pointer because this affects the operating unit performance.

Recommendation: Acquisition cycle of 1 minute, if permitted by the process.

5.8 User Data Area, Coordination

The coordination user data area is two data words long. It serves to realize the following functions:

- Detection of operating unit startup by the PLC program,
- Detection of the current operating unit operating mode by the PLC program,
- Detection by the PLC program that the operating unit is ready to communicate.

Note

Each time the coordination area is updated by the operating unit, the entire coordination area is written.

Therefore, the PLC program must not execute any modifications in the coordination area.

Bit assignment in coordination area

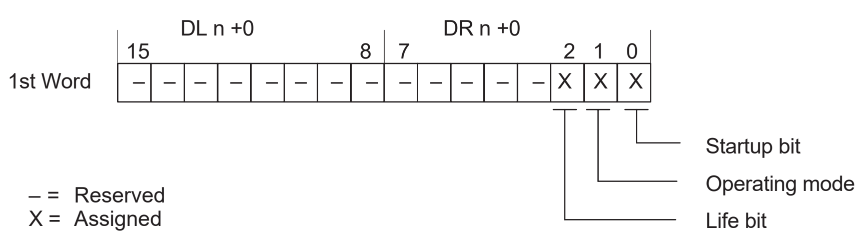


Figure 5-10 Significance of the bits in the coordination area

Startup bit

The startup bit is set to 0 for a short time during the start-up routine by the operating unit. After the startup routine has been completed, the bit is set permanently to 1.

Operating mode

As soon as the operating unit has been switched offline by the operator, the operating mode bit is set to 1. When the operating unit is working in normal operation, the operating mode bit is set to 0. The PLC program can be used to poll this bit and thus establish the current operating mode of the operating unit.

Life bit

The life bit is inverted by the operating unit at intervals of approx. one second. The PLC program can be used to poll this bit to check whether connection to the operating unit still exists.

5.9 User Data Area, Trend Request and Trend Transfer

Trends

A trend is the graphical representation of a value from the PLC. Reading of the value can be time-triggered or bit-triggered, depending on the configuration.

Time-triggered trends

The operating unit reads in trend values cyclically, according to the time interval defined in the configuration. Time-triggered trends are suitable for continuous progressions such as the operating temperature of a motor.

Bit-triggered trends

By setting a trigger bit in the trend transfer area pointer, the operating unit reads in either a trend value or the entire trend buffer. This is specified in the configuration. Bit-triggered trends are normally used to display values of an area subject to rapid variation. An example of this is the injection pressure for plastic moldings.

In order to be able to activate bit-triggered trends, corresponding data areas have to be specified in the ProTool project (under *Area Pointers*) and set up on the PLC. The operating unit and the PLC communicate with one another via those areas.

The following areas are available for trends:

- Trend request area
- Trend transfer area 1
- Trend transfer area 2 (required with switch buffer only)

Assign a trend to a bit in the configuration. This ensures the bit assignment is unique for all areas.

Switch buffer

The switch buffer is a second buffer for the same trend and can be set up during the configuration.

While the operating unit reads the value from Buffer 1, the PLC writes it in Buffer 2. If the operating unit reads from Buffer 2, the PLC writes to Buffer 1. This prevents the trend value being overwritten by the PLC when being read by the operating unit.

Partitioning of the area pointer

The trend request and trend transfer 1 and 2 area pointers, can be divided into separate data areas with a predefined maximum number and length (Table 5-5).

Table 5-5 Partitioning of the area pointer

	Data area		
	Trend request	Trend transfer	
		1	2
Number of data areas, maximum	8	8	8
Words in data area, total	8	8	8

Trend request area

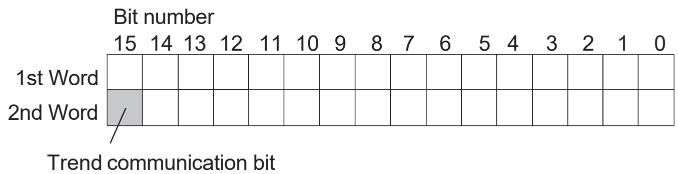
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

The trend request area can be used by the PLC to ascertain which trend is currently being displayed on the operating unit. Trends can also be triggered without analysis of the trend request area.

Trend transfer area 1

This area serves to trigger trends. In the PLC program, set the bit assigned to the trend in the trend transfer area and the trend communication bit. The operating unit detects triggering and reads in either a trend value or the entire buffer. It then resets the trend bit and the trend communication bit.

Trend transfer area(s)



The trend transfer area must not be altered by the PLC program until the trend communication bit has been reset.

Trend transfer area 2

Trend transfer area 2 is necessary for trends that are configured with a switch buffer. Its layout is precisely the same as that of trend transfer area 1.

5.10 User Data Area, LED Assignment

Application

The Operator Panel (OP), Multi Panel (MP) and Panel PC have function keys with Light Emitting Diodes (LEDs) integrated in them. These LEDs can be controlled from the PLC. This means, for example, that in specific situations, it is possible to indicate to the operator which key should be pressed by switching on an LED.

Condition

In order to control LEDs, corresponding data areas, so-called LED assignments, must be set up in the PLC and defined in the configuration as *area pointers*.

Partitioning of the area pointer

The LED assignment area pointer can be divided into separate data areas, as illustrated in the following table.

Table 5-6 Partitioning of the area pointer

Operating unit	Number of data areas, maximum	Words in data area, total
Panel PC	8	16
MP 370	8	16
MP 270, MP 270B	8	16
OP 270	8	16
OP 170B	8	16

Note

The area pointer in question can no longer be selected in the *Insert new area pointer* window when the maximum number has been reached. Area pointers of the same type appear gray.

LED assignment

The assignment of the individual LEDs to the bits in the data areas is defined when the function keys are configured. This involves specifying a bit number within the assignment area for each LED.

The bit number (n) identifies the first of two successive bits which control the following LED states (refer to Table 5-7):

Table 5-7 LED states

Bit n + 1	Bit n	LED function
0	0	Off
0	1	Flashes
1	0	Flashes
1	1	Permanently on

5.11 Recipes

Description

During the transfer of data records between the operating unit and PLC, both communication peers alternately access common communication areas in the PLC. The function and structure of the recipe-specific communication area (“data mailbox”) and the mechanisms involved in synchronized transfer of data records are the subject of this chapter.

Information on setting up the data mailbox in ProTool is provided in the online help.

Downloading methods

There are two methods of downloading data records between operating unit and PLC:

- Asynchronous transfer (Page 5-19)
- Synchronized transfer using the data mailbox (Page 5-20)

Data records are always transferred directly, i.e. the tag values are read or written directly from or to the address configured for the tag without being stored intermediately.

Trigger downloading of data records

There are three methods of triggering the transfer of data:

- By operator input on the recipe display (Page 5-21)
- By PLC jobs (Page 5-22)
- By activating configured functions (Page 5-23)

If transfer of data records is initiated by a configured function or a PLC job, the recipe display on the operating unit remains fully functional as the data records are transferred in the background.

Simultaneous processing of multiple transfer jobs is not possible, however. In such cases, the operating unit returns a system message refusing additional transfer requests.

A list of the most important system messages together with notes on the possible causes of the associated errors and remedies for them is provided in Appendix, Part A.

5.11.1 Asynchronous data transfer

Purpose

In the case of asynchronous transfer of data records between operating unit and PLC, there is **no** coordination of the communication areas commonly used. For this reason, there is no need to set up a data mailbox during the configuration process.

Application

The **asynchronous** transfer of data records is applicable, for example, when

- the uncontrolled overwriting of data by the communication peers can be reliably prevented by the system,
- the PLC does not require any details of the recipe and data record numbers, or
- the transfer of data records is initiated by operator input on the operating unit.

Read values

On triggering a read transfer, the values are read from the PLC addresses and downloaded to the operating unit.

- **Transfer initiated by operator input on recipe display**:

  Data is uploaded to the operating unit. There it can be processed, e.g. values can be modified and the changes saved.

- **Transfer initiated by function or PLC job**:

  The data is saved directly to the storage medium.

Write values

On triggering a write transfer, the values are written to the PLC addresses.

- **Transfer initiated by operator input on recipe display**:

  The current values are written to the PLC.

- **Transfer initiated by function or PLC job**:

  The values on the storage medium are written to the PLC.

5.11.2 Synchronous data transfer

Purpose

In the case of synchronous data transfer, both the communication peers set status bits in the commonly used data mailbox. In this way, the PLC program can prevent uncontrolled overwriting of each other's data by the two units.

Application

The **synchronous** transfer of data records is applicable, for example, when

- the PLC is the "active partner" for transfer of data records,
- details of the recipe and data record numbers are to be analyzed on the PLC, or
- transfer of data records is initiated by a PLC job.

Condition

In order to synchronize the transfer of data records between the operating unit and PLC, the following conditions must be fulfilled in the configuration:

- the data mailbox must have been set up in *System* → *Area Pointer*;
- the recipe properties must specify the PLC with which the operating unit has to synchronize transfer of data records.

  The PLC is specified in the recipe editor in *Properties* → *Transfer*.

Detailed information on this is provided in *ProTool Configuring Windows-based Systems* User Guide.

5.11.3 Data mailbox for synchronized data transfer

Structure

The data mailbox has a defined length of 5 words. Its structure is as follows:

	15 … 0
1st Word	Current recipe number (1 – 999)
2nd Word	Current data record number (0 – 65,535)
3rd Word	Reserved
4th Word	Status (0, 2, 4, 12)
5th Word	Reserved

Status word

The status word (Word 4) can assume the following values:

Value		Explanation
Decimal	Binary	
0	0000 0000	Transfer permitted, data mailbox is accessible
2	0000 0010	Transfer in progress
4	0000 0100	Transfer completed without errors
12	0000 1100	Errors occurred during transfer

5.11.4 Synchronization process

Read from the PLC by operating the recipe view

<table>
<tr><th>Step</th><th colspan="2">Action</th></tr>
<tr><td rowspan="2">1</td><td colspan="2">Check status word = 0?</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td>2</td><td>The operating unit enters the recipe number to be read and the status “Transfer in progress” in the data mailbox and sets the data record number to zero.</td><td rowspan="4">Operation cancelled and system message returned</td></tr>
<tr><td>3</td><td>The operating unit reads the values from the PLC and displays them in the recipe view.
In the case of recipes with synchronous tags, the values from the are also written in the tags.</td></tr>
<tr><td>4</td><td>The operating unit sets the status to “Transfer completed”.</td></tr>
<tr><td>5</td><td>In order to enable another transfer operation, the PLC program has to reset the status word to zero.</td></tr>
</table>

Write in the PLC by operating the recipe view

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number to be written and the status “Transfer in progress” in the data mailbox.	Operation cancelled and system message returned
3	The operating unit writes the current values to the PLC. In the case of recipes with synchronized tags, the modified values between the recipe views and tags are compared and then written to the PLC.	
4	The operating unit sets the status to “Transfer completed”.	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Read from the PLC by PLC job “PLC → DAT” (no. 69)

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the job and the status “Transfer in progress” in the data mailbox.	Operation cancelled and no message returned
3	The operating unit reads the value from the PLC and saves the value in the data record specified by the job.	
4	• If the option “Overwrite” has been specified for the job, existing data records are overwritten without prior warning. The operating unit sets the status to “Transfer completed”. • If “Do not overwrite” was specified in the job and the data record already exists, the operating unit terminates the process and enters `0000 1100` in the status word of the data mailbox.	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Details of the structure of the PLC job are provided on Page 5-25.

Write in the PLC by PLC job “DAT → PLC” (no. 70)

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the job and the status “Transfer in progress” in the data mailbox.	Operation cancelled and no message returned
3	The operating unit retrieves the value from the data record specified in the job from the data medium and writes that value in the PLC.	
4	The operating unit sets the status to “Transfer completed”.	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Details of the structure of the PLC job are provided on Page 5-25.

Read from the PLC by configured function

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the function and the status “Transfer in progress” in the data mailbox.	Operation cancelled and system message returned
3	The operating unit reads the data from the PLC and saves it to the data record specified by the function.	
4	• If the option “Overwrite” has been specified for the function, existing data records are overwritten without prior warning. The operating unit sets the status to “Transfer completed”. • If “Do not overwrite” was specified in the job and the data record already exists, the operating unit terminates the process and enters `0000 1100` in the status word of the data mailbox.	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Write in the PLC by configured function

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the function and the status “Transfer in progress” in the data mailbox.	Operation cancelled and system message returned
3	The operating unit retrieves the value from the data record specified in the function from the data medium and writes that value in the PLC.	
4	The operating unit sets the status to “Transfer completed”.	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Note

For reasons of data consistency, analysis of the recipe and data record number on the PLC cannot be performed until the status in the data mailbox is set to “Transfer completed” or “Errors occurred during transfer”.

Possible causes of errors

If the downloading of data records is terminated due to errors, it may be due to one of the following reasons:

- Tag address not set up on PLC,
- Overwriting of data records not possible,
- Recipe number not available
- Data record number not available

A list of the most important system messages together with notes on the possible causes of the associated errors and remedies for them is provided in Appendix, Part A.

Response to error-based termination

The operating unit responds as follows when the downloading of data records is terminated due to an error:

- **Transfer initiated by operator input in recipe view**

  Indication on the status bar on the recipe view and issue of system messages.

- **Transfer initiated by function**

  System messages issued.

- **Transfer initiated by PLC job**

  No feedback of information on operating unit

Regardless of the response of the operating unit, the status of the transfer can be checked by reading the status word in the data mailbox.

5.11.5 PLC jobs for recipes

Purpose

The transfer of data records between operating unit and PLC can also be triggered by the PLC program. This requires no operator input on the operating unit.

The two PLC jobs **No. 69** and **No. 70** can be used for this.

No. 69: Read data record from PLC (“PLC → DAT”)

PLC Job **No. 69** downloads data records from the PLC to the operating unit. The structure of this PLC job is as follows:

	Left byte (LB)	Right byte (RB)
Word 1	0	69
Word 2	Recipe number (1 to 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	Do not overwrite existing data record: 0 Overwrite existing data record: 1	

No. 70: Write data record to PLC (“DAT → PLC”)

PLC Job **No. 70** downloads data records from the operating unit to the PLC. The structure of this PLC job is as follows:

	Left byte (LB)	Right byte (RB)
Word 1	0	70
Word 2	Recipe number (1 to 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	—	

Part III Connection to SIMATIC S7

Communication Management with SIMATIC S7

6

This chapter describes the communication between the operating unit and SIMATIC S7 PLC. All the network configurations are explained in which the operating unit can be integrated.

General information

With the PLC system SIMATIC S7, operating units can be connected via different network configurations. The network configuration depends on the CPU being used. The following network configurations are possible:

PLC		Protocol profile
Can be set in ProTool	**Modules**	
SIMATIC S7-300/400	CPU Communication-capable FM	MPI DP[1] Standard[1] Universal[1]
SIMATIC S7-200	CPU	PPI MPI[1] DP[1] Standard[1] Universal[1]

1 Only CPUs with a PROFIBUS-DP interface or CP module.

Operating units

The following operating units can be connected to a SIMATIC S7 PLC:

- Panel PC
- Standard PC
- MP 370

- MP 270, MP 270B
- TP 270, OP 270
- TP 170B, OP 170B
- TP 170A

Installation

The drivers for the connection to a SIMATIC S7 PLC are a component part of the ProTool configuration software and are installed automatically.

Connection of the operating unit to the PLC is basically restricted to the physical connection of the operating unit. Special function blocks for connection to the PLC are not required.

6.1 Basic Functioning Method

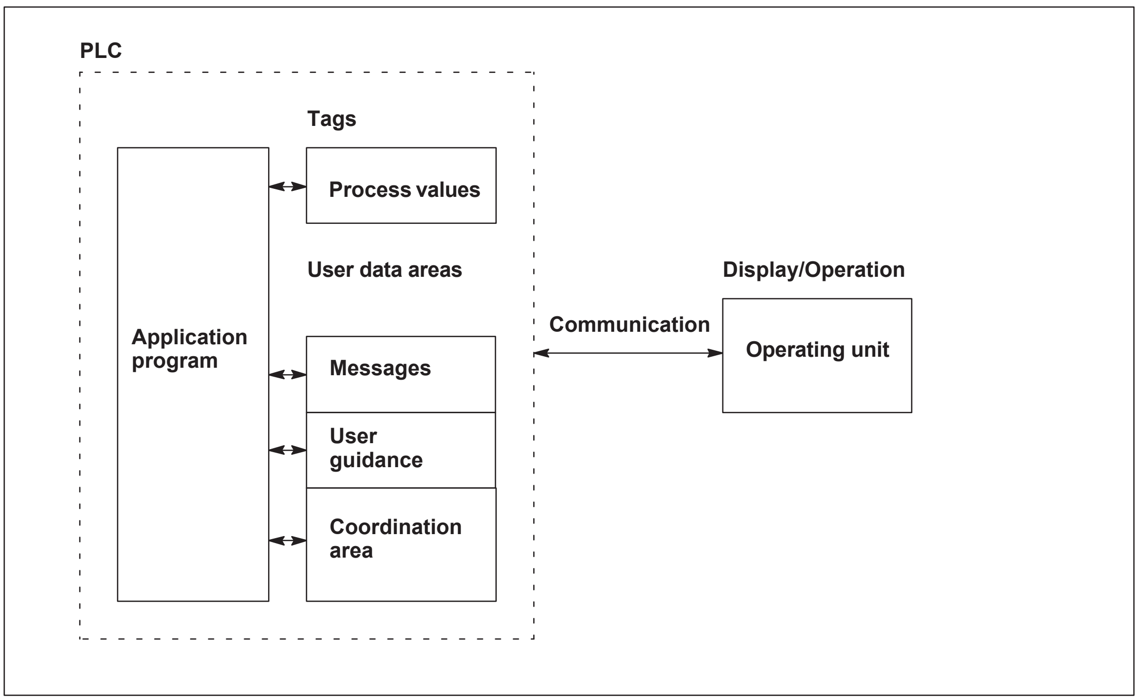


Figure 6-1 Communication structure

Task of the tags

The general exchange of data between the PLC and operating unit is performed by means of the process values. To do this, tags must be specified in the configuration which point to an address in the PLC. The operating unit reads the value from the specified address and displays it. In the same way, the operator can enter a value on the operating unit, which is then written to the address in the PLC.

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

A detailed description of the user data areas is provided in Chapter 7.

6.2 Configuring SIMATIC S7

Network configuration

The operating units communicate with the S7-200 and S7-300/400 via the S7 protocol. Connection is possible via both the MPI interface and the PROFIBUS interface of the CPU. The simplest network configuration consists of one CPU and one operating unit. A more complex configuration might consist of a CPU and several operating units, for example. Figure 6-2 depicts the various possible network configurations.

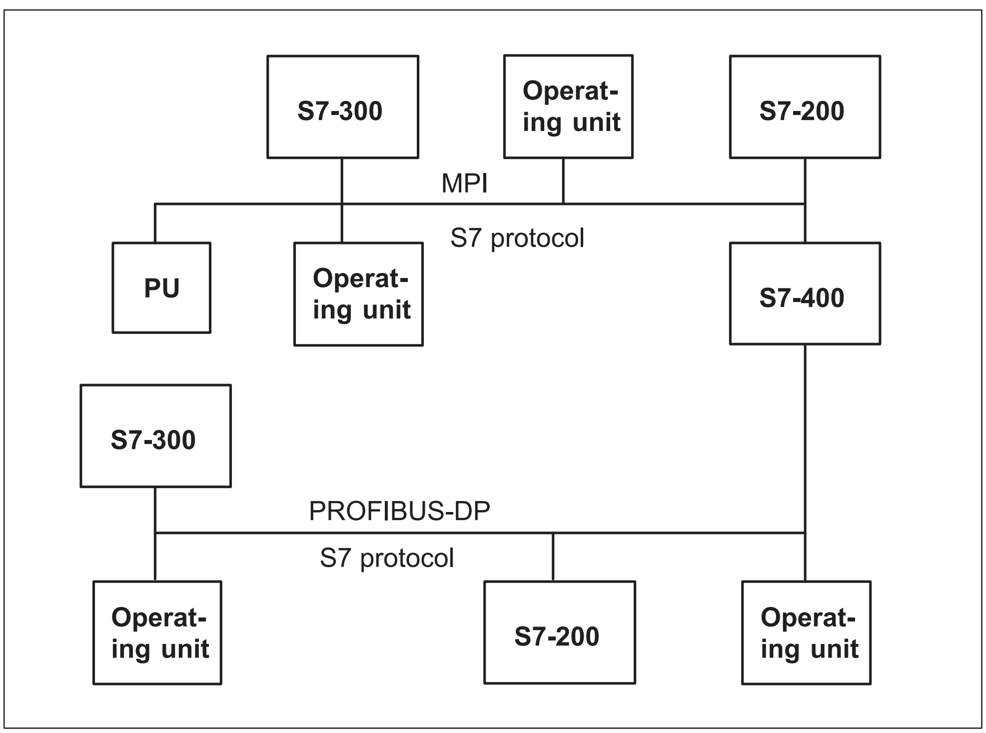


Figure 6-2 SIMATIC S7 network configurations

The following components have been approved for connecting the operating unit to a SIMATIC S7:

Table 6-1 Approved components

Components	Order number
SINEC L2 bus terminal RS 485	6GK1500-0A_006
SINEC L2 bus connector (straight)	6GK1500-0EA02
SINEC L2 bus connector (curved)[1)]	6ES7972-0B20-0XA0
SINEC L2 FO bus terminal	6GK1500-1A_00
Cable	6ES7901-0_ _ _0-0AA0

1 When using the curved bus connector, memory cards can no longer be removed or inserted.
'_' Length code

Connection of a PC to a SIMATIC S7 also requires the use of a Communication Processor (CP). Table 6-2 illustrates which operating system is approved for which communication processor.

Table 6-2 Communication processors and approved operating systems

Communication processor	Windows 98 SE	Windows Millenium	Windows NT 4.0
CP 5611	Yes	Yes	Yes
CP 5412 A2	No	No	Yes
CP 5511	Yes	Yes	Yes
CP 5613	No	No	Yes
CP 5614	No	No	Yes

Communication processor	Windows 2000 Professional	Windows XP Professional
CP 5611	Yes	Yes
CP 5412 A2	No	No
CP 5511	Yes	Yes
CP 5613	Yes	Yes
CP 5614	Yes	Yes

Data types

When configuring tags and area pointers, the data types listed in Tables 6-3 and 6-4 are available for use.

Table 6-3 Data types for S7-300/400

Data type	Addressed by	Format
Data block	DB	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING, TIMER, COUNTER, DATE, TIME, DATE AND TIME, TIME OF DAY
Flag	F	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING, TIMER, COUNTER, DATE, TIME, DATE AND TIME, TIME OF DAY
Input	E	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Peripheral input	PE	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Output	A	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Peripheral output	PA	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Timer	T	Timer
Counter	Z	Counter

Table 6-4 Data types for S7-200

Data type	Addressed by	Format
Tag	V	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Input	E	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Output	A	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Flag	F	CHAR, BYTE, INT, WORD, DINT, DWORD, REAL, BOOL, STRING
Timer	T	DINT
Counter	Z	INT

6.3 Connection to S7-200, S7-300 and S7-400 via MPI

Configuration

When connection is made via the MPI, the operating unit is connected to the MPI interface on the S7-300/400. Several operating units can be connected to one SIMATIC S7 and several SIMATIC S7s to an operating unit.

Figure 6-3 illustrates a possible network configuration. The numbers 1, 2, etc. are examples of addresses. The addresses of the S7 nodes are assigned via the STEP 7 hardware configuration or network configuration.

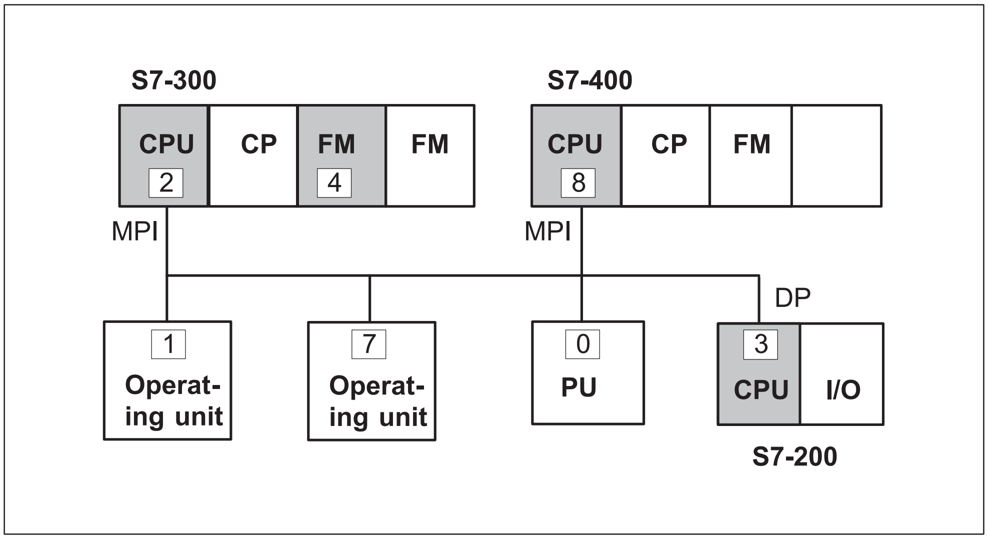


Figure 6-3 Connecting the operating unit to SIMATIC S7

Communication peer

Each SIMATIC S7 module which is capable of communication via the MPI connection represents a communication peer for the operating unit. This involves:

- every CPU
- communication-compatible function modules (FMs), such as the FM 353.

Modules that are communication-compatible are shown shaded in Figure 6-3.

Number of connectable operating units

An operating unit can exchange data with a maximum of eight communication peers (e.g. CPU or FM) simultaneously. In the case of S7-200, four communication peers are possible.

Similarly, a maximum number of connections to operating units is defined for each communication-compatible module. For example, three operating units can be connected simultaneously to a CPU 314 and thirty-one to a CPU 414-1. For details of the maximum number of connections that a module may have at a time, refer to the documentation for the module concerned.

Information on unit-specific restrictions is provided in the ProTool online help under the key word *System limits (Windows-based systems)*.

Operating unit configuration

In order that the operating unit can communicate and exchange data with a CPU or an FM, it must be correctly configured. To do this, the operating unit address must be defined in the configuration with ProTool and the connections to the communication peers configured.

When creating a new project, the project assistant requests the definition of the PLC. First of all, select the protocol `SIMATIC S7–200` or `SIMATIC S7–300/400` and then define the following parameters after clicking on the *Parameter* button. For any subsequent parameter modifications, select the item *PLC* in the project window.

Parameters

The parameters are divided into three groups.

- Use *OP Parameters* to enter the parameters for the operating unit in the network configuration. This is done only once. Any alteration to the operating unit parameters applies to all communication peers.
- Use *Network Parameters* to enter the parameters for the network to which the operating unit is linked. By clicking the *More* button, it is possible to set the HSA and the number of masters in the network.

  If ProTool has been installed in "STEP 7 integrated" and the operating unit is linked to the network, the network parameters are applied. Click the *More* button to display the global network parameters.
- Use *Peer Parameters* to address the S7 modules with which the operating unit should exchange data. A symbolic name has to be defined for each communication peer.

The individual parameters are explained in Table 6-5.

Setting up the interface

To define the interface, select
Start → Settings → Control Panel → Set PU/PC interface.

Access point of the application	S7ONLINE
Module configuration used	MPI (with MPI) PROFIBUS (with PROFIBUS)

No settings need to be defined when using units with Windows CE, such as the MP 270.

Table 6-5 Configuration parameters

Group	Parameters	Explanation
Operating unit parameters	Address	MPI address of the operating unit
	Interface	Interface on the operating unit with which the unit is connected to the MPI network.
	Only once master on the bus	This deactivates an additional protection function against bus faults when connecting the operating unit to the network. A passive station (slave) can only transmit data when requested to by an active station (master). If only slaves are connected to the operating unit, this protection function must be deactivated by activating the option *Only once master on the bus*. In the case of a S7-200, an operating unit must be defined as master.
Network parameters	Profile	The protocol profile used in the network configuration. Enter *MPI* here.
	Baud rate	The baud rate at which communication takes place over the network.
Peer parameters	Address	MPI address of the S7 module (CPU, FM or CP) to which the operating unit is connected.
	Slot[1]	Number of the slot containing the S7 module with which the operating unit exchanges data.
	Rack[1]	Number of the rack containing the S7 module with which the operating unit exchanges data.
	Cyclic operation[1]	If cyclical operation is activated, the PLC optimizes data transfer between the operating unit and PLC. This achieves a better performance. **Limitations:** Where several operating units are running in parallel operation, cyclical operation should be deactivated.
More button	HSA	Highest Station Address; this must be identical throughout the whole network configuration.
	Master	Number of masters in the network. This need only be specified in the case of a PROFIBUS network so that the bus parameters can be calculated correctly.

1 Not applicable for the SIMATIC S7-200.

6.3.1 Addressing the S7-300 using the MPI

MPI address

Each communication-capable module in the S7-300 has a unique MPI address which may only be assigned once within the entire network configuration. Only one CPU may be used in each rack. Figure 6-4 illustrates the direct connection of the operating unit to the MPI interface of the CPU.

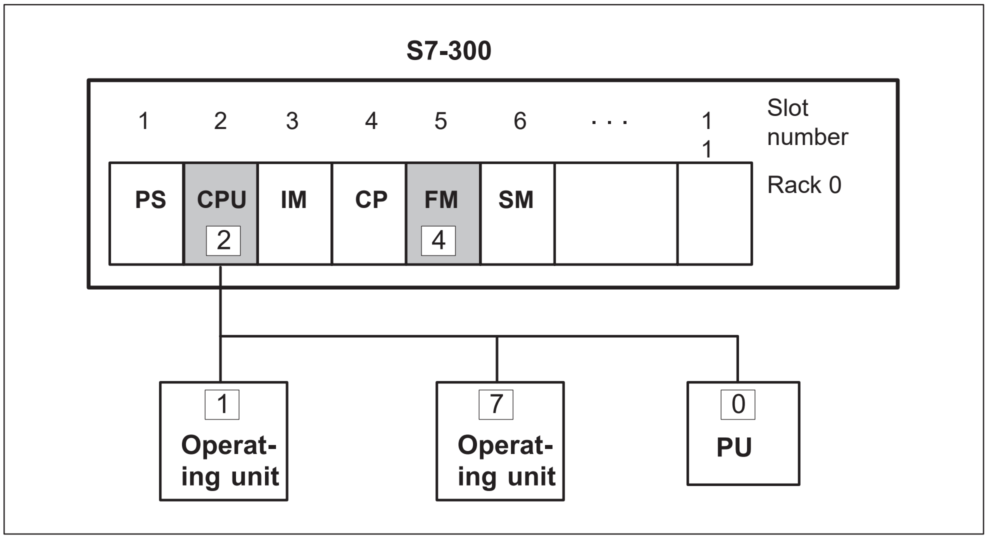


Figure 6-4 Network configuration with S7-300 and operating unit – one rack

Address of the peer

Differentiation must be made in the addressing between peers with an *own MPI address* and those *without an own MPI address*.

- In the case of peers with their own MPI address, only the MPI address needs to be specified. Slot and rack details are not relevant.
- In the case of peers without their own MPI address, the MPI address of the peer via which the connection is established must be specified. In addition, the slot and rack numbers of peers without their own MPI addresses must be specified.

Example

In order that the operating unit can communicate with the CPU illustrated in Figure 6-4, the following parameters must be specified for the *communication peer* S7-CPU:

Table 6-6 Example based on Figure 6-4

	Own MPI address	No own MPI address
Address	2	2
Slot number	0	2
Rack	0	0

These values are also defined as the default values in ProTool.

FM address

The operating unit can only communicate with FM modules which have an MPI address. This covers all the FMs connected to the K bus.

FMs which have no MPI address are connected to the P bus. This includes the FM 350, for example. The data from these FMs can be visualized on the operating unit by means of the I/O pattern of the CPU.

Table 6-7 Example based on Figure 6-4

	Own MPI address	No own MPI address
Address	4	2
Slot number	0	5
Rack	0	0

Number of racks

A S7-300 can be comprised of a maximum of 4 racks. The operating unit can communicate with any communication-compatible module in those racks. Figure 6-5 illustrates a configuration involving multiple racks and the allocation of addresses.

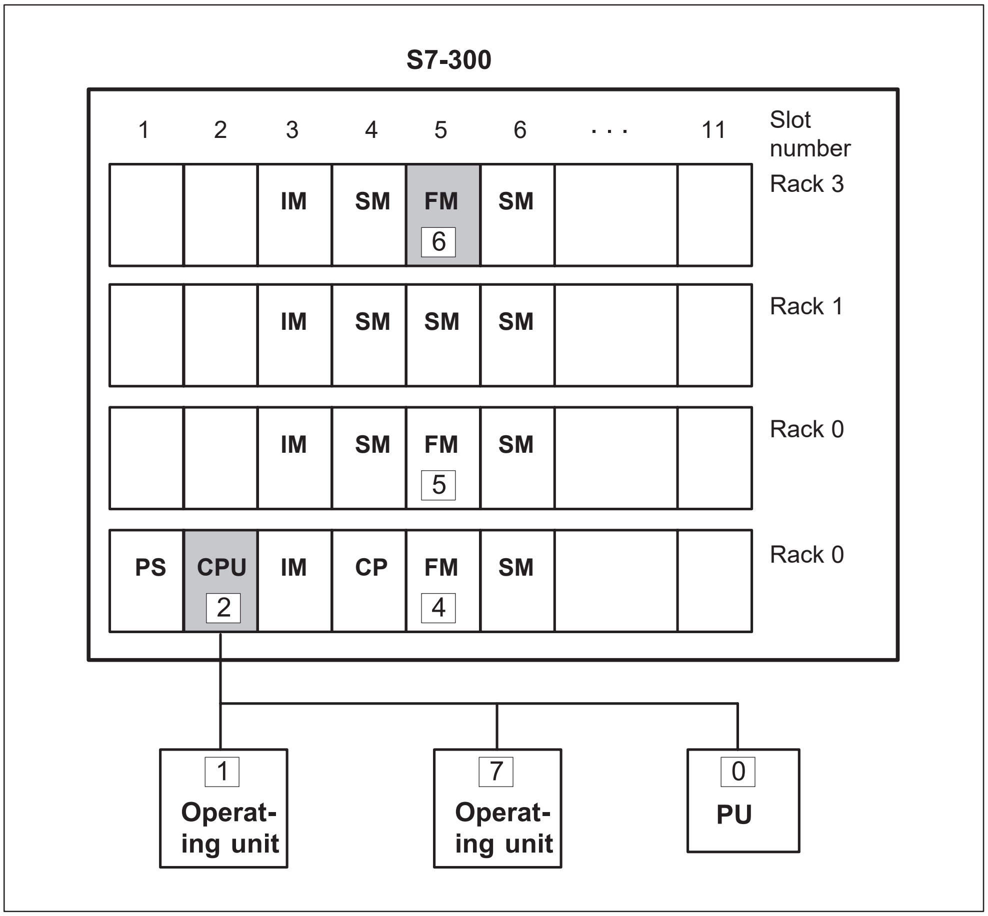


Figure 6-5 Network configuration with S7-300 and operating unit – four racks

Example

In order that the operating unit can communicate with the shaded FM illustrated in Figure 6-5, the following parameters must be specified for the *communication peer*:

Table 6-8 Example based on Figure 6-5

	Own MPI address	No own MPI address
Address	6	2
Slot number	0	5
Rack	0	3

6.3.2 Addressing the S7-400 using the MPI

MPI address

Only those modules equipped with an MPI connector have an MPI address. The MPI address must be unique within the network configuration. Modules which do not have an MPI connector are addressed indirectly by means of

- the MPI address of the module to which the operating unit is connected,
- the slot and rack in which the module is installed and with which the operating unit should communicate.

Figure 6-6 illustrates a simple network configuration with one rack.

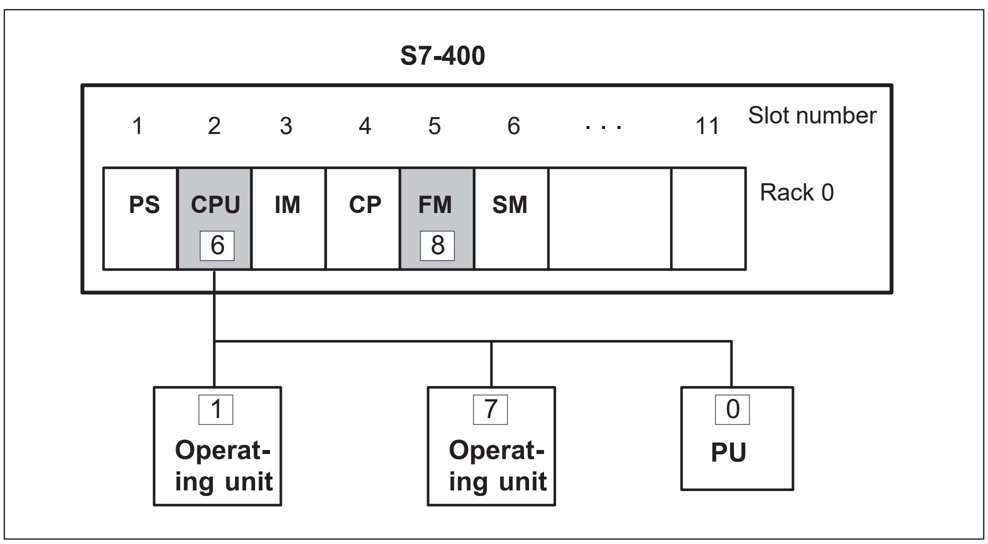


Figure 6-6 Network configuration with S7-400 and operating unit – one rack

Example

In order that the operating unit can communicate with the shaded CPU illustrated in Figure 6-6, the following parameters must be specified for the *communication peer*:

Table 6-9 Example based on Figure 6-6

	Own MPI address	No own MPI address
Address	6	6
Slot number	0	2
Rack	0	0

Example

In order that the operating unit can communicate with the shaded FM illustrated in Figure 6-6, the following parameters must be specified for the *communication peer*:

Table 6-10 Example based on Figure 6-6

	Own MPI address	No own MPI address
Address	8	6
Slot number	0	5
Rack	0	0

Operating unit to FM

The operating unit can only communicate with FM modules which are connected to the K-bus. This includes the FM 453, for example.

Only applicable for the FM NC and FM 357-2:

The SIMATIC-NC protocol must be configured for these SINUMERIK FMs.

6.3.3 Addressing the S7-200 using MPI and PROFIBUS

Configuration

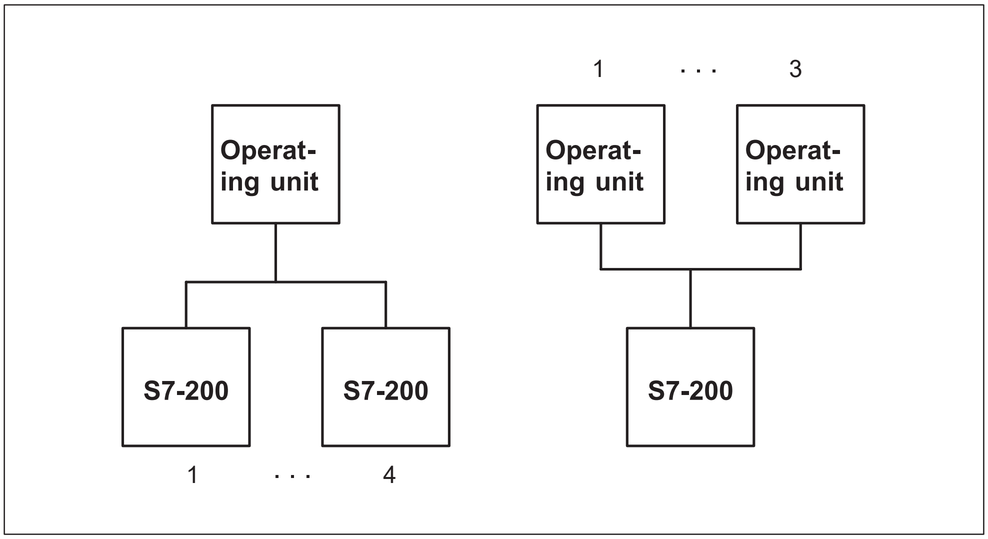


Figure 6-7 Configuration options of operating unit and S7-200

The SIMATIC S7-200 PLC must be configured as a passive node in the network configuration. The S7-200 is connected via the DP connector.

A maximum of 4 PLCs can be connected to one operating unit. Figure 6-7 illustrates both network configurations. Any combination of these configurations can be used in a single MPI network. Which operating unit communicates with which PLC must be defined in ProTool. Each MPI address may only be assigned once in the network configuration.

Information on unit-specific restrictions is provided in the ProTool online help under the key word *System limits (Windows systems)*.

CPU/Module	Port	Baud rate	No. of masters on CPU
CPU 21x	0.1	9.6–19.2 kbaud	3
CPU 215	DP	9.6–12 Mbaud	5
CPU 22x	0.1	9.6–187.5 kbaud	3
EM 277 (DP module für CPU 22x)	DP	9.6–12 Mbaud	5

Example configuration

Figure 6-8 illustrates an example of an MPI network configuration in which one operating unit communicates with several PLCs.

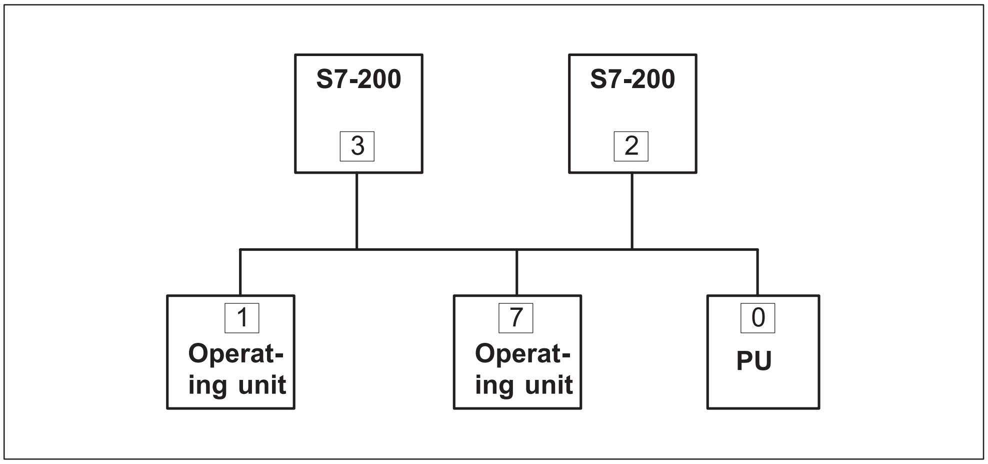


Figure 6-8 Example configuration with S7-200

Using this example configuration, the units can communicate with each other as follows:

Operating unit Address	PLC Address
1	3+2
7	2

Note

In the case of MPI/DP, communication problems may occur at Port 0 on a first generation SIMATIC S7-200 (CPU 214, 215, 216). Therefore, we recommend connection to Port 1. When a CPU 214 (no Port 1 available) is implemented, reduce the baud rate to 9.6 kbaud.

6.4 Connection to S7-200, S7-300 and S7-400 via PROFIBUS

Configuration

Within a PROFIBUS network, an operating unit can be connected to all S7 modules that have an integrated PROFIBUS or PROFIBUS-DP interface and support the S7 driver. Several operating units can be connected to one PLC and several PLCs to one operating unit.

Figure 6-9 illustrates a possible network configuration. The numbers 1, 2, … are examples of addresses. The addresses of the PLC nodes are assigned via the STEP 7 hardware configuration or network configuration.

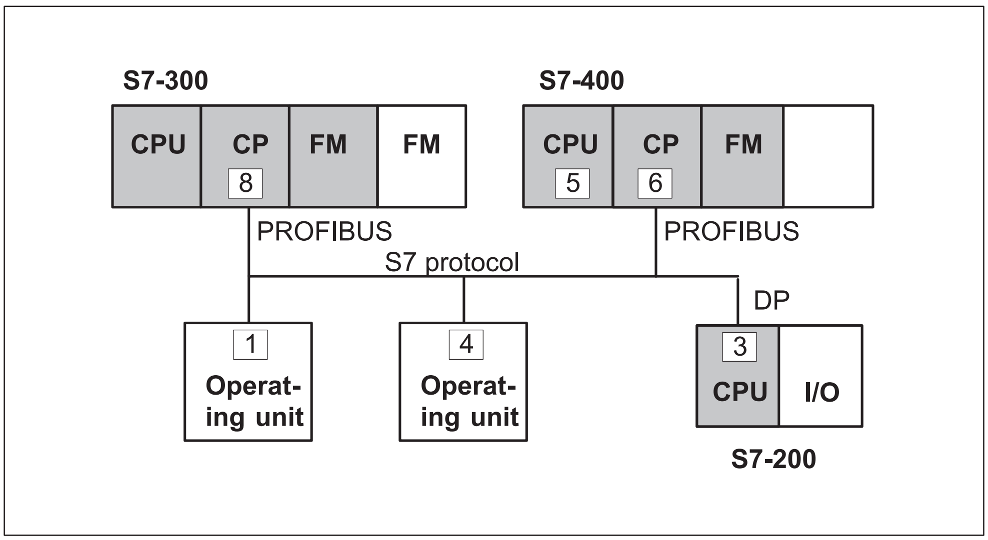


Figure 6-9 Connecting the operating unit to the SIMATIC S7 via PROFIBUS

Communication peer

As in the case of the MPI interface, the operating unit can exchange data with any communication-capable S7 module via PROFIBUS and PROFIBUS-DP. This involves:

- any CPU that supports the S7 driver, such as CPU 413-2DP, CPU 414-2DP, CPU 315-2DP from version 315-2AF01-0AB0
- communication-capable function modules (FMs)
- communication processors (CP), such as CP 342-5DP

The modules with which the operating unit can communicate are illustrated, shaded, in Figure 6-9.

Operating unit configuration

In order that the operating unit can communicate and exchange data with a CPU or an FM, it must be correctly configured. To do this, the operating unit address must be defined in the configuration with ProTool and the connections to the communication peers configured.

When creating a new project, the project assistant requests the definition of the PLC. First of all, select the protocol `SIMATIC S7-200` or `SIMATIC S7-300/400` and then define the following parameters after clicking on the *Parameter* button. For any subsequent parameter modifications, select the item *PLC* in the project window.

Parameters

The parameters are divided into three groups.

- Use *OP Parameters* to enter the parameters for the operating unit in the network configuration. This is done only once. Any alteration to the operating unit parameters applies to all communication peers.
- Use *Network Parameters* to enter the parameters for the network to which the operating unit is linked. By clicking the *More* button, it is possible to set the HSA and the number of masters in the network.

  If ProTool has been installed in “STEP 7 integrated” and the operating unit is linked to the network, the network parameters are applied. Click the *More* button to display the global network parameters.
- Use *Peer Parameters* to address the S7 modules with which the operating unit should exchange data. A symbolic name has to be defined for each communication peer.

The individual parameters are explained in Table 6-11.

Table 6-11 Configuration parameters

Group	Parameters	Explanation
Operating unit parameters	Address	PROFIBUS address of the operating unit.
	Interface	Interface on the operating unit with which the unit is connected to the PROFIBUS network.
	Only once master on the bus	This deactivates an additional protection function against bus faults when connecting the operating unit to the network. A passive station (slave) can only transmit data when requested to by an active station (master). If only slaves are connected to the operating unit, this protection function must be deactivated by activating the option *Only once master on the bus*. In the case of a S7-200, an operating unit must be defined as master.
Network parameters	Profile	The protocol profile used in the network configuration. Enter *DP*, *Standard* or *Universal* here. This setting must be identical throughout the whole network configuration.
	Baud rate	The baud rate at which communication takes place over the network.
Peer parameters	Address	PROFIBUS address of the S7 module (CPU, FM or CP) to which the operating unit is connected.
	Slot[1]	Number of the slot containing the S7 module with which the operating unit exchanges data.
	Rack[1]	Number of the rack containing the S7 module with which the operating unit exchanges data.
	Cyclic operation[1]	If cyclical operation is activated, the PLC optimizes data transfer between the operating unit and PLC. This achieves a better performance. **Limitations:** Where several operating units are running in parallel operation, cyclical operation should be deactivated.

Table 6-11 Configuration parameters, continued

Group	Parameters	Explanation
More button	HSA	Highest Station Address; this must be identical throughout the whole network configuration.
	Master	Number of masters in the network. This must be specified in the case of a PROFIBUS network so that the bus parameters can be calculated correctly.

1 Not applicable for the SIMATIC S7-200.

Addressing using S7-300

A communication-capable S7 module is addressed by means of the following parameters:

Address:	*PROFIBUS address of the operating unit*
Slot:	*Slot number of the S7 module*
Rack:	*Rack in which the S7 module is installed.*

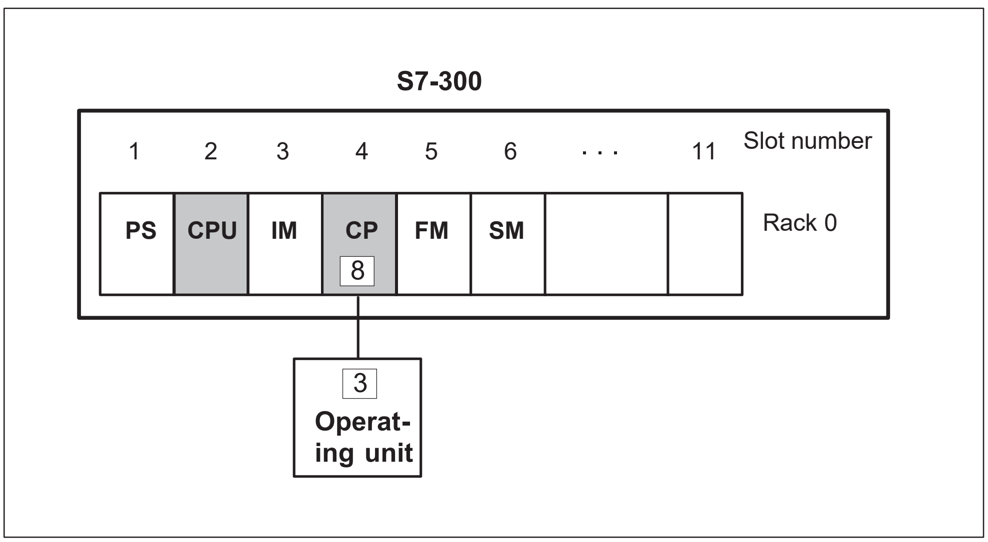


Figure 6-10 Network configuration with S7-300 and operating unit – PROFIBUS-DP profile

The CPU illustrated in Figure 6-10 is addressed as follows:

Address:	8
Slot:	2
Rack:	0

Addressing using S7-200

Addressing using the S7-200 is performed in the same way as with the MPI (refer to Chapter 6.3.3).

Addressing using S7-400

A communication-capable S7 module is addressed by means of the following parameters:

Address:	*PROFIBUS address of the CP or the DP interface of the CPU*
Slot:	*Slot number of the S7 module*
Rack:	*Rack in which the S7 module is installed.*

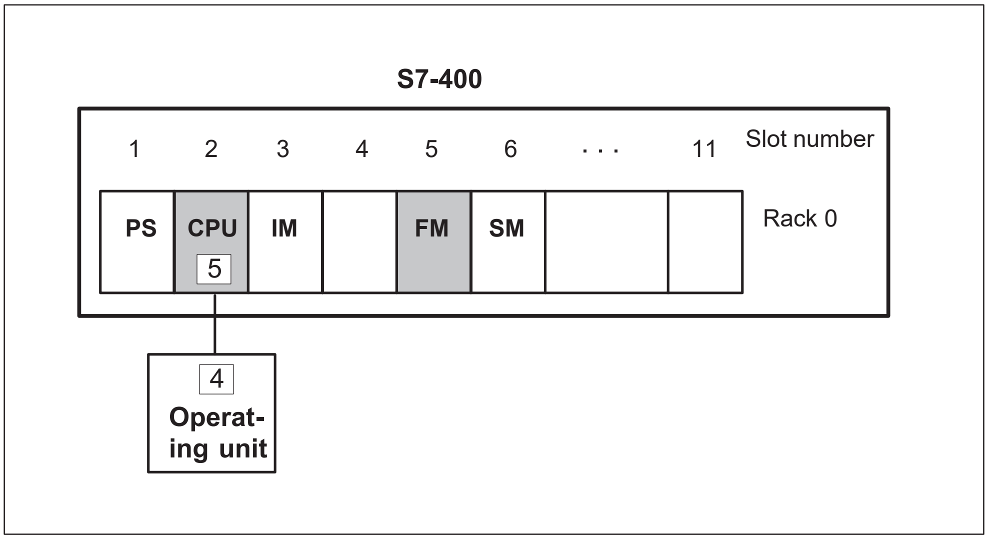


Figure 6-11 Network configuration with S7-400 and operating unit – PROFIBUS-DP profile

The CPU illustrated in Figure 6-11 is addressed as follows:

Address:	5
Slot:	0
Rack:	0

The FM is addressed as follows:

Address:	5
Slot:	5
Rack:	0

6.5 Configuration of DP Direct Keys for the Operating Unit

Use

The F, K and S keys on the operator panels can also be used as DP direct keys in addition to their normal use in the configuration. In the case of touch panels, the *Direct Key* function must be appended to the configured button. DP direct keys means that after pressing the key or button, a bit is set in the I/O area of the CPU.

The DP direct keys are conceived for the normal S7 CPU DP inputs and, therefore, are configured in the same way as an ET 200 station, for example. The cycle time of the DP bus is derived from the sum of all inputs and outputs configured. Thus, the response time of the DP direct keys can also be defined. In a typical configuration, the response time of the DP direct keys is < 100 ms.

Requirements

The operating unit must be connected to a SIMATIC S7 PLC via a PROFIBUS-DP.

ProTool must be installed in “STEP 7 integrated” and the operating unit integrated in the PROFIBUS network. A detailed description of this is available in the “ProTool Configuring Windows-based Systems” User’s Guide.

Operating unit

The DP direct keys can be used with the following operating units:

- MP 370
- MP 270, MP 270B
- TP 270, OP 270
- TP 170B, OP 170B

Configuration with STEP 7

The operating unit must be configured as an active node for general communication (reading and writing tags) (refer to Chapter 6.4). The operating unit must also be configured as a slave in the PROFIBUS-DP network for the DP direct keys. Figure 6-12 illustrates the basic structure based on an S7-400.

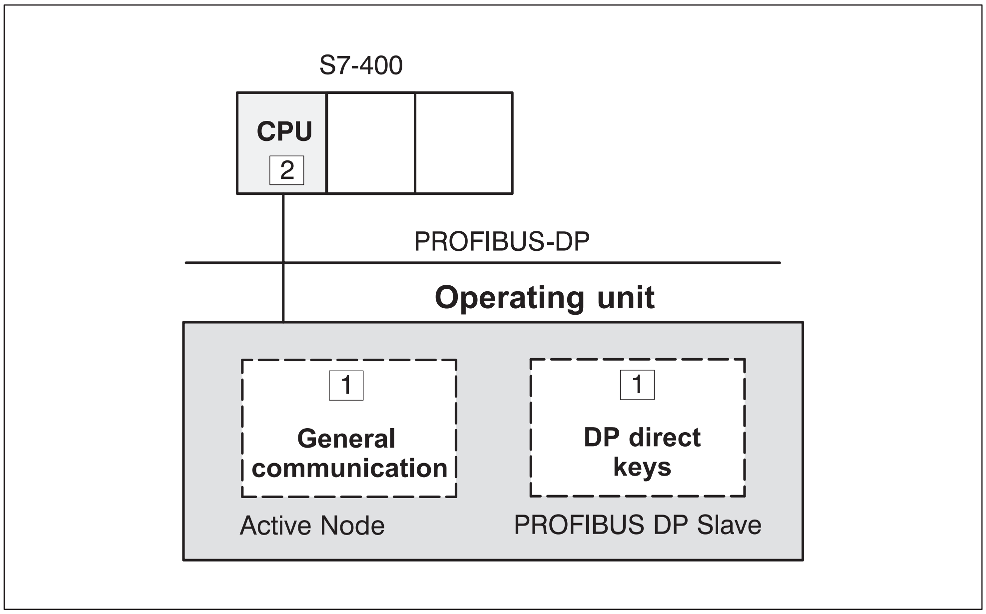


Figure 6-12 Configuration of the operating unit with DP direct keys

Basic procedures during configuration

The following section describes how to configure the operating unit in the case of STEP 7 for general communication purposes (as master) and how to configure the operating unit as slave for DP direct keys.

1. Create a STEP 7 project and configure the hardware with a DP-capable CPU, e.g. CPU 315-2 DP.
2. Select the menu items *System* → *PLC* and then the *Edit* and *Parameters* buttons in succession.
3. A dialog box opens in which to select the network and the CPU with which the operating unit should be connected. The network parameters are then assumed. Figure 6-13 illustrates an example configuration.

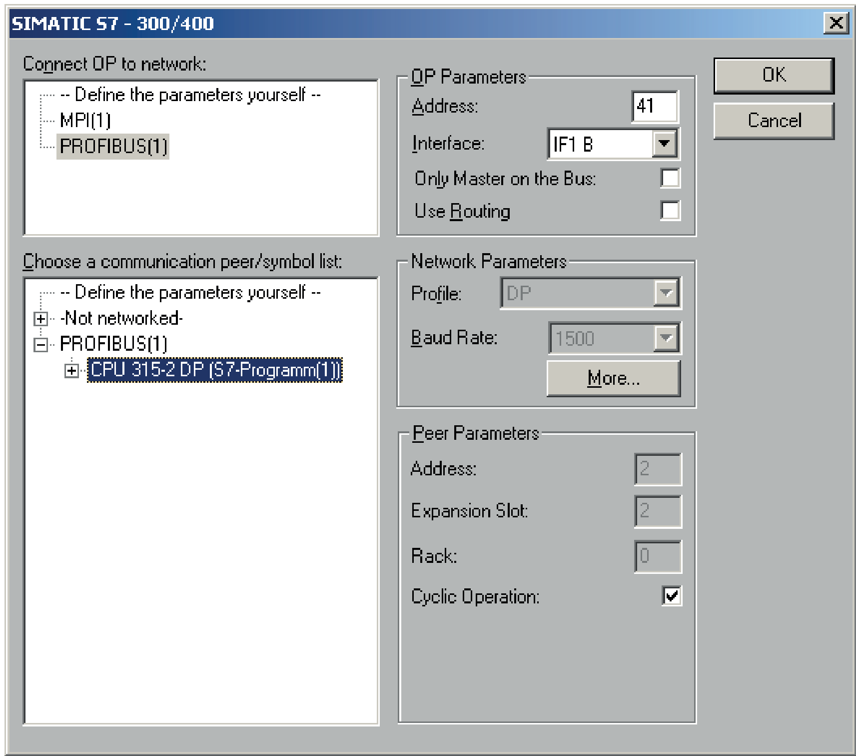


Figure 6-13 Operating panel connection to network and CPU – example

Steps 1 to 3 configure the operating unit as an active node in the PROFIBUS-DP network. Steps 4 to 7 configure the operating unit as a PROFIBUS-DP slave in order to use the DP direct keys. The operating unit is thus configured as an active node and DP slave with the same address.

4. Select the corresponding operating unit group (e.g. MP 270B, OP 270 or TP 270, keyboard unit) in the `Hardware Catalog` window. The operating unit groups are located under:
   – *Stations already configured*
   – *SIMATIC OP*
5. Use the Drag&Drop method to move the operating unit group to the DP master system. The `Properties – DP-Slave` window provides a list of all operating units which can be configured in this network. Select the relevant operating unit. In the example provided, this is the TP 270-10” with address 41; refer to Figure 6-14.

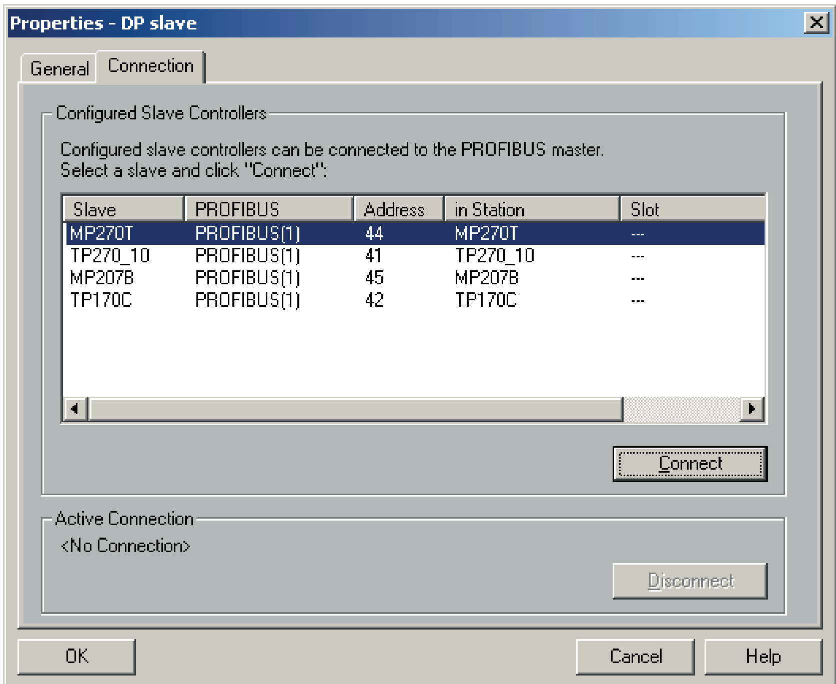


Figure 6-14 Connect slave

The operating unit configured as a DP slave for the DP direct keys has the same address as the operating unit configured as an active node. In this example, the address is 41. Figure 6-15 illustrates the entire network configuration.

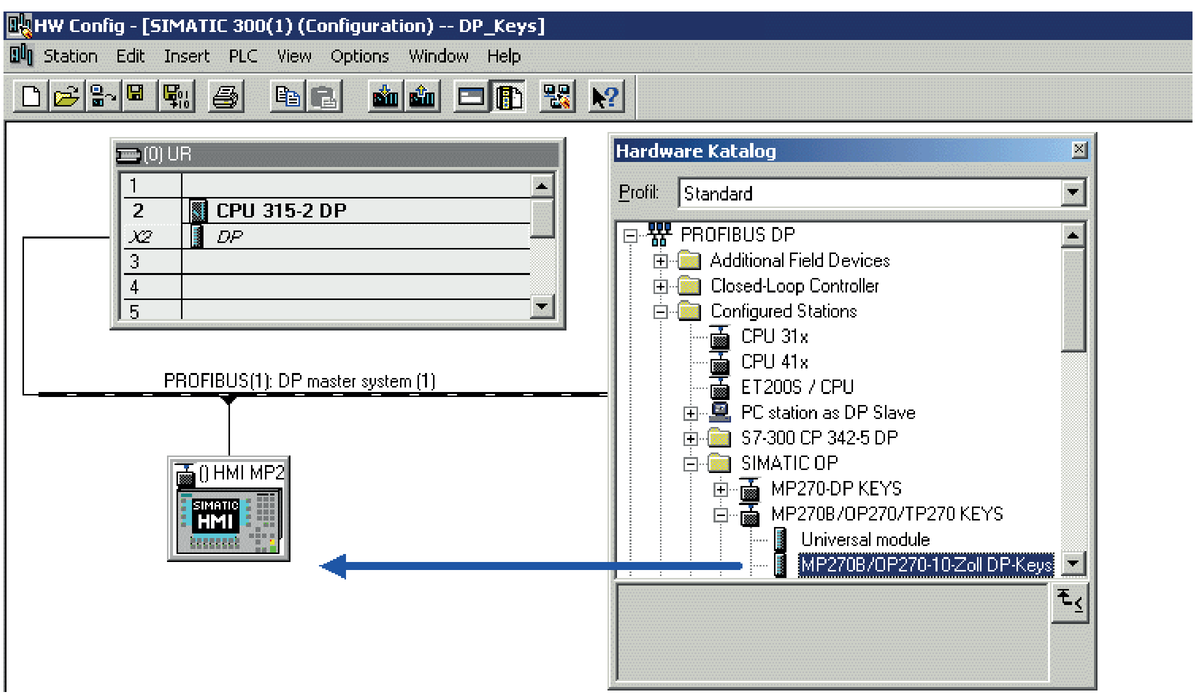


Figure 6-15 Configuration of the DP direct keys – example

6. Arrange the corresponding device keys in the bottom part of the station window. The device keys possible are arranged in the `Hardware Catalog` window under the operating unit group.

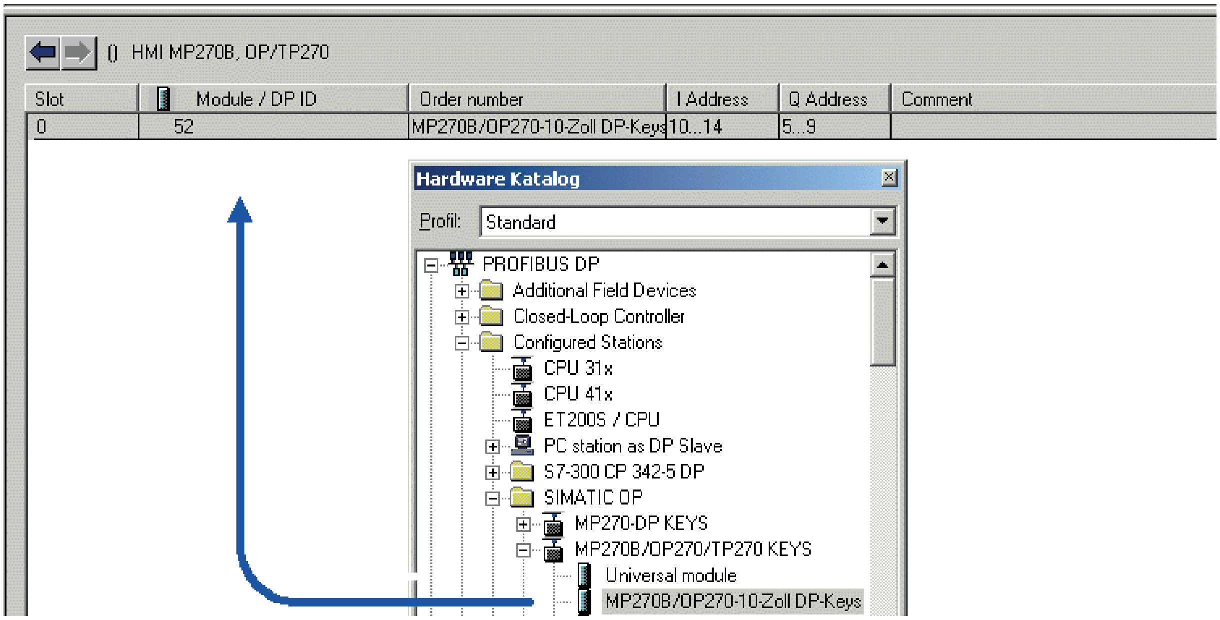


Figure 6-16   Insert the device key in the station window

Input/Output assignment

The operating unit keys or buttons are assigned to bytes in the DP input area and the LEDs are assigned to bytes in the DP output area. Table 6-12 illustrates the number of bytes used by the various operating units. The precise assignment is indicated in Figures 6-17 to 6-19.

The touch panels have no fixed keys. They only have buttons which are freely configurable. A button can be assigned a bit in the DP input area by means of the *Direct Key* function. The numbering direction of the bits in the DP input area is from right to left. Contrary to the operator panels, which have a fixed key assignment, buttons on the touch panels can be assigned as required. A detailed description of the function is available in the “ProTool Configuring Windows-based Systems” User’s Guide.

Table 6-12 Assignment of the DP inputs/outputs

Operating unit	Inputs	Outputs
MP 370 keyboard unit, MP 270, MP 270B, OP 270-10”	5 Bytes	5 Bytes
MP 370 touch panel, TP 270-10”	5 Bytes	–
OP 270-6”, OP 170	4 Bytes	4 Bytes
TP 270-6”, TP 170	4 Bytes	–

Assignment of the inputs/outputs for MP 370

7	6	5	4	3	2	1	0	Byte	7	6	5	4	3	2	1	0
S8	S7	S6	S5	S4	S3	S2	S1	n+0	S8	S7	S6	S5	S4	S3	S2	S1
S16	S15	S14	S13	S12	S11	S10	S9	n+1	S16	S15	S14	S13	S12	S11	S10	S9
F8	F7	F6	F5	F4	F3	F2	F1	n+2	F8	F7	F6	F5	F4	F3	F2	F1
F16	F15	F14	F13	F12	F11	F10	F9	n+3	F16	F15	F14	F13	F12	F11	F10	F9
ACK	ALT	CTRL	SHIFT	F20	F19	F18	F17	n+4	ACK	A–Z left	A–Z right	INFO	F20	F19	F18	F17

Keys **LEDs**

Figure 6-17 Assignment of keys/LEDs in the input/output area for MP 370

Assignment of the input/output areas for MP 270 and OP 270-10”

7	6	5	4	3	2	1	0	Byte	7	6	5	4	3	2	1	0
F8	F7	F6	F5	F4	F3	F2	F1	n+0	F8	F7	F6	F5	F4	F3	F2	F1
F16	F15	F14	F13	F12	F11	F10	F9	n+1					F12	F11	F10	F9
K4	K3	K2	K1	F20	F19	F18	F17	n+2	K4	K3	K2	K1				
K12	K11	K10	K9	K8	K7	K6	K5	n+3	K12	K11	K10	K9	K8	K7	K6	K5
ACK	ALT	CTRL	SHIFT	K16	K15	K14	K13	n+4	ACK	A–Z left	A–Z right	INFO	K16	K15	K14	K13

Keys **LEDs**

Figure 6-18 Assignment of keys/LEDs in the input/output area for MP 270 and OP 270-10”

Assignment of the input/output areas for MP 270-6” and OP 170

7	6	5	4	3	2	1	0	Byte	7	6	5	4	3	2	1	0
F8	F7	F6	F5	F4	F3	F2	F1	n+0	F8	F7	F6	F5	F4	F3	F2	F1
K2	K1	F14	F13	F12	F11	F10	F9	n+1	K2	K1						
K10	K9	K8	K7	K6	K5	K4	K3	n+2	K10	K9	K8	K7	K6	K5	K4	K3
ACK	ALT	CTRL	SHIFT					n+3	ACK	A–Z left	A–Z right	INFO				

Keys (bits 7–0, left) **LEDs** (bits 7–0, right)

Figure 6-19 Assignment of keys/LEDs in the input/output area for MP 270-6” and OP 170

PROFIBUS screen number (touch panels only)

If the PROFIBUS direct keys use the same bits for different functions in various screens, the S7 must differentiate between the respective functionality by means of the screen numbers. The screen function *PROFIBUS Screen Number* is provided in order to bypass the delayed updating of the screen number in the PLC following a screen change.

The *PROFIBUS Screen Number* function can be used within the DP input area to set any bits for identifying the screen and simultaneously transfer them to the PLC by means of the direct key bits. This ensures a unique assignment between the control bit and screen number at all times.

There is a varying number of fast functions available depending on the distribution of the bits in the DP input area:

Operating unit	No. of bits, total	Possible distribution (example)	No. of fast functions
Touch panels with 6” display[1]	24	12 screens à 12 direct keys	144
		4 screens à 20 direct keys	80
Touch panels with 10”/12”display[2]	40	20 screens à 20 direct keys	400
		8 screens à 32 direct keys	256

1 Example: TP 170B
2 Example: MP 270, touch panel and MP 370, touch panel

6.6 Connection to S7-200 via the PPI

Concept

The PPI connection concerns a point-to-point connection in which the operating unit is the master and the S7-200 can be the slave.

Configuration

When connection is made to the S7-200, the operating unit is connected to the MPI interface on the S7-200. The operating unit is connected via the serial connector of the CPU. Figure 6-20 illustrates a possible network configuration. The numbers 1, 2 and 3 are examples of addresses.

A maximum of one S7-200 can be connected to an operating unit. However, several operating units can be connected to an S7-200. From the point of view of the S7-200, only one connection is possible at any specific time.

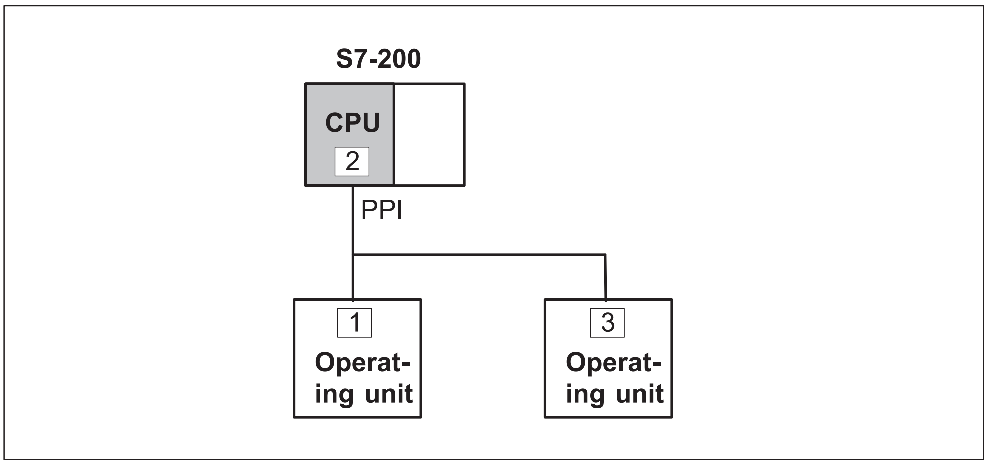


Figure 6-20 Connecting the operating unit to the SIMATIC S7-200

Operating unit requirements

The following requirements must be fulfilled for connection using the PPI:

- Only one PLC may be configured.
- The PC-PPI cable has been approved for ProTool from V5.2 SP2 for Windows 95/98 and from V6.0 for Windows ME and Windows 2000 as a point-to-point connection.

Setting up the interface

The interface can be set up as follows under Windows:
Settings → Control Panel → Set PU/PC interface

Access point of the application	S7ONLINE
Module configuration used	PPI

No settings need be made for operating units with Windows CE.

Operating unit configuration

In order that the operating unit can communicate and exchange data with a CPU, it must be correctly configured. To do this, the operating unit address must be defined in the configuration with ProTool and the connections to the communication peers configured.

When creating a new project, the project assistant requests the definition of the PLC. Select the driver `SIMATIC S7-200` and then define the parameters, indicated below, after clicking on the *Parameter* button. For any subsequent parameter modifications, select the item *PLC* in the project window.

Parameters

The parameters are divided into three groups.

- Use *OP Parameters* to enter the parameters for the operating unit in the network configuration. This is done only once. Any alteration to the operating unit parameters applies to all communication peers.
- Use *Network Parameters* to enter the parameters for the network to which the operating unit is linked. By clicking the *More* button, it is possible to set the HSA and the number of masters in the network.
- Use *Peer Parameters* to address the S7 modules with which the operating unit should exchange data. A symbolic name has to be defined for each communication peer.

The individual parameters are explained in Table 6-13.

Table 6-13 Configuration parameters

Group	Parameters	Explanation
Operating unit parameters	Address	PPI address of the operating unit.
	Interface	Interface on the operating unit with which the unit is connected to the PPI network.
	Only once master on the bus	One operating unit in the configuration must be defined as master. This is performed using this check box.

Table 6-13 Configuration parameters, continued

Group	Parameters	Explanation
Network parameters	Profile	The protocol profile used in the network configuration. Enter *PPI* here.
	Baud rate	Baud rate (9.6; 19.2 or 187.5 kbaud) used for communication in the network configuration.
Peer parameters	Address	The PPI address of the S7 module to which the operating unit is connected.
	Cyclical operation	This parameter is irrelevant in respect of the S7-200.
More button	HSA	Highest Station Address; this must be identical throughout the whole network configuration.
	Master	The number of masters defined in the network must be set to *1*.

6.7 Connection to a SINUMERIK Module

Operating unit

The following operating units can be connected to the SINUMERIK 810D and SINUMERIK 840D PLCs:

- MP 370
- MP270B
- TP 270, OP 270
- TP 170B, OP 170B

Addressing of SINUMERIK PLCs

If the operating unit is connected to a SINUMERIK LC, the PLC must be configured in ProTool using the menu item *System* → *PLC*. Every PLC with which the operating unit communicates must be set up as an individual PLC. If the operating unit should communicate with the integrated S7-CPU and the SINUMERIK PLC, two PLCs must be set up in ProTool (standard case).

Configuration in ProTool

The *SIMATIC S7 – NC* PLC must be set up for the SINUMERIK 810D/840D because the NC has its own address.

The addressing of the SINUMERIK 810D/840D for connection via MPI and PROFIBUS-DP is described below by means of examples.

Peer address using MPI

The integrated S7-CPU and the SINUMERIK 810D/840D represent two different partners for the operating unit, and must be set up in ProTool as two PLCs. Each partner has its own MPI address. The following table contains the addressing. Figure 6-21 illustrates the dialog box in ProTool containing the addressing of the SINUMERIK.

	SIMATIC S7-300/400 CPU	SINUMERIK 810D/840D
Address	2	3
Slot number	0	0
Rack	0	0

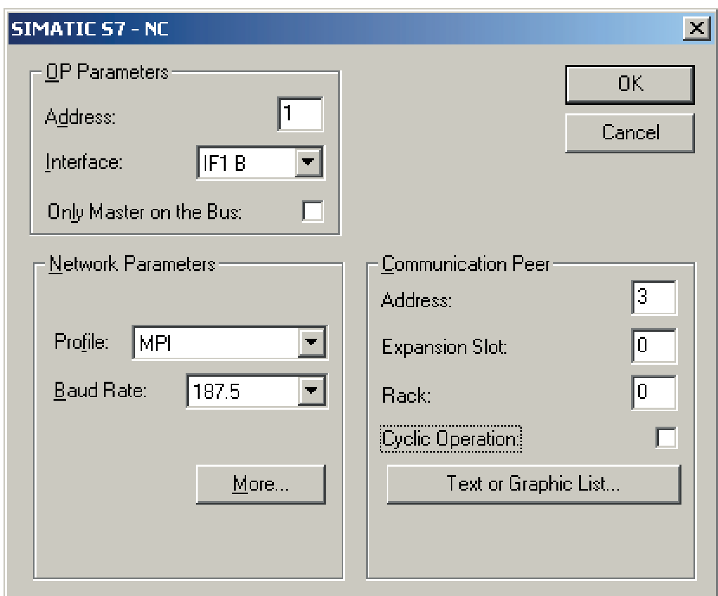


Figure 6-21 Configuration of the SINUMERIK in ProTool – MPI profile

The SINUMERIK 810D/840D contains one CPU. In order to connect the operating unit to the SINUMERIK 810D/840D, two PLCs must be configured in ProTool with the addresses 2 and 3. Figure 6-22 illustrates a configuration with SINUMERIK 810D.

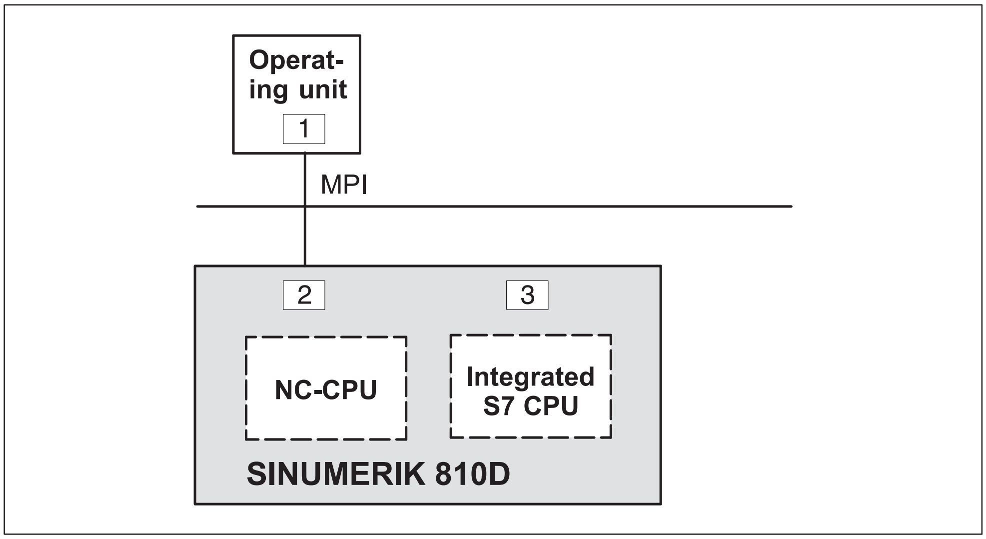


Figure 6-22 Network configuration with SINUMERIK 810D and operating unit – MPI profile

	SIMATIC S7-300 CPU	Integrated SINUMERIK 810D/840D
Address	3	2
Slot number	0	0
Rack	0	0

Peer address with PROFIBUS-DP

The integrated S7-CPU and the SINUMERIK represent two different partners for the operating unit, and must be set up in ProTool two PLCs. Both partners are accessed via the DP address of the CP. The following table contains the addressing. Figure 6-23 illustrates the dialog box in ProTool containing the addressing of the SINUMERIK.

	Integrated S7 CPU	SINUMERIK 810D/840D
Address	8	8
Slot number	3	2
Rack	0	0

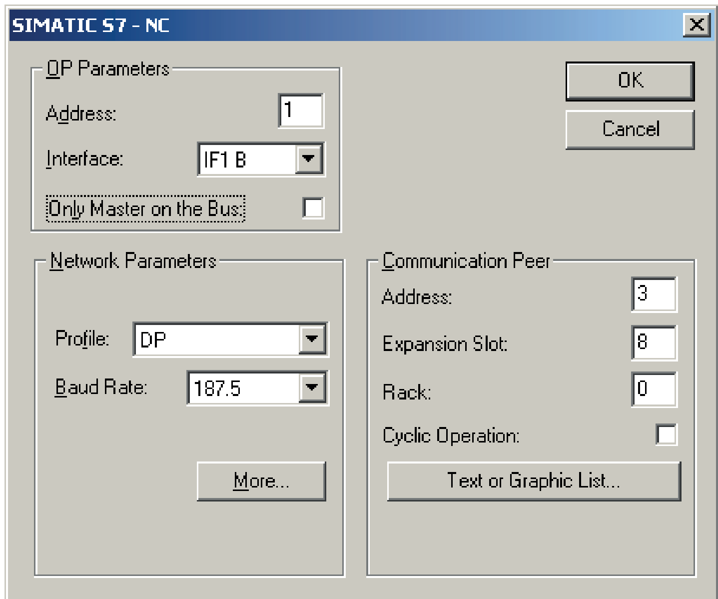


Figure 6-23 Configuration of the FM-NC in ProTool – PROFIBUS-DP profile

6.8 Optimization

Acquisition cycle and update time

The acquisition cycles defined in the configuration software for the area pointers and the acquisition cycles for the tags are major factors in respect of the real update times which are achieved.

The update time is the acquisition cycle plus transmission time plus processing time.

In order to achieve optimum update times, the following points should be observed during configuration:

- When setting up the individual data areas, make them as large as necessary but as small as possible.
- Setting acquisition cycles which are too short unnecessarily impairs overall performance. Set the acquisition cycle to correspond to the modification time of the process values. The rate of change of temperature of a furnace, for example, is considerably slower than the acceleration curve of an electric motor.

  Guideline value for the acquisition cycle: 1 second

- If necessary, dispense with cyclic transmission of user data areas (acquisition cycle = 0) in order to improve the update time. Instead, use PLC jobs to transfer the user data areas at random times.
- In order that changes on the PLC are reliably detected, they must occur during the actual acquisition cycle at least.
- Set the baud rate to the highest possible value.

Screens

The real screen updating rate which can be achieved is dependent on the type and quantity of data to be displayed.

In order to achieve short updating times, ensure that short acquisition cycles are only defined in the configuration for those objects which actually need to be updated quickly.

Trends

If, in the case of bit-triggered trends, the communication bit is set in the “trend transfer area”, the operating unit always updates all the trends whose bit is set in that area. It resets the bits afterwards.

The communication bit in the PLC program can only be set again after all the bits have been reset by the operating unit.

PLC jobs

If large numbers of PLC jobs are sent to the operating unit in quick succession, communication between the operating unit and PLC may become overloaded.

If the operating unit enters the value 0 in the first data word of the job mailbox, it signifies that the operating unit has accepted the job. It then processes the job, for which it requires a certain amount of time. If a new PLC job is then immediately entered in the job mailbox, it may take some time before the operating unit executes the next PLC job. The next PLC job is only accepted when sufficient computer performance is available.

7 User Data Areas for SIMATIC S7

Overview

User data areas are used for data exchange between the PLC and operating unit.

The user data areas are written to and read by the operating unit and the application program alternately during the process of communication. By analyzing the data stored there, the PLC and operating unit reciprocally initiate predefined actions.

This chapter describes the function, layout and special features of the various user data areas.

7.1 User Data Areas Available

Definition

User data areas can be located in data blocks and memory areas in the PLC.

Set up the user data areas both in the ProTool project and in the PLC.

The user data areas can be set up and modified in the ProTool project using the menu items *Insert → Area Pointers*.

Function range

The user data areas available are dependent on the operating unit used. The tables 7-1 and 7-2 provide an overview of the functional range of the individual operating units.

Table 7-1 User data areas available, Part 1

User data area	Panel PC	Standard PC	MP 370
User version	x	x	x
Job mailbox	x	x	x
Event messages	x	x	x
Screen number	x	x	x
Data mailbox	x	x	x
Date/Time	x	x	x
Date/Time PLC	x	x	x
Coordination	x	x	x
Trend request	x	x	x
Trend transfer 1, 2	x	x	x
LED assignment [1]	x	–	x
OP/PLC acknowledgement	x	x	x
Alarm messages	x	x	x

[1] Only possible using operating units with keyboard.

Table 7-2 User data areas available, Part 2

User data area	MP 270 MP 270B	TP 270 OP 270	TP 170B OP 170B	TP 170A
User version	x	x	x	–
Job mailbox	x	x	x	–
Event messages	x	x	x	x
Screen number	x	x	x	–
Data mailbox	x	x	x	–
Date/Time	x	x	x	–
Date/Time PLC	x	x	x	x
Coordination	x	x	x	–
Trend request	x	x	–	–
Trend transfer 1, 2	x	x	–	–
LED assignment [1]	x	x	x	–
OP/PLC acknowledgement	x	x	x	–
Alarm messages	x	x	x	–

[1] Only possible using operating units with keyboard.

Table 7-3 illustrates the way in which the PLC and operating unit access the individual user data areas – Read (R) or Write (W).

Table 7-3 Application of the user data areas

User data area	Necessary for	Operating unit	PLC
User version	ProTool Runtime checks whether the ProTool project version and the project in the PLC are consistent.	R	W
Job mailbox	Triggering of functions on the operating unit by PLC program	R/W	R/W
Event messages	Bit reporting process arrival and departure of event messages	R	W
Screen number	Evaluation by the PLC as to which screen is currently open	W	R
Data mailbox	Downloading of data records with synchronization	R/W	R/W
Date/Time	Transfer of date and time from the operating unit to the PLC	W	R
PLC date/time	Transfer of date and time from the PLC to the operating unit.	R	W
Coordination	Operating unit status polled by the PLC program	W	R
Trend request	Configured trends with “Triggering via bit” or configured history trends	W	R
Trend transfer 1	Configured trends with “Triggering via bit” or configured history trends	R/W	R/W
Trend transfer area 2	Configured history trend with “switch buffer”	R/W	R/W
LED assignment	LED triggered by the PLC	R	W
Operating unit acknowledgement	Message from the operating unit to the PLC indicating an alarm message has been acknowledged	W	R
PLC acknowledgement	Alarm message acknowledgement from the PLC	R	W
Alarm messages	Bit reporting process arrival and departure of alarm messages	R	W

The user data areas and their associated area pointers are explained in the following chapters.

7.2 User Data Area, User Version

Usage

When starting up the operating unit, it is possible to check whether the operating unit is connected to the correct PLC. This is important when several operating units are used.

To do this, the operating unit compares a value stored in the PLC with the value defined in the configuration. In this way, the compatibility of the configuration data with the PLC program is ensured. If there is a mismatch, a system message appears on the operating unit and the runtime configuration is terminated.

In order to use this user data area, set up the following during the configuration:

- Specify the configuration version – value between 1 and 255.

  ProTool: *System* → *Settings*

- Data address of the value for the version stored in the PLC:

  ProTool: *Insert* → *Area Pointers*, available types: *User version*

Danger

The user version is only checked while the connection is being established when ProTool Runtime is started. If the PLC is subsequently changed, the user version is not checked.

7.3 User Data Area, Job Mailbox

Description

The job mailbox can be used to send PLC jobs to the operating unit, thus initiating actions on the operating unit. These functions include:

- displaying screens
- setting date and time

The job mailbox is set up under *Area Pointer* and has a length of four data words.

The first word of the job mailbox contains the job number. Depending on the PLC job in question, up to three parameters can then be specified.

Data Word	Left byte (LB)	Right byte (RB)
n+0	0	Job no.
n+2	Parameter 1	
n+4	Parameter 2	
n+6	Parameter 3	

Figure 7-1 Structure of the user data area, job mailbox

If the first word of the job mailbox is not equal to zero, the operating unit analyzes the PLC job. The operating unit then sets this data word to zero again. For this reason, the parameters must be entered in the job mailbox first and then the job number.

The possible PLC jobs, including job number and parameters, are provided in the "ProTool Online Help" and the Appendix, Part B.

7.4 User Data Area, Event and Alarm Messages and Acknowledgement

Definition

Messages consist of a static text and/or tags. The text and tags can be defined by the user.

Messages are subdivided into event messages and alarm messages. The programmer defines the event message and alarm message.

Event messages

An event message indicates a status, e.g.

- `Motor switched on`
- `PLC in manual mode`

Alarm messages

An alarm message indicates an operational fault, e.g.

- `Valve not opening`
- `Motor temperature too high`

Acknowledgement

Since alarm messages indicate an abnormal operational status, they must be acknowledged. They can be acknowledged either by

- operator input on the operating unit
- setting a bit in the PLC acknowledgement area.

Triggering messages

A message is triggered by setting a bit in one of the message areas on the PLC. The location of the message areas is defined by means of the configuration software. The corresponding area must also be set up in the PLC.

As soon as the bit in the PLC event/alarm message area has been set and that area has been transferred to the operating unit, the operating unit detects that the relevant message has “arrived”.

Conversely, when the same bit is reset on the PLC by the operating unit, the message is registered as having “departed”.

Message areas

Table 5-4 indicates the number of message areas for event and alarm messages, for alarm acknowledgement OP (Operating unit→ PLC) and for alarm acknowledgement PLC (PLC → Operating unit) and the number of words for the various operating units.

Table 7-4 Division of message areas

Operating unit	Event message area, Alarm message area Acknowledgement area OP, Acknowledgement area PLC	
	Number of data areas, maximum	**Words in data area, total**
Panel PC	8	125
Standard PC	8	125
MP 370	8	125
MP 270, MP 270B	8	125
TP 270, OP 270	8	125
TP 170B, OP 170B	8	125
TP 170A	8	125[1]

1 Only possible for event messages.

Assignment of message bit to message number

A message can be assigned to each bit in the configured message area. The bits are assigned to the message numbers in ascending order.

Example:

The following event message area has been configured in the PLC:

`DB 60        Address 42  Length 5` (in words)

Figure 7-2 illustrates the assignment of all 80 (5 x 16) message numbers to the individual bit numbers in the PLC event message area. The assignment is performed automatically on the operating unit.

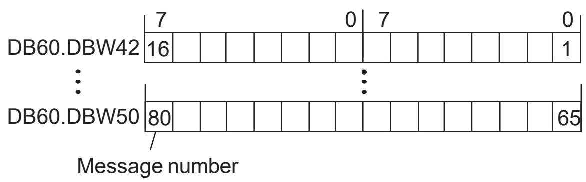


Figure 7-2 Assignment of message bit and message number

User data areas, acknowledgement

If the PLC should be informed of an alarm message acknowledgement on the operating unit or the acknowledgement should be initiated on the PLC itself, the relevant acknowledgement areas must also be set up in the PLC. These acknowledgement areas must also be specified in the ProTool project under *Area Pointers*.

- **Acknowledgement area Operating Unit → PLC**:

  This area is used to inform the PLC when an alarm message has been acknowledged by means of operator input on the operating unit. The “Alarm Ack. OP” area pointer must be created or configured for this.

- **Acknowledgement area PLC → Operating Unit**:

  This area is used when an alarm message is acknowledged by the PLC. In this case, the area pointer “PLC acknowledgement” must be set.

These acknowledgement areas must also be specified in the configuration under *Area Pointers*.

Figure 7-3 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 7-5 and 7-6.

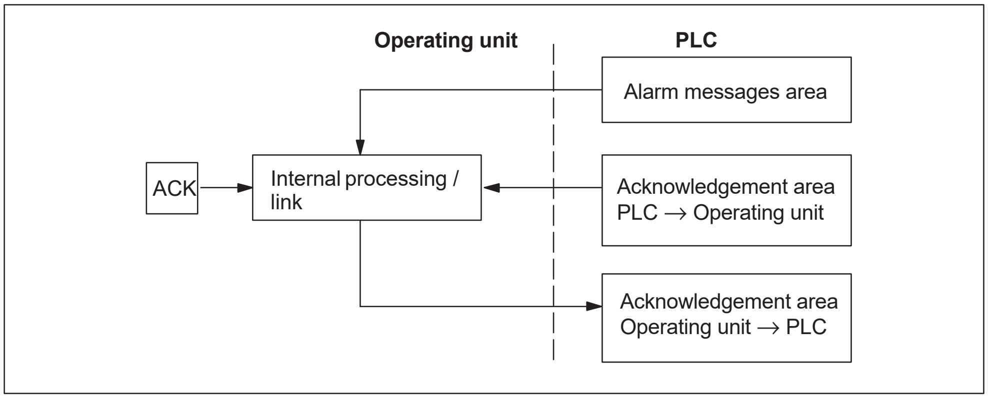


Figure 7-3 Alarm message and acknowledgement areas

Assignment of acknowledgement bit to message number

Each alarm message is assigned a message number. The message number is assigned the same bit number in the alarm messages area as that assigned in the acknowledgement area. Under normal circumstances, the acknowledgement area is the same length as the associated alarm messages area.

If the length of an acknowledgement area is not equal to the overall length of the associated alarm messages area, and there are succeeding alarm messages and acknowledgement areas, the following assignment applies:

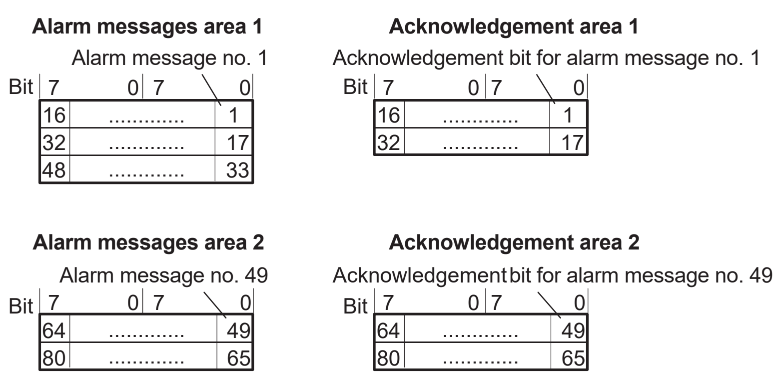


Figure 7-4 Assignment of acknowledgement bit and message number

Acknowledgement area PLC → Operating unit

A bit set in this area by the PLC initiates the acknowledgement of the corresponding alarm message in the operating unit, thus fulfilling the same function as pressing the ACK button. Reset the bit before setting the bit in the alarm message area again. Figure 7-5 illustrates the signal diagram.

The acknowledgement area PLC → Operating Unit

- must follow on immediately from the associated alarm messages area,
- must have precisely the same polling time and
- may not be any longer than the associated alarm messages area.

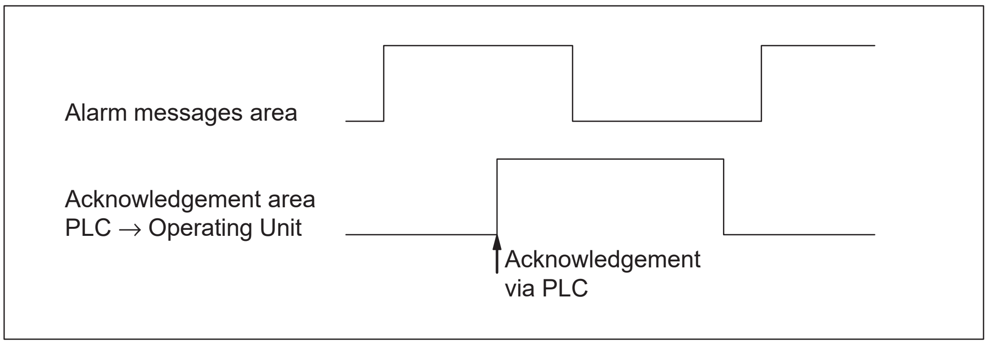


Figure 7-5 Signal diagram for acknowledgement area PLC → Operating Unit

Acknowledgement area Operating Unit → PLC

When a bit is set in the alarm message area, the operating unit resets the associated bit in the acknowledgement area. As a result of processing by the operating unit, the two processes indicate a slight difference with regard to time. If the alarm message is acknowledged on the operating unit, the bit in the acknowledgement area is set. In this way, the PLC can detect that the alarm message has been acknowledged. Figure 7-6 illustrates the signal diagram.

The acknowledgement area Operating Unit → PLC must be no longer than the associated alarm messages area.

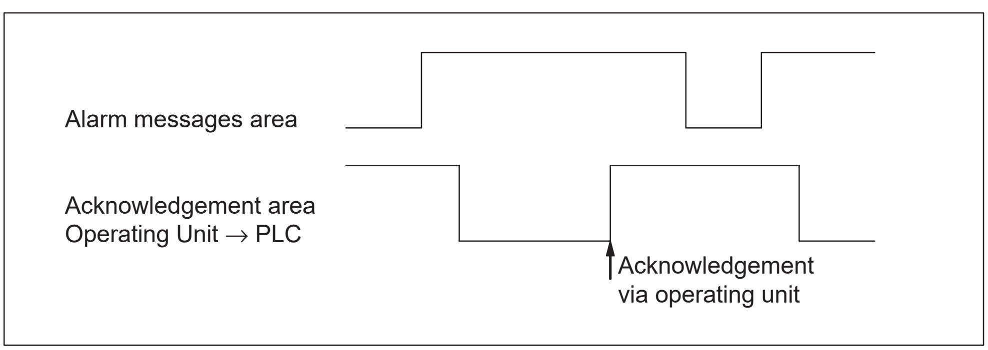


Figure 7-6 Signal diagram for acknowledgement area Operating Unit → PLC

Acknowledgement area size

The acknowledgement areas PLC → Operating Unit and Operating Unit → PLC must not be any longer than the associated alarm message areas. The acknowledgement area, however, be smaller if acknowledgement by the PLC is not required for all alarm messages. This is also valid when the acknowledgement need not be detected in the PLC for all alarm messages. Figure 7-7 illustrates such a case.

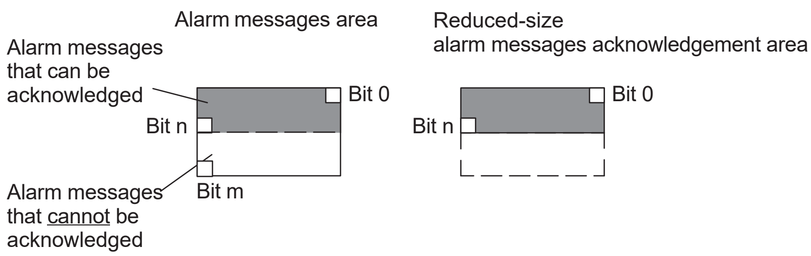


Figure 7-7 Reduced–size acknowledgement area

Note

Place important alarm messages in the alarm messages area starting at Bit 0 in ascending order.

7.5 User Data Area, Screen Numbers

Application

The operating units store information concerning the screen currently open on the unit in the screen number user data area.

This enables the transfer of data regarding the current operating unit display content to the PLC which, in turn, can trigger certain reactions; e.g. call in a different screen.

Requirements

If the screen number area should be used, it must be specified in the ProTool project as an *Area Pointer*. It can only be stored in one PLC and only once.

The screen number area is downloaded to the PLC spontaneously, i.e. the transfer is always initiated when a change is selected on the operating unit. Therefore, it is not necessary to configure an acquisition cycle.

Structure

The screen number area is a data area with a fixed length of 5 data words.

The structure of the screen number area in the PLC memory is illustrated below.

	7 ... 0 | 7 ... 0
1st Word	Current screen type
2nd Word	Current screen number
3rd Word	Reserved
4th Word	Current field number
5th Word	Reserved

Entry	Assignment
Current screen type	1 for basic screen or 4 for fixed window
Current screen number	1 to 65535
Current field number	1 to 65535

7.6 User Data Area, Date/Time

Transferring date and time

The transfer of date and time from the operating unit to the PLC can be triggered by PLC jobs 40 and 41. Both can be used to read the date and time from the operating unit and write it to the Date/Time data area. They can be analyzed by the PLC program in this area.

The jobs differ in respect of the format in which the information is stored. PLC job 40 writes in the format S7 DATE_AND_TIME, and PLC job 41 uses the same format as the operating unit. Both formats are in BCD code.

Format S7 DATE_AND_TIME (BCD-coded)

The format used by PLC Job 40 has the following structure:

<table>
<tr><th>Byte</th><th>7 … 4</th><th>3 … 0</th></tr>
<tr><td>n+0</td><td colspan="2">Year (80–99/0–29)</td></tr>
<tr><td>n+1</td><td colspan="2">Month (1–12)</td></tr>
<tr><td>n+2</td><td colspan="2">Day (1–31)</td></tr>
<tr><td>n+3</td><td colspan="2">Hour (0–23)</td></tr>
<tr><td>n+4</td><td colspan="2">Minute (0–59)</td></tr>
<tr><td>n+5</td><td colspan="2">Second (0–59)</td></tr>
<tr><td>n+6</td><td>Reserved</td><td>Reserved</td></tr>
<tr><td>n+7</td><td>Reserved</td><td>Weekday (1–7, 1=Sun)</td></tr>
</table>

Figure 7-8 Structure of data area Date/Time in DATE_AND_TIME format

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Note

When entering data in the year data area, please note that the values 80–99 represent 1980 to 1999 and 0–29 the years 2000 to 2029.

Operating unit format

The format used by PLC Job 41 has the following structure:

Byte	7 … 0
n+0	Reserved
n+1	Hour (0–23)
n+2	Minute (0–59)
n+3	Second (0–59)
n+4	Reserved
n+5	Reserved
n+6	Reserved
n+7	Weekday (1–7, 1=Sun)
n+8	Day (1–31)
n+9	Month (1–12)
n+10	Year (80–99/0–29)
n+11	Reserved

Figure 7-9 Structure of the Date/Time data area in operating unit format

> **Note**
>
> When entering data in the year data area, please note that the values 80–99 represent 1980 to 1999 and 0–29 the years 2000 to 2029.

Differences in the S7 format as compared to the operating unit format

The S7 DATE_AND_TIME format differs from the operating unit format in the following ways:

- Different sequence of entries
- Memory requirements reduced from 12 to 8 bytes

7.7 User Data Area, Date/Time PLC

Transfer of date and time to the operating unit

The downloading of date and time to the operating unit is generally useful when the PLC is master for time.

The TP 170A operating unit represents a special case here:

Synchronization with the PLC system time is necessary when a *Single message display* screen object is to be inserted in a ProTool screen. The *Single message display* screen object is the only TP 170A screen object which has access to the unit's system time. This restriction only applies to the TP 170A.

DATE_AND_TIME format (BCD coded)

Byte	7 … 4	3 … 0
n+0	Year (80–99/0–29)	
n+1	Month (1–12)	
n+2	Day (1–31)	
n+3	Hour (0–23)	
n+4	Minute (0–59)	
n+5	Second (0–59)	
n+6	Reserved	Reserved
n+7	Reserved	Weekday (1–7, 1=Sun)

Figure 7-10 Structure of data area Date/Time in DATE_AND_TIME format

---

Note

When entering data in the year data area, please note that the values 80–99 represent 1980 to 1999 and 0–29 the years 2000 to 2029.

The PLC writes cyclically to the data area, whereby the operating unit reads and synchronizes (refer to the ProTool User's Guide).

The following example illustrates how the program code may appear:

```
Call "READ_CLK"          //SFC1

RET_VAL := MW100

CDT := "DATEN_DB".DATE_AND_TIME_FUER_TP170
```

In this case, the following symbolic names are used:

READ_CLK	=	SFC1
DATEN_DB	=	Symbolic name for a DB, e.g. DB6 (area pointer)
DATE_AND_TIME_FUER_TP170	=	Symbolic name for a tag of the type DATE_AND_TIME

Note

In the configuration, do not select too small an acquisition cycle for the Date/Time area pointer because this affects the operating unit performance.

Recommendation: Acquisition cycle of 1 minute, if permitted by the process.

7.8 User Data Area, Coordination

The coordination user data area is two data words long. It serves to realize the following functions:

- Detection of operating unit startup by the PLC program,
- Detection of the current operating unit operating mode by the PLC program,
- Detection by the PLC program that the operating unit is ready to communicate.

Note

Each time the coordination area is updated by the operating unit, the entire coordination area is written.

Therefore, the PLC program must not execute any modifications in the coordination area.

Bit assignment in coordination area

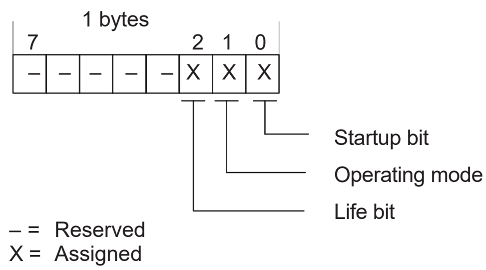


Figure 7-11 Significance of the bits in the coordination area

Startup bit

The startup bit is set to 0 for a short time during the start–up routine by the operating unit. After the startup routine has been completed, the bit is set permanently to 1.

Operating mode

As soon as the operating unit has been switched offline by the operator, the operating mode bit is set to 1. When the operating unit is working in normal operation, the operating mode bit is set to 0. The PLC program can be used to poll this bit and thus establish the current operating mode of the operating unit.

Life bit

The life bit is inverted by the operating unit at intervals of approx. one second. The PLC program can be used to poll this bit to check whether connection to the operating unit still exists.

7.9 User Data Area, Trend Request and Trend Transfer

Trends

A trend is the graphical representation of a value from the PLC. Reading of the value can be time-triggered or bit-triggered, depending on the configuration.

Time–triggered trends

The operating unit reads the trend values cyclically according to the cycle interval defined in the configuration. Time-triggered trends are suitable for continuous progressions such as the operating temperature of a motor.

Bit–triggered trends

By setting a trigger bit in the trend transfer area pointer, the operating unit reads in either a trend value or the entire trend buffer. This is specified in the configuration. Bit-triggered trends are normally used to display values of an area subject to rapid variation. An example of this is the injection pressure for plastic moldings.

In order to be able to activate bit-triggered trends, corresponding data areas have to be specified in the ProTool project (under *Area Pointers*) and set up on the PLC. The operating unit and the PLC communicate with one another via those areas.

The following areas are available for trends:

- Trend request area
- Trend transfer area 1
- Trend transfer area 2 (required with switch buffer only)

Assign a trend to a bit in the configuration. This ensures the bit assignment is unique for all areas.

Switch buffer

The switch buffer is a second buffer for the same trend and can be set up during the configuration.

While the operating unit reads the value from Buffer 1, the PLC writes it in Buffer 2. If the operating unit reads from Buffer 2, the PLC writes to Buffer 1. This prevents the trend value being overwritten by the PLC when being read by the operating unit.

Partitioning of the area pointers

The trend request and trend transfer 1 and 2 area pointers can be divided into separate data areas with a predefined maximum number and length (Table 5-5).

Table 7-5 Partitioning of the area pointer

	Data area		
	Trend request	Trend transfer	
		1	2
Number of data areas, maximum	8	8	8
Words in data area, total	8	8	8

Trend request area

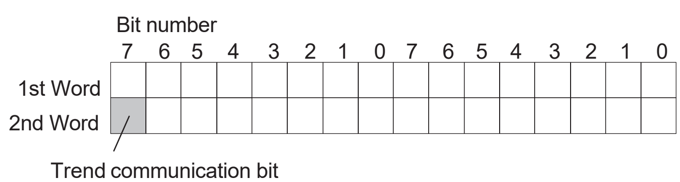
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

The trend request area can be used by the PLC to ascertain which trend is currently being displayed on the operating unit. Trends can also be triggered without analysis of the trend request area.

Trend transfer area 1

This area serves for triggering trends. In the PLC program, set the bit assigned to the trend in the trend transfer area and the trend communication bit. The operating unit detects triggering and reads in either a trend value or the entire buffer. It then resets resets the trend bit and the trend communication bit.

Trend transfer area(s)



The trend transfer area must not be altered by the PLC program until the trend communication bit has been reset.

Trend transfer area 2

Trend transfer area 2 is necessary for trends that are configured with a switch buffer. Its layout is precisely the same as that of trend transfer area 1.

7.10 User Data Area, LED Assignment

Application

The Operator Panel (OP), Multi Panel (MP) and Panel PC have function keys with Light Emitting Diodes (LEDs) integrated in them. These LEDs can be controlled from the PLC. This means, for example, that in specific situations, it is possible to indicate to the operator which key should be pressed by switching on an LED.

Requirements

In order to control LEDs, corresponding data areas, so-called LED assignments, must be set up in the PLC and defined in the configuration as *Area Pointers*.

Partitioning of the area pointer

The LED assignment area pointer can be divided into separate data areas, as illustrated in the following table.

Table 7-6 Partitioning of the area pointer

Operating unit	Number of data areas, maximum	Words in data area, total
Panel PC	8	16
MP 370	8	16
MP 270, MP 270B	8	16
OP 270	8	16
OP 170B	8	16

Note

The area pointer in question can no longer be selected in the *Insert new area pointer* window when the maximum number has been reached. Area pointers of the same type appear gray.

LED assignment

The assignment of the individual LEDs to the bits in the data areas is defined when the function keys are configured. This involves specifying a bit number within the assignment area for each LED.

The bit number (n) identifies the first of two successive bits which control the following LED states (refer to Table 7-7):

Table 7-7 LED states

Bit n + 1	Bit n	LED function
0	0	Off
0	1	Flashes
1	0	Flashes
1	1	Permanently on

7.11 Recipes

Description

During the transfer of data records between the operating unit and PLC, both communication peers alternately access common communication areas in the PLC. The function and structure of the recipe–specific communication area (“data mailbox”) and the mechanisms involved in synchronized transfer of data records are the subject of this chapter.

Information on setting up the data mailbox in ProTool is provided in the online help.

Downloading methods

There are two methods of downloading data records between operating unit and PLC:

- Asynchronous transfer (Page 7-20)
- Synchronized transfer using the data mailbox (Page 7-21)

Data records are always transferred directly, i.e. the tag values are read or written directly from or to the address configured for the tag without being stored intermediately.

Trigger downloading of data records

There are three methods of triggering the transfer of data:

- By operator input on the recipe display (Page 7-22)
- By PLC jobs (Page 7-23)
- By activating configured functions (Page 7-24)

If transfer of data records is initiated by a configured function or a PLC job, the recipe display on the operating unit remains fully functional as the data records are transferred in the background.

Simultaneous processing of multiple transfer jobs is not possible, however. In such cases, the operating unit returns a system message refusing additional transfer requests.

A list of the most important system messages together with notes on the possible causes of the associated errors and remedies for them is provided in Appendix, Part A.

7.11.1 Asynchronous data transfer

Purpose

In the case of asynchronous transfer of data records between operating unit and PLC, there is **no** coordination of the communication areas commonly used. For this reason, there is no need to set up a data mailbox during the configuration process.

Application

The **asynchronous** transfer of data records is applicable, for example, when the

- uncontrolled overwriting of data by the communication peers can be reliably prevented by the system,
- the PLC does not require any details of the recipe and data record numbers, or
- transfer of data records is initiated by operator input on the operating unit.

Read values

On triggering a read transfer, the values are read from the PLC addresses and downloaded to the operating unit.

- **Transfer initiated by operator input on recipe display**:

  Data is uploaded to the operating unit. There it can be processed, e.g. values can be modified and the changes saved.
- **Transfer initiated by function or PLC job**:

  The data is saved directly to the storage medium.

Write values

On triggering a write transfer, the values are written to the PLC addresses.

- **Transfer initiated by operator input on recipe display**:

  The current values are written to the PLC.
- **Transfer initiated by function or PLC job**:

  The values on the storage medium are written to the PLC.

7.11.2 Synchronous data transfer

Purpose

In the case of synchronous data transfer, both the communication peers set status bits in the commonly used data mailbox. In this way, the PLC program can prevent uncontrolled overwriting of each other's data by the two units.

Application

The **synchronous** transfer of data records is applicable, for example, when

- the PLC is the "active partner" for transfer of data records,
- details of the recipe and data record numbers are to be analyzed on the PLC, or
- transfer of data records is initiated by PLC job.

Requirements

In order to synchronize the transfer of data records between the operating unit and PLC, the following conditions must be fulfilled in the configuration:

- the data mailbox must have been set up in *System* → *Area Pointer*;
- the recipe properties must specify the PLC with which the operating unit has to synchronize transfer of data records.

  The PLC is specified in the recipe editor in *Properties* → *Transfer*.

Detailed information on this is provided in *ProTool Configuring Windows–based Systems* User Guide.

7.11.3 Data mailbox for synchronized data transfer

Structure

The data mailbox has a defined length of 5 words. Its structure is as follows:

	7 0	7 0
1st Word	Current recipe number (1 – 999)	
2nd Word	Current data record number (0 – 65,535)	
3rd Word	Reserved	
4th Word	Status (0, 2, 4, 12)	
5th Word	Reserved	

Status word

The status word (Word 4) can assume the following values:

Value		Explanation
Decimal	Binary	
0	0000 0000	Transfer permitted, data mailbox is accessible
2	0000 0010	Transfer in progress
4	0000 0100	Transfer completed without errors
12	0000 1100	Errors occurred during transfer

7.11.4 Synchronization process

Read from the PLC by operating the recipe view

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe number to be read and the status "Transfer in progress" in the data mailbox and sets the data record number to zero.	Operation cancelled and system message returned
3	The operating unit reads the values from the PLC and displays them on the recipe display. In the case of recipes with synchronous tags, the values from the are also written in the tags.	
4	The operating unit sets the status to "Transfer completed".	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Write in the PLC by operating the recipe view

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number to be written and the status “Transfer in progress” in the data mailbox.	Operation cancelled and system message returned
3	The operating unit writes the current values to the PLC. In the case of recipes with synchronized tags, the modified values between the recipe views and tags are compared and then written to the PLC.	
4	The operating unit sets the status to “Transfer completed”.	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Read from the PLC by PLC job “PLC → DAT” (no. 69)

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the job and the status “Transfer in progress” in the data mailbox.	Operation cancelled and no message returned
3	The operating unit reads the value from the PLC and saves the value in the data record specified by the job.	
4	• If the option “Overwrite” has been specified for the job, existing data records are overwritten without prior warning. The operating unit sets the status to “Transfer completed”. • If “Do not overwrite” was specified in the job and the data record already exists, the operating unit terminates the process and enters `0000 1100` in the status word of the data mailbox.	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Details of the structure of the PLC job are provided on Page 7-26.

Write in the PLC by PLC job “DAT → PLC” (no. 70)

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the job and the status “Transfer in progress” in the data mailbox.	Operation cancelled and no message returned
3	The operating unit retrieves the value from the data record specified in the job from the data medium and writes that value in the PLC.	
4	The operating unit sets the status to “Transfer completed”.	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Details of the structure of the PLC job are provided on Page 7-26.

Read from the PLC by configured function

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the function and the status “Transfer in progress” in the data mailbox.	Operation cancelled and system message returned
3	The operating unit reads the data from the PLC and saves it to the data record specified by the function.	
4	• If the option “Overwrite” has been specified for the function, existing data records are overwritten without prior warning. The operating unit sets the status to “Transfer completed”. • If “Do not overwrite” was specified in the job and the data record already exists, the operating unit terminates the process and enters `0000 1100` in the status word of the data mailbox.	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Write in the PLC by configured function

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the function and the status “Transfer in progress” in the data mailbox.	Operation cancelled and system message returned
3	The operating unit retrieves the value from the data record specified in the function from the data medium and writes that value in the PLC.	
4	The operating unit sets the status to “Transfer completed”.	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Note

For reasons of data consistency, analysis of the recipe and data record number on the PLC cannot be performed until the status in the data mailbox is set to “Transfer completed” or “Errors occurred during transfer”.

Possible causes of errors

If the downloading of data records is terminated due to errors, it may be due to one of the following reasons:

- Tag address not set up on PLC
- Overwriting of data records not possible
- Recipe number not available
- Data record number not available

A list of the most important system messages together with notes on the possible causes of the associated errors and remedies for them is provided in Appendix, Part A.

Response to error-based termination

The operating unit responds as follows when the downloading of data records is terminated due to an error:

- **Transfer initiated by operator input on recipe display**:

  Indication on the status bar on the recipe display and issue of system messages.

- **Transfer initiated by function**:

  System messages issued.

- **Transfer initiated by PLC job**:

  No feedback of information on operating unit

Regardless of the response of the operating unit, the status of the transfer can be checked by reading the status word in the data mailbox.

7.11.5 PLC jobs for recipes

Purpose

The transfer of data records between operating unit and PLC can be triggered by the PLC program. This requires no operator input on the operating unit.

The two PLC jobs **No. 69** and **No. 70** can be used for this.

No. 69: Read data record from PLC (“PLC → DAT”)

PLC Job **No. 69** downloads data records from the PLC to the operating unit. The structure of this PLC job is as follows:

	Left byte (LB)	Right byte (RB)
Word 1	0	69
Word 2	Recipe number (1 to 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	Do not overwrite existing data record: 0 Overwrite existing data record: 1	

No. 70: Write data record to PLC (“DAT → PLC”)

PLC Job **No. 70** downloads data records from the operating unit to the PLC. The structure of this PLC job is as follows:

	Left byte (LB)	Right byte (RB)
Word 1	0	70
Word 2	Recipe number (1 to 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	—	

Part IV Connection to SIMATICWinAC

Communication Management with SIMATIC WinAC – Overview

8

General Information

The following chapters contain an overview of the two standard methods of communication between the SIMATIC HMI software ProTool/Pro Runtime and a SIMATIC WinAC (Windows Automation Center) PLC.

Communication is possible via the following two protocols:

- SIMATIC S7300/400
- SIMATIC S7 – WinAC

Note

In the case of new configurations, it is recommended to use the SIMATIC S7 - 300/400 protocol. This protocol has the advantage of a higher degree of functionality as compared to the SIMATIC S7 - WinAC protocol.

Until now, the SIMATIC S7 - WinAC protocol was intended for a communication connection between ProTool/Pro Runtime and WinAC Basis and WinAC Pro. The communication channel used in this connection, however, does not support Alarm_S and, thus, neither the SIMATIC ProAgent option packet. In addition, it is not possible to display the CPU diagnostics buffer when using the WinAC protocol.

The following applies to existing configurations defined using SIMATIC WinAC:

These can be converted to SIMATIC S7 300/400 without loss of the tag addresses. To do this, change the protocol in the PLC dialog.

The communication management for the SIMATIC S7 PLC with a SIMATIC WinAC PLC for MP 370 is described in the “SIMATIC – WinAC for MP 370” user’s guide supplement to the “Communication for Windows-based Systems” User’s Guide.

Communication Management with SIMATIC WinAC 9

This chapter describes the device-internal communication between the SIMATIC HMI software ProTool/Pro Runtime and the SIMATIC WinAC PLC.

Device-internal means that the SIMATIC WinAC PLC must be available on the same operating unit on which SIMATIC HMI software ProTool/Pro Runtime is installed.

General information

Note

In the following chapters, the term 'WinAC' includes the products SIMATIC WinAC Basis, SIMATIC WinAC RTX, SIMATIC WinAC Pro and SIMATIC WinAC Slot.

SIMATIC WinAC is a PC-based automation system from the STEP 7 automation system product series.

Operating units

The following operating units can be connected to a SIMATIC WinAC PLC:

- Panel PC
- Standard PC

9.1 Basic Functioning Method

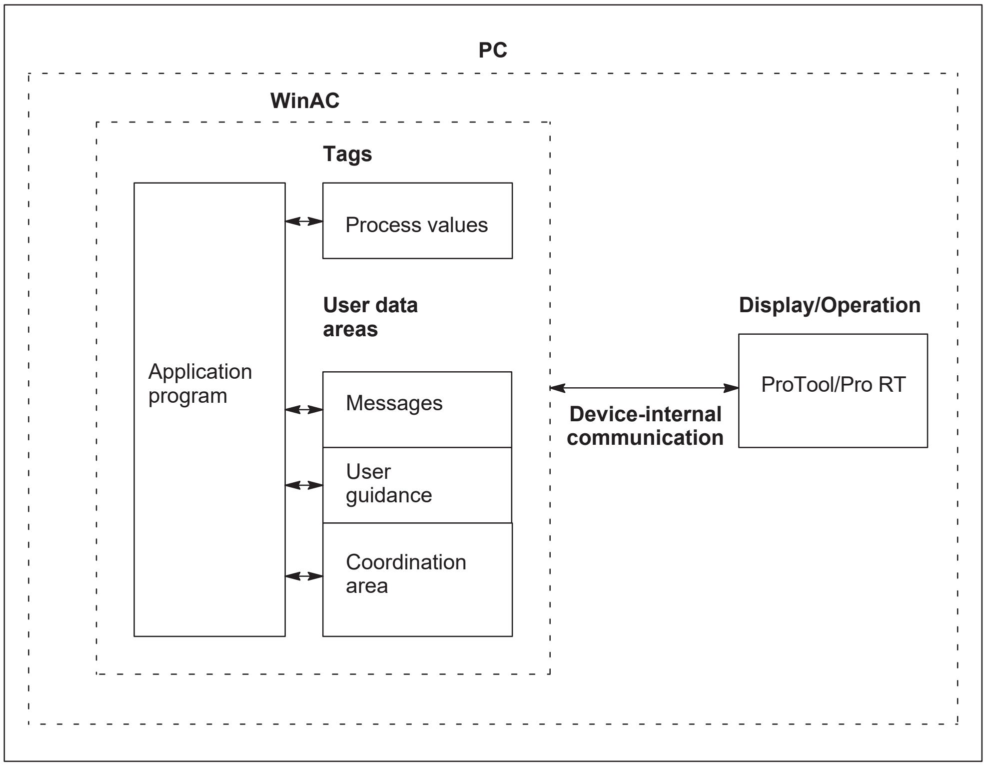


Figure 9-1 Communication structure

The following sections describe the **device-internal communication** between the ProTool/Pro Runtime and WinAC using the protocols listed below:

- SIMATIC S7 - 300/400 (preferable)
- SIMATIC S7 - WinAC

Task of the tags

The general exchange of data between the PLC and operating unit is performed by means of the process values. To do this, tags must be specified in the configuration which point to an address in the PLC. The operating unit reads the value from the specified address and displays it. In the same way, the operator can enter a value on the operating unit, which is then written to the address in the PLC.

9.2 Overview

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

User data area are required, for example, for:

- Trends
- PLC jobs
- Controlling LEDs
- Life bit monitoring

A detailed description of the user data areas is provided in Chapter 10.

9.3 Communication Management Using the SIMATIC S7 - 300/400 Protocol – General Information

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Note

Take the information provided in Chapter 8 into account when selecting the protocol to be used.

Conditions

Install one of the following WinAC products:

- WinAC Basis
- WinAC RTX
- WinAC Pro
- WinAC Slot

In order to communicate with the selected WinAC product, the following products are also required:

- SIMATIC STEP 7 configuration software from V5.1 SP3.
- SIMATIC NET CD configuration software from 7/2001 (optional)
- WinAC Basis from V4.0 (optional)

When selecting these products, take their approvals for the various operating systems into account.

In addition, SIMATIC HMI software ProTool/Pro CS must be integrated in STEP 7. Integrated configuration means that ProTool/Pro automatically reads the parameters for the PLC from STEP 7.

Note

External communication requires the installation of the SIMATIC NET CD configuration software from 7/2001. Otherwise, ProTool/Pro RT can only communicate internally with a WinAC PLC (i.e. on the same operating unit).

Example configuration

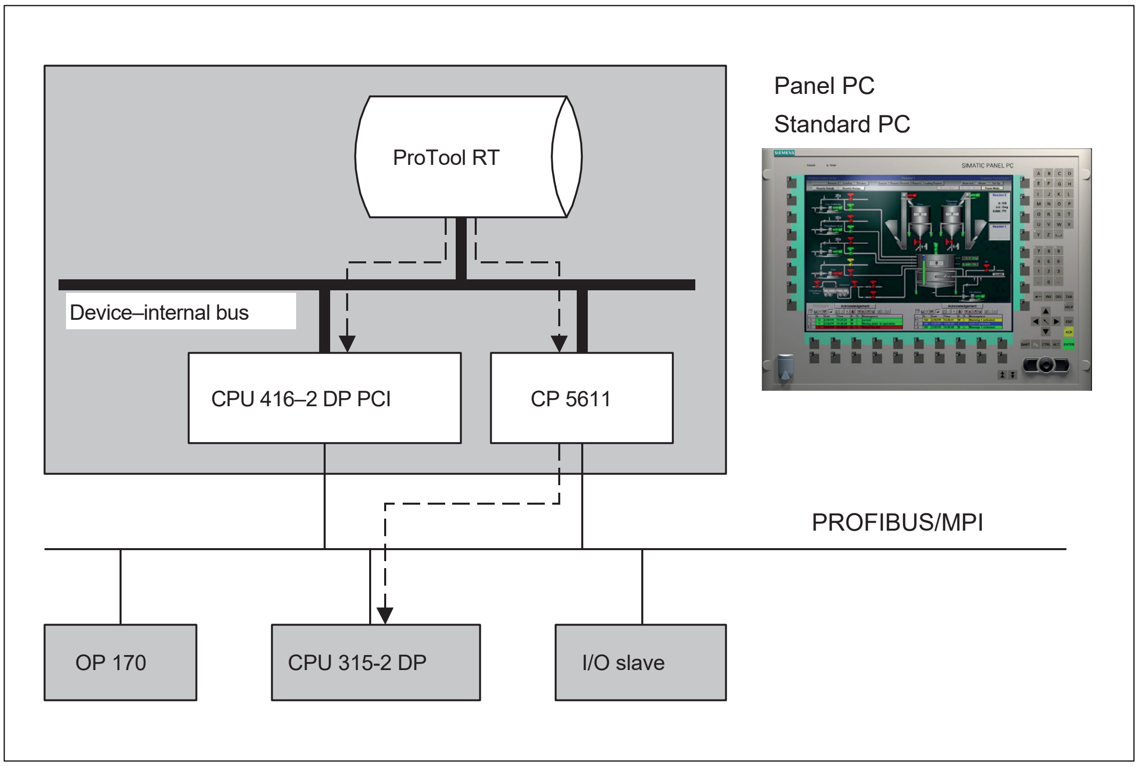

Figure 9-2 Communication example – connection of a SIMATIC S7 - 300/400 via internal device bus and externally via a CP 5611

The communication illustrated in Figure 9-2 is only possible when a SIMATIC NET CD from 07/2001 is installed.

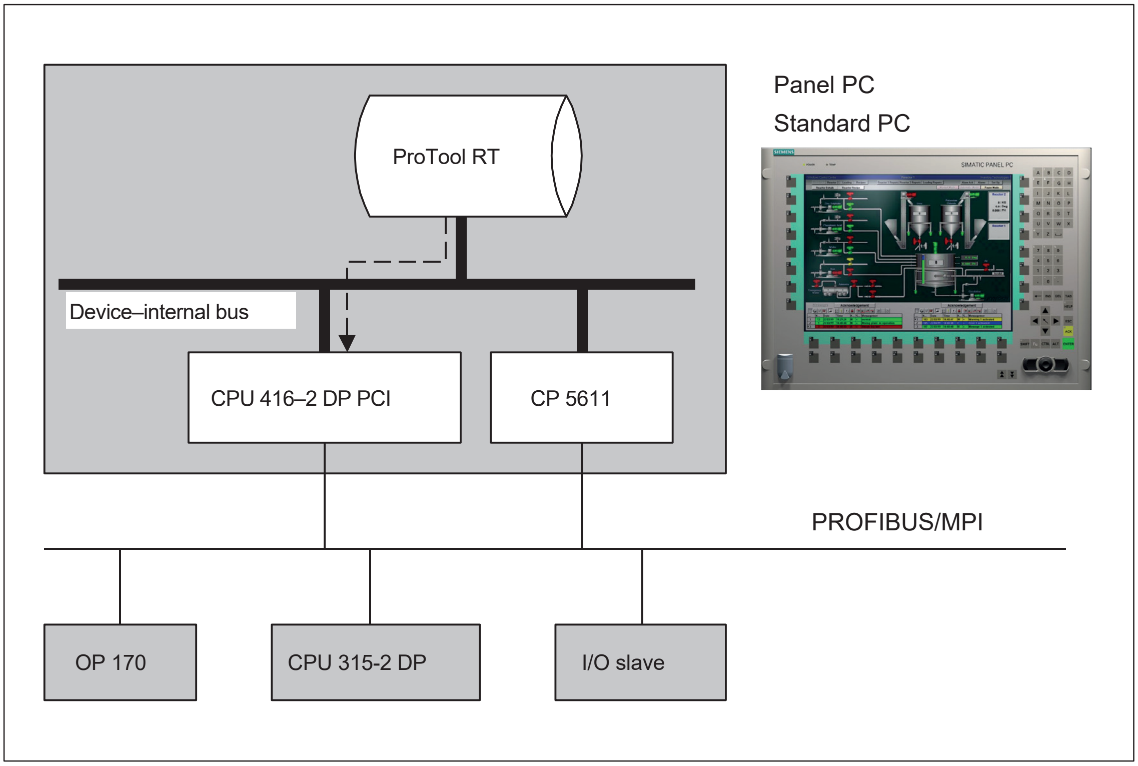

Figure 9-3 Communication example – connection of a SIMATIC S7 - 300/400 via internal device bus

The communication illustrated in Figure 9-3 is also possible when a SIMATIC NET CD from 07/2001 is not installed.

Configuration of the communication

Observe the documentation to STEP 7.

The configuration of internal communication is divided into three steps:

1. Configuration in STEP 7.
   – Insertion of a SIMATIC PC station in the STEP 7 project in the SIMATIC manager.
   – Check that the `Compatibility` check box in the SIMATIC PC station Properties dialog is active.

– Mark the operating unit you configured from the SIMATIC manager and select `Properties` using the right mouse button. The following window appears:

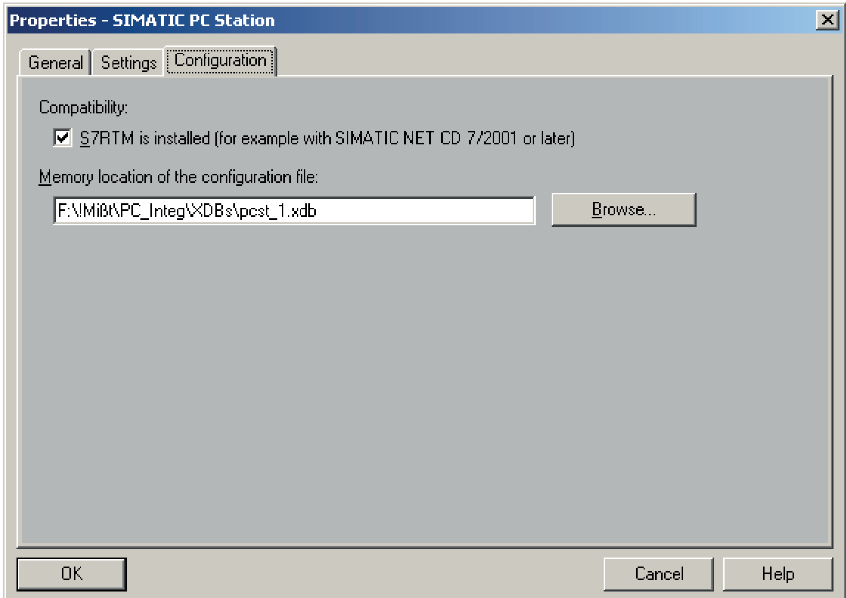

Figure 9-4 Define configuration

When the `Compatibility` check box is activated, ProTool CS assumes that the SIMATIC NET CD 7/2001 has been installed on the runtime operating unit and offers both external and internal communication partners in the PLC dialog.

– Change to HW Config.

– Access the catalog under *SIMATIC PC-Station → HMI* and select SIMATIC ProTool/Pro RT. Place it on the required index.

– Complete the configuration of the operating unit (according to the version e.g. WinAC, CPs).

– In the SIMATIC Manager, the *SIMATIC PC Station* now contains the ProTool/Pro CS configuration.

2. Configuring the communication setting in the ProTool/Pro configuration.
   – Open the configuration created in Step 1 in the SIMATIC Manager.
   – Select your operating unit.
   – Select the required communication partner in the PLC dialog. In the case of device-internal communication, open *SIMATIC PC Station* in the PLC dialog and select the required communication partner.
   – Edit the project.
3. Configuring the PC using ProTool/Pro Runtime.
   – Observe the documentation on the SIMATIC NET CD
   – Open the Component configurator
   – Insert SIMATIC ProTool/Pro RT in the same index as in HW Config
   – Complete the configuration of the operating unit (refer to the SIMATIC NET CD documentation or that of other products)

Note

The ActiveX Control SIMATIC Panel OCX for WinAC can be integrated ProTool/Pro Runtime.

The integration is described in the “Configuring Windows-based Systems” User’s Guide.

9.4 Communication Using the SIMATIC S7 - WinAC Protocol

Note

Take the information provided in Chapter 8 into account when selecting the protocol to be used.

Requirements

WinAC and ProTool/Pro RT must be installed on the same PC.

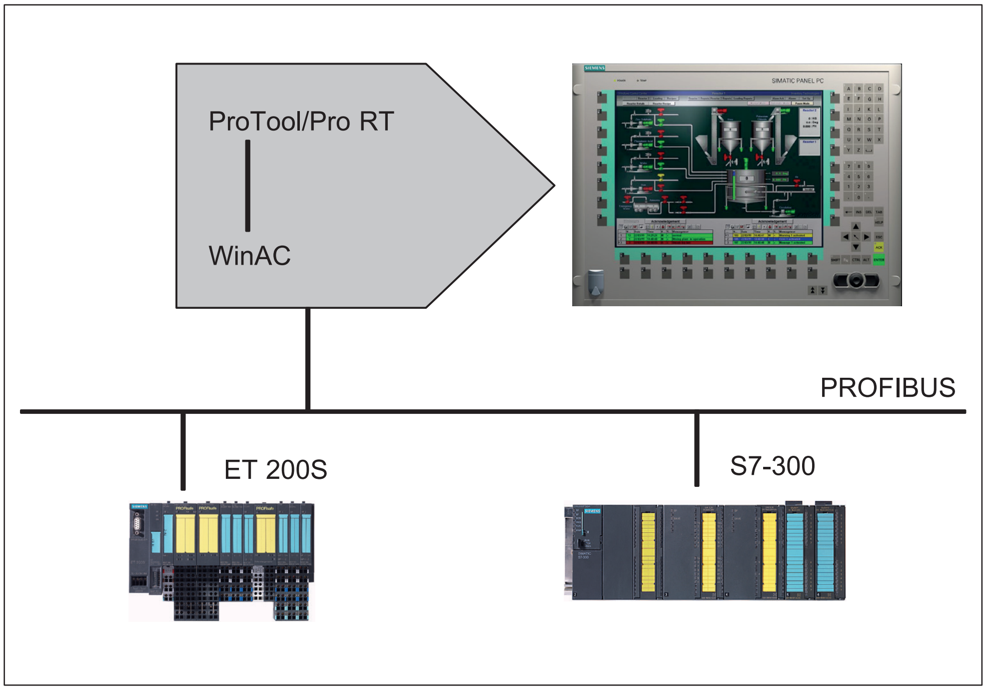

Figure 9-5 Example configuration for SIMATIC WinAC with Panel PC 670

In an example configuration corresponding to Figure 9-5, there is no access to the external buffer – the SIMATIC S7-300 PLC is used here.

Installation

The SIMATIC S7 - WinAC protocol is used in ProTool/Pro.

1. Open a ProTool/Pro project and select the PLCs.
2. Select *PLC → Properties*.

   A dialog box opens up.
3. Define the SIMATIC S7 - WinAC protocol in the dialog box.

Note

No parameters need to be entered in the SIMATIC S7 - WinAC protocol in ProTool/Pro.

However, the symbolic addressing of tags can be used if a PLC is selected in the ProTool project window and then use the Properties to open the *PLC* window. Select the *Parameters* button. Enter the CPU network and the CPU in the *SIMATIC S7 – WinAC*. Confirm with the *OK* button. Symbolic addressing is then possible.

ProTool uses the WinAC Computing Interface for communication with WinAC. To enable communication to the WinAC, the WinAC Computing Interface and *PU/PC Interface* must be defined.

WinAC Computing Interface settings:

1. Press *Start* → *SIMATIC* → *PC Based Controlled* → *Computing Configuration*.

   A dialog box opens up.

2. Select the *Computing* tab control.
3. Select the following:
   – *MPI = 3* for WinAC Slot or
   – *CPU 416-2DP ISA* for WinAC Pro or
   – *WinLC* for WinAC Basis

PU/PC interface settings:

1. Select *Start* → *Settings* → *Control Panel*→ *Set PU/PC Interface*.
2. Select the *Computing* access point and assign *PC internal (local) as used interface*.

User Data Areas for SIMATIC WinAC 10

Overview

User data areas are used for data exchange between the PLC and operating unit.

The user data areas are written to and read by the operating unit and the application program alternately during the process of communication. By analyzing the data stored there, the PLC and operating unit reciprocally initiate predefined actions.

This chapter describes the function, layout and special features of the various user data areas.

10.1 User Data Areas Available

Definition

User data areas can be located in data blocks and memory areas in the PLC.

Set up the user data areas both in the ProTool project and in the PLC.

The user data areas can be set up and modified in the ProTool project using the menu items *Insert* → *Area Pointers*.

Function range

The user data areas available are dependent on the operating unit used. The tables 10-1 and 10-2 provide an overview of the functional range of the individual operating units.

Table 10-1 User data areas available, Part 1

User data area	Panel PC	Standard PC	MP 370
User version	x	x	x
Job mailbox	x	x	x
Event messages	x	x	x
Screen number	x	x	x
Data mailbox	x	x	x
Date/Time	x	x	x
Date/Time PLC	x	x	x
Coordination	x	x	x
Trend request	x	x	x
Trend transfer 1, 2	x	x	x
LED assignment [1]	x	–	x
OP/PLC acknowledgement	x	x	x
Alarm messages	x	x	x

[1] Only possible using operating units with keyboard.

Table 10-2 User data areas available, Part 2

User data area	MP 270 MP 270B	TP 270 OP 270	TP 170B OP 170B	TP 170A
User version	x	x	x	–
Job mailbox	x	x	x	–
Event messages	x	x	x	x
Screen number	x	x	x	–
Data mailbox	x	x	x	–
Date/Time	x	x	x	–
Date/Time PLC	x	x	x	x
Coordination	x	x	x	–
Trend request	x	x	–	–
Trend transfer 1, 2	x	x	–	–
LED assignment [1]	x	x	x	–
OP/PLC acknowledgement	x	x	x	–
Alarm messages	x	x	x	–

[1] Only possible using operating units with keyboard.

Table 10-3 illustrates the way in which the PLC and operating unit access the individual user data areas – Read (R) or Write (W).

Table 10-3 Application of the user data areas

User data area	Necessary for	Operating unit	PLC
User version	ProTool Runtime checks whether the ProTool project version and the project in the PLC are consistent.	R	W
Job mailbox	Triggering of functions on the operating unit by PLC program	R/W	R/W
Event messages	Bit reporting process arrival and departure of event messages	R	W
Screen number	Evaluation by the PLC as to which screen is currently open	W	R
Data mailbox	Downloading of data records with synchronization	R/W	R/W
Date/Time	Transfer of date and time from the operating unit to the PLC	W	R
PLC date/time	Transfer of date and time from the PLC to the operating unit.	R	W
Coordination	Operating unit status polled by the PLC program	W	R
Trend request	Configured trends with “Triggering via bit” or configured history trends	W	R
Trend transfer 1	Configured trends with “Triggering via bit” or configured history trends	R/W	R/W
Trend transfer area 2	Configured history trend with “switch buffer”	R/W	R/W
LED Assignment	LED triggered by the PLC	R	W
OP acknowledgement	Message from the operating unit to the PLC indicating an alarm message has been acknowledged	W	R
PLC acknowledgement	Alarm message acknowledgement from the PLC	R	W
Alarm messages	Bit reporting process arrival and departure of alarm messages	R	W

The user data areas and their associated area pointers are explained in the following chapters.

10.2 User Data Area, User Version

Usage

When starting up the operating unit, it is possible to check whether the operating unit is connected to the correct PLC. This is important when several operating units are used.

To do this, the operating unit compares a value stored in the PLC with the value defined in the configuration. In this way, the compatibility of the configuration data with the PLC program is ensured. If there is a mismatch, a system message appears on the operating unit and the runtime configuration is terminated.

In order to use this user data area, set up the following during the configuration:

- Specify the configuration version – value between 1 and 255.

  ProTool: *System* → *Settings*

- Data address of the value for the version stored in the PLC:

  ProTool: *Insert* → *Area Pointers*, available types: *User version*

Danger

The user version is only checked while the connection is being established when ProTool Runtime is started. If the PLC is subsequently changed, the user version is not checked.

10.3 User Data Area, Job Mailbox

Description

The job mailbox can be used to send PLC jobs to the operating unit, thus initiating actions on the operating unit. These functions include:

- displaying screens
- setting date and time

The job mailbox is set up under *Area Pointer* and has a length of four data words.

The first word of the job mailbox contains the job number. Depending on the PLC job in question, up to three parameters can then be specified.

Data Word	Left byte (LB)	Right byte (RB)
n+0	0	Job no.
n+2	Parameter 1	
n+4	Parameter 2	
n+6	Parameter 3	

Figure 10-1 Structure of the user data area, job mailbox

If the first word of the job mailbox is not equal to zero, the operating unit analyzes the PLC job. The operating unit then sets this data word to zero again. For this reason, the parameters must be entered in the job mailbox first and then the job number.

The possible PLC jobs, including job number and parameters, are provided in the “ProTool Online Help” and the Appendix, Part B.

10.4 User Data Area, Event and Alarm Messages and Acknowledgement

Definition

Messages consist of a static text and/or tags. The text and tags can be defined by the user.

Messages are subdivided into event messages and alarm messages. The programmer defines the event message and alarm message.

Event messages

An event message indicates a status, e.g.

- `Motor switched on`
- `PLC in manual mode`

Alarm messages

An alarm message indicates an operational fault, e.g.

- `Valve not opening`
- `Motor temperature too high`

Acknowledgement

Since alarm messages indicate an abnormal operational status, they must be acknowledged. They can be acknowledged either by

- operator input on the operating unit
- setting a bit in the PLC acknowledgement area.

Triggering messages

A message is triggered by setting a bit in one of the message areas on the PLC. The location of the message areas is defined by means of the configuration software. The corresponding area must also be set up in the PLC.

As soon as the bit in the PLC event/alarm message area has been set and that area has been transferred to the operating unit, the operating unit detects that the relevant message has “arrived”.

Conversely, when the same bit is reset on the PLC by the operating unit, the message is registered as having “departed”.

Message areas

Table 10-4 indicates the number of message areas for event and alarm messages, for alarm acknowledgement OP (Operating unit → PLC) and for alarm acknowledgement PLC (PLC → Operating unit) and the number of words for the various operating units.

Table 10-4 Division of message areas

Operating unit	Event message area, Alarm message area Acknowledgement area OP, Acknowledgement area PLC	
	Number of data areas, maximum	**Words in data area, total**
Panel PC	8	125
Standard PC	8	125
MP 370	8	125
MP 270, MP 270B	8	125
TP 270, OP 270	8	125
TP 170B, OP 170B	8	125
TP 170A	8	125[1]

1 Only possible for event messages.

Assignment of message bit and message number

A message can be assigned to each bit in the configured message area. The bits are assigned to the message numbers in ascending order.

Example:

The following event message area has been configured in the PLC:

`DB 60        Address 42  Length 5` (in words)

Figure 5-2 illustrates the assignment of all 80 (5 x 16) message numbers to the individual bit numbers in the PLC event message area. The assignment is performed automatically on the operating unit.

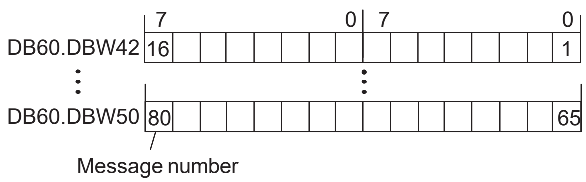

Figure 10-2 Assignment of message bit and message number

User data areas, acknowledgement

If the PLC should be informed of an alarm message acknowledgement on the operating unit or the acknowledgement should be initiated on the PLC itself, the relevant acknowledgement areas must also be set up in the PLC. These acknowledgement areas must also be specified in the ProTool project under *Area Pointers*.

- **Acknowledgement area Operating Unit → PLC**:

  This area is used to inform the PLC when an alarm message has been acknowledged by means of operator input on the operating unit. The “Alarm Ack. OP” area pointer must be created or configured for this.

- **Acknowledgement area PLC → Operating Unit**:

  This area is used when an alarm message is acknowledged by the PLC. In this case, the area pointer “PLC acknowledgement” must be set.

These acknowledgement areas must also be specified in the configuration under *Area Pointers*.

Figure 10-3 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 10-5 and 10-6.

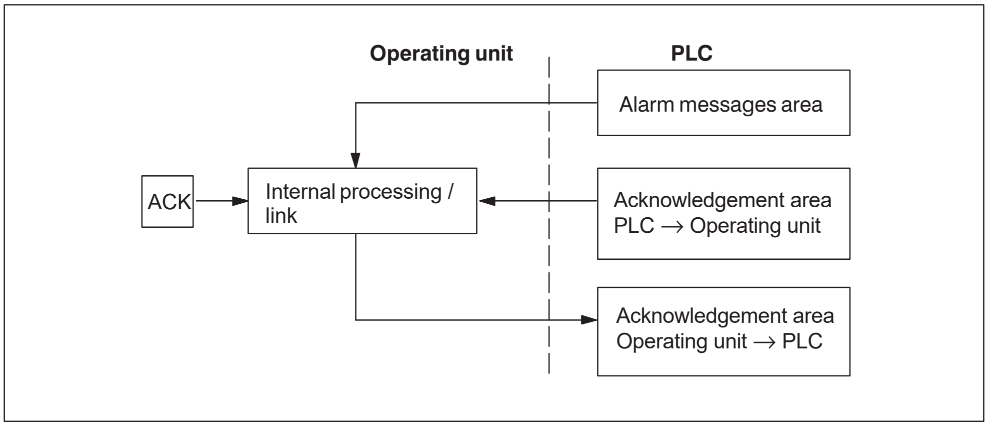

Figure 10-3 Alarm message and acknowledgement areas

Assignment of acknowledgement bit to message number

Each alarm message is assigned a message number. The message number is assigned the same bit number in the alarm messages area as that assigned in the acknowledgement area. Under normal circumstances, the acknowledgement area is the same length as the associated alarm messages area.

If the length of an acknowledgement area is not equal to the overall length of the associated alarm messages area, and there are succeeding alarm messages and acknowledgement areas, the following assignment applies:

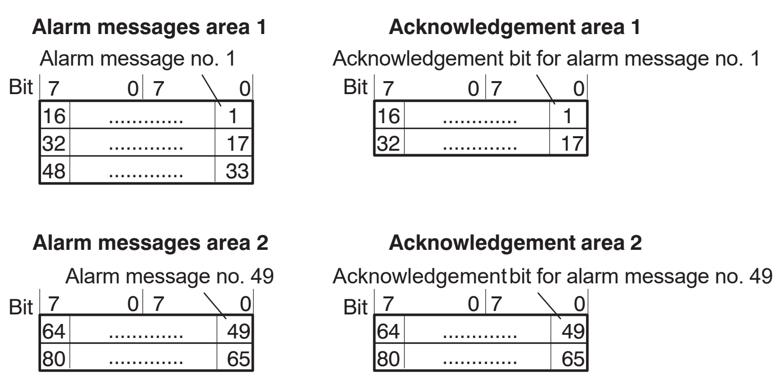

Figure 10-4 Assignment of acknowledgement bit and message number

Acknowledgement area PLC → Operating Unit

A bit set in this area by the PLC initiates the acknowledgement of the corresponding alarm message in the operating unit, thus fulfilling the same function as pressing the ACK button. Reset the bit before setting the bit in the alarm message area again. Figure 10-5 shows the signal diagram.

The acknowledgement area PLC → Operating Unit

- must follow on immediately from the associated alarm messages area,
- must have precisely the same polling time and
- may not be any longer than the associated alarm messages area.

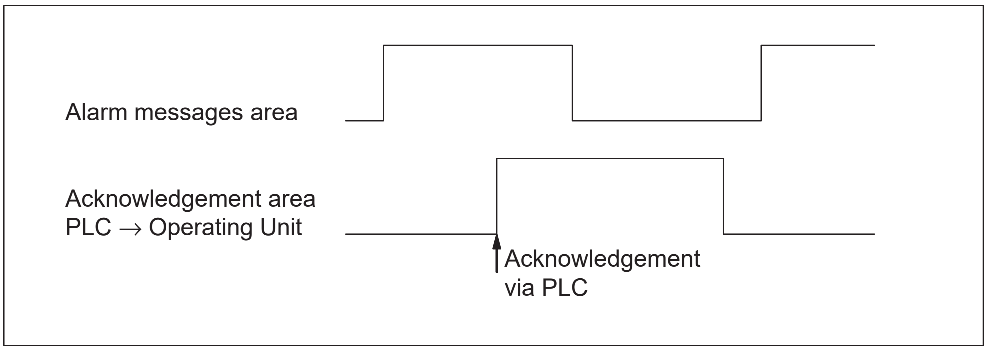

Figure 10-5 Signal diagram for acknowledgement area PLC → Operating Unit

Acknowledgement area Operating Unit → PLC

When a bit is set in the alarm message area, the operating unit resets the associated bit in the acknowledgement area. As a result of processing by the operating unit, the two processes indicate a slight difference with regard to time. If the alarm message is acknowledged on the operating unit, the bit in the acknowledgement area is set. In this way, the PLC can detect that the alarm message has been acknowledged. Figure 10-6 illustrates the signal diagram.

The acknowledgement area Operating Unit → PLC must be no longer than the associated alarm messages area.

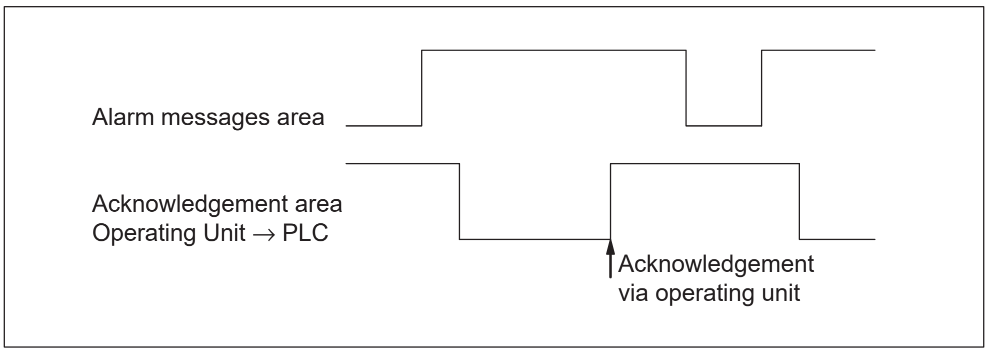

Figure 10-6 Signal diagram for acknowledgement area Operating Unit → PLC

Acknowledgement area size

The acknowledgement areas PLC → Operating Unit and Operating Unit → PLC must not be any longer than the associated alarm message areas. The acknowledgement area, however, be smaller if acknowledgement by the PLC is not required for all alarm messages. This is also valid when the acknowledgement need not be detected in the PLC for all alarm messages. Figure 10-7 illustrates such a case.

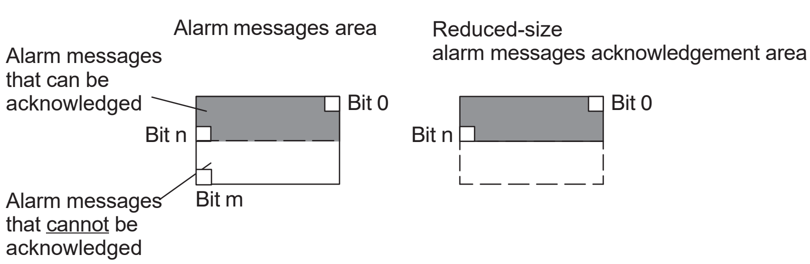

Figure 10-7 Reduced-size acknowledgement area

Note

Place important alarm messages in the alarm messages area starting at Bit 0 in ascending order.

10.5 User Data Area, Screen Numbers

Application

The operating units store information concerning the screen currently open on the unit in the screen number user data area.

This enables the transfer of data regarding the current operating unit display content to the PLC which, in turn, can trigger certain reactions; e.g. call in a different screen.

Requirements

If the screen number area should be used, it must be specified in the ProTool project as an *Area Pointer*. It can only be stored in one PLC and only once.

The screen number area is downloaded to the PLC spontaneously, i.e. the transfer is always initiated when a change is selected on the operating unit. Therefore, it is not necessary to configure an acquisition cycle.

Structure

The screen number area is a data area with a fixed length of 5 data words.

The structure of the screen number area in the PLC memory is illustrated below.

	7 0 | 7 0
1st Word	Current screen type
2nd Word	Current screen number
3rd Word	Reserved
4th Word	Current field number
5th Word	Reserved

Entry	Assignment
Current screen type	1 for basic screen or 4 for fixed window
Current screen number	1 to 65535
Current field number	1 to 65535

10.6 User Data Area, Date/Time

Transferring date and time

The transfer of date and time from the operating unit to the PLC can be triggered by PLC jobs 40 and 41. Both can be used to read the date and time from the operating unit and write it to the Date/Timedata area. They can be analyzed by the PLC program in this area.

The jobs differ in respect of the format in which the information is stored. PLC job 40 writes in the format S7 DATE_AND_TIME, and PLC job 41 uses the same format as the operating unit. Both formats are in BCD code.

Format S7 DATE_AND_TIME (BCD-coded)

The SIMATIC S7 format used by PLC Job 40 has the following structure:

Byte	7 … 4	3 … 0
n+0	Year (80–99/0–29)	
n+1	Month (1–12)	
n+2	Day (1–31)	
n+3	Hour (0–23)	
n+4	Minute (0–59)	
n+5	Second (0–59)	
n+6	1/10 seconds (0–9)	1/100 Seconds (0–9)
n+7	1/1000 second (0–9)	Weekday (1–7, 1=Sun)

Figure 10-8 Structure of data area Date/Time in S7 DATE_AND_TIME format

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Note

When entering data in the year data area, please note that the values 80–99 represent 1980 to 1999 and 0–29 the years 2000 to 2029.

Operating unit format

The format used by PLC Job 41 has the following structure:

Byte	7 0
n+0	Reserved
n+1	Hour (0–23)
n+2	Minute (0–59)
n+3	Second (0–59)
n+4	Reserved
n+5	Reserved
n+6	Reserved
n+7	Weekday (1–7, 1=Sun)
n+8	Day (1–31)
n+9	Month (1–12)
n+10	Year (0–99)
n+11	Reserved

Figure 10-9 Structure of the Date/Time data area in operating unit format

Differences in the S7 format as compared to the operating unit format

The S7 DATE_AND_TIME format differs from the operating unit format in the following ways:

- Different sequence of entries
- Details of 1/10, 1/100 and 1/1000 seconds integrated in the format
- Memory requirements reduced from 12 to 8 bytes

10.7 User Data Area, Date/Time PLC

Transfer of date and time to the operating unit

The downloading of date and time to the operating unit is generally useful when the PLC is master for time.

The TP 170A operating unit represents a special case here:

Synchronization with the PLC system time is necessary when a `Single message display` screen object is to be inserted in a ProTool screen. The `Single message display` screen object is the only TP 170A screen object which has access to the unit's system time. This restriction only applies to the TP 170A.

DATE_AND_TIME format (BCD coded)

Byte	7 … 4	3 … 0
n+0	Year (80–99/0–29)	
n+1	Month (1–12)	
n+2	Day (1–31)	
n+3	Hour (0–23)	
n+4	Minute (0–59)	
n+5	Second (0–59)	
n+6	1/10 seconds (0–9)	1/100 Seconds (0–9)
n+7	1/1000 second (0–9)	Weekday (1–7, 1=Sun)

Figure 10-10 Structure of data area Date/Time in S7 DATE_AND_TIME format

Note

When entering data in the year data area, please note that the values 80–99 represent 1980 to 1999 and 0–29 the years 2000 to 2029.

The PLC writes cyclically to the data area, whereby the operating unit reads and synchronizes (refer to the ProTool User's Guide).

Note

In the configuration, do not select too small an acquisition cycle for the Date/Time area pointer because this affects the operating unit performance.

Recommendation: Acquisition cycle of 1 minute, if permitted by the process.

10.8 User Data Area, Coordination

The coordination user data area is two data words long. It serves to realize the following functions:

- Detection of operating unit startup by the PLC program,
- Detection of the current operating unit operating mode by the PLC program,
- Detection by the PLC program that the operating unit is ready to communicate.

Note

Each time the coordination area is updated by the operating unit, the entire coordination area is written.

Therefore, the PLC program must not execute any modifications in the coordination area.

Bit assignment in coordination area

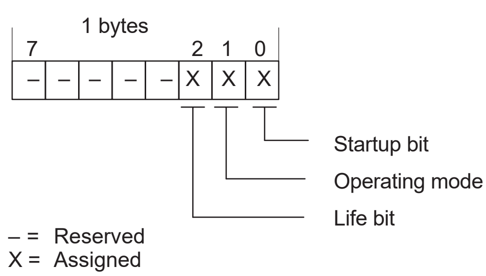


Figure 10-11 Significance of the bits in the coordination area

Startup bit

The startup bit is set to 0 for a short time during the start-up routine by the operating unit. After the startup routine has been completed, the bit is set permanently to 1.

Operating mode

As soon as the operating unit has been switched offline by the operator, the operating mode bit is set to 1. When the operating unit is working in normal operation, the operating mode bit is set to 0. The PLC program can be used to poll this bit and thus establish the current operating mode of the operating unit.

Life bit

The life bit is inverted by the operating unit at intervals of approx. one second. The PLC program can be used to poll this bit to check whether connection to the operating unit still exists.

10.9 User Data Area, Trend Request and Trend Transfer

Trends

A trend is the graphical representation of a value from the PLC. Reading of the value can be time-triggered or bit-triggered, depending on the configuration.

Time-triggered trends

The operating unit reads the trend values cyclically according to the cycle interval defined in the configuration. Time-triggered trends are suitable for continuous progressions such as the operating temperature of a motor.

Bit-triggered trends

By setting a trigger bit in the trend transfer area pointer, the operating unit reads in either a trend value or the entire trend buffer. This is specified in the configuration. Bit-triggered trends are normally used to display values of an area subject to rapid variation. An example of this is the injection pressure for plastic moldings.

In order to be able to activate bit-triggered trends, corresponding data areas have to be specified in the ProTool project (under *Area Pointers*) and set up on the PLC. The operating unit and the PLC communicate with one another via those areas.

The following areas are available for trends:

- Trend request area
- Trend transfer area 1
- Trend transfer area 2 (required with switch buffer only)

Assign a trend to a bit in the configuration. This ensures the bit assignment is unique for all areas.

Switch buffer

The switch buffer is a second buffer for the same trend and can be set up during the configuration.

While the operating unit reads the value from Buffer 1, the PLC writes it in Buffer 2. If the operating unit reads from Buffer 2, the PLC writes to Buffer 1. This prevents the trend value being overwritten by the PLC when being read by the operating unit.

Partitioning of the area pointers

The trend request and trend transfer 1 and 2 area pointers can be divided into separate data areas with a predefined maximum number and length (Table 10-5).

Table 10-5 Partitioning of the area pointer

	Data area		
	Trend request	Trend transfer	
		1	2
Number of data areas, maximum	8	8	8
Words in data area, total	8	8	8

Trend request area

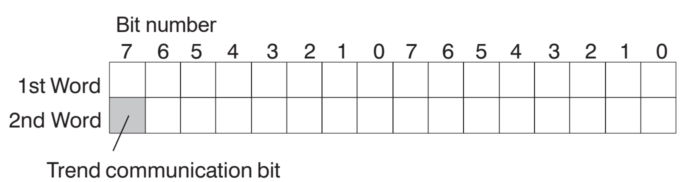
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

The trend request area can be used by the PLC to ascertain which trend is currently being displayed on the operating unit. Trends can also be triggered without analysis of the trend request area.

Trend transfer area 1

This area serves for triggering trends. In the PLC program, set the bit assigned to the trend in the trend transfer area and the trend communication bit. The operating unit detects triggering and reads in either a trend value or the entire buffer. It then resets resets the trend bit and the trend communication bit.

Trend transfer area(s)



The trend transfer area must not be altered by the PLC program until the trend communication bit has been reset.

Trend transfer area 2

Trend transfer area 2 is necessary for trends that are configured with a switch buffer. Its layout is precisely the same as that of trend transfer area 1.

10.10 User Data Area, LED Assignment

Application

The Operator Panel (OP), Multi Panel (MP) and Panel PC have function keys with Light Emitting Diodes (LEDs) integrated in them. These LEDs can be controlled from the PLC. This means, for example, that in specific situations, it is possible to indicate to the operator which key should be pressed by switching on an LED.

Requirements

In order to control LEDs, corresponding data areas, so-called LED assignments, must be set up in the PLC and defined in the configuration as *Area Pointers*.

Partitioning of the area pointer

The LED assignment area pointer can be divided into separate data areas, as illustrated in the following table.

Table 10-6 Partitioning of the area pointer

Operating unit	Number of data areas, maximum	Words in data area, total
Panel PC	8	16
MP 370	8	16
MP 270, MP 270B	8	16
OP 270	8	16
OP 170B	8	16

Note

The area pointer in question can no longer be selected in the *Insert new area pointer* window when the maximum number has been reached. Area pointers of the same type appear gray.

LED assignment

The assignment of the individual LEDs to the bits in the data areas is defined when the function keys are configured. This involves specifying a bit number within the assignment area for each LED.

The bit number (n) identifies the first of two successive bits which control the following LED states (refer to Table 10-7):

Table 10-7 LED flashing frequency

Bit n + 1	Bit n	LED function
0	0	Off
0	1	Flashes
1	0	Flashes
1	1	Permanently on

10.11 Recipes

Description

During the transfer of data records between the operating unit and PLC, both communication peers alternately access common communication areas in the PLC. The function and structure of the recipe-specific communication area (“data mailbox”) and the mechanisms involved in synchronized transfer of data records are the subject of this chapter.

Information on setting up the data mailbox in ProTool is provided in the online help.

Downloading method

There are two methods of downloading data records between operating unit and PLC:

- Asynchronous transfer (Page 10-20)
- Synchronized transfer using the data mailbox (Page 10-21)

Data records are always transferred directly, i.e. the tag values are read or written directly from or to the address configured for the tag without being stored intermediately.

Trigger downloading of data records

There are three methods of triggering the transfer of data:

- By operator input on the recipe display (Page 10-23)
- By PLC jobs (Page 10-24)
- By activating configured functions (Page 10-25)

If transfer of data records is initiated by a configured function or a PLC job, the recipe display on the operating unit remains fully functional as the data records are transferred in the background.

Simultaneous processing of multiple transfer jobs is not possible, however. In such cases, the operating unit returns a system message refusing additional transfer requests.

A list of the most important system messages together with notes on the possible causes of the associated errors and remedies for them is provided in Appendix, Part A.

10.11.1 Asynchronous data transfer

Purpose

In the case of asynchronous transfer of data records between operating unit and PLC, there is **no** coordination of the communication areas commonly used. For this reason, there is no need to set up a data mailbox during the configuration process.

Application

The **asynchronous** transfer of data records is applicable, for example, when the

- uncontrolled overwriting of data by the communication peers can be reliably prevented by the system,
- the PLC does not require any details of the recipe and data record numbers, or
- transfer of data records is initiated by operator input on the operating unit.

Read values

On triggering a read transfer, the values are read from the PLC addresses and downloaded to the operating unit.

- **Transfer initiated by operator input in recipe view**

  Data is uploaded to the operating unit. There it can be processed, e.g. values can be modified and the changes saved.

- **Transfer initiated by function or PLC job**

  The data is saved directly to the storage medium.

Write values

On triggering a write transfer, the values are written to the PLC addresses.

- **Transfer initiated by operator input in recipe view**

  The current values are written to the PLC.

- **Transfer initiated by function or PLC job**

  The values on the storage medium are written to the PLC.

10.11.2 Synchronous data transfer

Purpose

In the case of synchronous data transfer, both the communication peers set status bits in the commonly used data mailbox. In this way, the PLC program can prevent uncontrolled overwriting of each other's data by the two units.

Application

The **synchronous** transfer of data records is applicable, for example, when

- the PLC is the "active partner" for transfer of data records,
- details of the recipe and data record numbers are to be analyzed on the PLC, or
- transfer of data records is initiated by PLC job.

Requirements

In order to synchronize the transfer of data records between the operating unit and PLC, the following conditions must be fulfilled in the configuration:

- the data mailbox must have been set up in *System* → *Area Pointer*;
- the recipe properties must specify the PLC with which the operating unit has to synchronize transfer of data records.

  The PLC is specified in the recipe editor in *Properties* → *Transfer*.

Detailed information on this is provided in *ProTool Configuring Windows-based Systems* User's Guide.

10.11.3 Data mailbox for synchronized data transfer

Structure

The data mailbox has a defined length of 5 words. Its structure is as follows:

	7 0	7 0
1st Word	Current recipe number (1 – 999)	
2nd Word	Current data record number (0 – 65,535)	
3rd Word	Reserved	
4th Word	Status (0, 2, 4, 12)	
5th Word	Reserved	

Status word

The status word (Word 4) can assume the following values:

Value		Explanation
Decimal	Binary	
0	0000 0000	Transfer permitted, data mailbox is accessible
2	0000 0010	Transfer in progress
4	0000 0100	Transfer completed without errors
12	0000 1100	Errors occurred during transfer

10.11.4 Synchronization process

Read from the PLC by operating the recipe view

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe number to be read and the status "Transfer in progress" in the data mailbox and sets the data record number to zero.	Operation cancelled and system message returned
3	The operating unit reads the values from the PLC and displays them on the recipe display. In the case of recipes with synchronous tags, the values from the are also written in the tags.	
4	The operating unit sets the status to "Transfer completed".	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Write in the PLC by operating the recipe view

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number to be written and the status "Transfer in progress" in the data mailbox.	Operation cancelled and system message returned
3	The operating unit writes the current values to the PLC. In the case of recipes with synchronized tags, the modified values between the recipe views and tags are compared and then written to the PLC.	
4	The operating unit sets the status to "Transfer completed".	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Read from the PLC by PLC job “PLC → DAT” (no. 69)

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the job and the status “Transfer in progress” in the data mailbox.	Operation cancelled and no message returned
3	The operating unit reads the value from the PLC and saves the value in the data record specified by the job.	
4	• If the option “Overwrite” has been specified for the job, existing data records are overwritten without prior warning. The operating unit sets the status to “Transfer completed”. • If “Do not overwrite” was specified in the job and the data record already exists, the operating unit terminates the process and enters `0000 1100` in the status word of the data mailbox.	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Details of the structure of the PLC job are provided on Page 10-26.

Write in the PLC by PLC job “DAT → PLC” (no. 70)

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the job and the status “Transfer in progress” in the data mailbox.	Operation cancelled and no message returned
3	The operating unit retrieves the value from the data record specified in the job from the data medium and writes that value in the PLC.	
4	The operating unit sets the status to “Transfer completed”.	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Details of the structure of the PLC job are provided on Page 10-26.

Read from the PLC by configured function

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the function and the status “Transfer in progress” in the data mailbox.	Operation cancelled and system message returned
3	The operating unit reads the data from the PLC and saves it to the data record specified by the function.	
4	• If the option “Overwrite” has been specified for the function, existing data records are overwritten without prior warning. The operating unit sets the status to “Transfer completed”. • If “Do not overwrite” was specified in the job and the data record already exists, the operating unit terminates the process and enters `0000 1100` in the status word of the data mailbox.	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Write in the PLC by configured function

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the function and the status “Transfer in progress” in the data mailbox.	Operation cancelled and system message returned
3	The operating unit retrieves the value from the data record specified in the function from the data medium and writes that value in the PLC.	
4	The operating unit sets the status to “Transfer completed”.	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Note

For reasons of data consistency, analysis of the recipe and data record number on the PLC cannot be performed until the status in the data mailbox is set to “Transfer completed” or “Errors occurred during transfer”.

Possible causes of errors

If the downloading of data records is terminated due to errors, it may be due to one of the following reasons:

- Tag address not set up on PLC,
- Overwriting of data records not possible,
- Recipe number not available
- Data record number not available

A list of the most important system messages together with notes on the possible causes of the associated errors and remedies for them is provided in Appendix, Part A.

Response to error-based termination

The operating unit responds as follows when the downloading of data records is terminated due to an error:

- **Transfer initiated by operator input in recipe view**

  Indication on the status bar on the recipe display and issue of system messages.
- **Transfer initiated by function**

  System messages issued.
- **Transfer initiated by PLC job**

  No feedback of information on operating unit

Regardless of the response of the operating unit, the status of the transfer can be checked by reading the status word in the data mailbox.

10.11.5 PLC jobs for recipes

Purpose

The transfer of data records between operating unit and PLC can be triggered by the PLC program. This requires no operator input on the operating unit.

The two PLC jobs **No. 69** and **No. 70** can be used for this.

No. 69: Read data record from PLC (“PLC → DAT”)

PLC Job **No. 69** downloads data records from the PLC to the operating unit. The structure of this PLC job is as follows:

	Left byte (LB)	Right byte (RB)
Word 1	0	69
Word 2	Recipe number (1 to 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	Do not overwrite existing data record: 0 Overwrite existing data record: 1	

No. 70: Write data record to PLC (“DAT → PLC”)

PLC Job **No. 70** downloads data records from the operating unit to the PLC. The structure of this PLC job is as follows:

	Left byte (LB)	Right byte (RB)
Word 1	0	70
Word 2	Recipe number (1 to 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	—	

Part V Connection to SIMATIC 505

Communication Management with SIMATIC 505

11

This chapter describes the data types supported and the optimization for communication between the operating unit and SIMATIC 505 PLC.

Known restrictions

An RS 422 connection to the SIMATIC 575-VME is not currently supported.

When the CPU 5602120 and CPU 5602820 series are used and the special functions are implemented, access to the S Memory data types (special user data types) is not possible. The standard data types can be used as normal.

Installation

The drivers for the connection to a SIMATIC 505 PLC are a component part of the ProTool configuration software and are installed automatically.

Using ProTool, the parameters for the connection to the PLC must also be set. Please refer to Chapters 12 and 13 for information regarding which parameters are necessary on the PLC side to connect the operating unit.

Program for controlling the DP driver

In the case of connection to PROFIBUS-DP, a PLC program is required which processes the protocol. An example program is supplied with ProTool (written in LADDER) which can be adapted for individual requirements. The example program supports linear P-addressing. The example program is located in the directory `PROTOOL\PLCPROG\SIMATIC505`.

Compatibility of ProTool V5.0x to newer versions

Newer versions of ProTool do not support exactly the same data formats as ProTool V5.0x for some PLCs. However, it is still possible to used your configuration. After calling in the configuration using a newer version of ProTool, the configuration window item object type *Tags* displays “invalid data format”. The configuration can be edited but not created.

Call in the dialog box for the tag with a double click. The old, invalid data format is displayed. Change the data format to a valid one.

11.1 Data Types

When configuring tags and area pointers, the user data types listed in Table 11-1 are available for use. The condition for this is that those data types have also been set up in TISOFT for the CPU.

Table 11-1 Data types for the operating unit

<table>
<tr><th>User data type</th><th>Addressed by</th><th>Format</th></tr>
<tr><td>Discrete Input</td><td>X</td><td>Bit</td></tr>
<tr><td>Discrete Output</td><td>Y</td><td>Bit</td></tr>
<tr><td>Control Relay</td><td>C</td><td>Bit</td></tr>
<tr><td>Tag Memory</td><td>V[1)]</td><td rowspan="5">Bit
+/– INT
INT
+/– DOUBLE
DOUBLE
REAL
ASCII</td></tr>
<tr><td>Word Input</td><td>WX[1)]</td></tr>
<tr><td>Word Output</td><td>WY[1)]</td></tr>
<tr><td>Constant Memory</td><td>K[1)]</td></tr>
<tr><td>Status Word Memory</td><td>STW[1)]</td></tr>
<tr><td>Timer/Counter Preset</td><td>TCP[1)]</td><td rowspan="2">+/– INT
INT</td></tr>
<tr><td>Timer/Counter Current</td><td>TCC[1)]</td></tr>
<tr><td>Analog Alarm</td><td></td><td></td></tr>
<tr><td>Process Loop</td><td></td><td></td></tr>
<tr><td>Special Function</td><td></td><td></td></tr>
</table>

1) When connected to the PROFIBUS-DP, only these user data types are used in the example programs supplied.

Analog Alarm, *Process Loop* and *Special Function* are general terms for a number of special user data types. If these collective terms are selected in the dialog box *Tag*, an additional selection list appears in which the actual user data types can be set (refer to Tables 11-2 to 11-4).

Table 11-2 Analog alarm

User data type	Addressed by	Format
Analog Alarm/Alarm Acknowledge Flags	AACK	+/–INT, INT
Analog Alarm Deadband	AADB	+/–INT, INT, REAL
Most Significant Word of Analog Alarm C-flags	ACFH	+/–INT, INT
Least Significant Word of Analog Alarm C-flags	ACFL	+/–INT, INT
Analog Alarm Error	AERR	+/–INT, INT, REAL
Analog Alarm High Alarm Limit	AHA	+/–INT, INT, REAL
Analog Alarm High-High Alarm Limit	AHHA	+/–INT, INT, REAL
Analog Alarm Low Alarm Limit	ALA	+/–INT, INT, REAL
Analog Alarm Low-Low Alarm Limit	ALLA	+/–INT, INT, REAL

Table 11-2 Analog alarm, continued

User data type	Addressed by	Format
Analog Alarm Orange Deviation Alarm Limit	AODA	+/–INT, INT, REAL
Analog Alarm Process Tag	APV	+/–INT, INT, REAL
Analog Alarm Process Tag High Limit	APVH	REAL
Analog Alarm Process Tag Low Limit	APVL	REAL
Analog Alarm Rate of Change Alarm Limit	ARCA	REAL
Analog Alarm Setpoint	ASP	+/–INT, INT, REAL
Analog Alarm SP High Limit	ASPH	+/–INT, INT, REAL
Analog Alarm SP Low Limit	ASPL	+/–INT, INT, REAL
Analog Alarm Sample Rate	ATS	REAL
Analog Alarm Flags	AVF	+/–INT, INT
Analog Alarm Yellow Deviation Alarm Limit	AYDA	+/–INT, INT, REAL
Alarm Peak Elapsed Time	APET	+/–INT, INT

Table 11-3 Process loop

User data type	Addressed by	Format
Loop Alarm/Alarm Acknowledge Flags	LACK	+/–INT, INT
Loop Alarm Deadband	LADB	+/–INT, INT, REAL
Most Significant Word of Loop C-flags	LCFH	+/–INT, INT
Least Significant Word of Loop C-flags	LCFL	+/–INT, INT
Loop Error	LERR	+/–INT, INT, REAL
Loop Alarm High Limit	LHA	+/–INT, INT, REAL
Loop Alarm High-High Limit	LHHA	+/–INT, INT, REAL
Loop Gain	LKC	REAL
Loop Derivative Gain Limiting Coefficient	LKD	REAL
Loop Low Alarm Limit	LLA	+/–INT, INT, REAL
Loop Low-Low Alarm Limit	LLLA	+/–INT, INT, REAL
Loop Output	LMN	+/–INT, INT, REAL
Loop Bias	LMX	+/–INT, INT, REAL
Loop Orange Deviation Limit	LODA	+/–INT, INT, REAL
Loop Process Tag	LPV	+/–INT, INT, REAL
Loop PV High Limit	LPVH	REAL
Loop PV Low Limit	LPVL	REAL
Loop Rate of Change Alarm Limit	LRCA	REAL
Loop Ramp/Soak Flags	LRSF	+/–INT, INT

Table 11-3 Process loop, continued

User data type	Addressed by	Format
Loop Ramp/Soak Step Number	LRSN	+/–INT, INT
Loop Setpoint	LSP	+/–INT, INT, REAL
Loop Setpoint High Point	LSPH	+/–INT, INT, REAL
Loop Setpoint Low Limit	LSPL	+/–INT, INT, REAL
Loop Rate	LTD	REAL
Loop Reset	LTI	REAL
Loop Sample Rate	LTS	REAL
Loop V-flags	LVF	+/–INT, INT
Loop Yellow Deviation Alarm Limit	LYDA	+/–INT, INT, REAL
Loop Peak Elapsed Time	LPET	+/–INT, INT

Table 11-4 Special function

User data type	Addressed by	Format
SF Program Peak Elapsed Time	PPET	+/–INT, INT
SF Subroutine Peak Elapsed Time	SPET	+/–INT, INT

11.2 Optimization

Acquisition cycle and update time

The acquisition cycles defined in the configuration software for the area pointers and the acquisition cycles for the tags are major factors in respect of the real update times which are achieved.

The update time is the acquisition cycle plus transmission time plus processing time.

In order to achieve optimum update times, the following points should be observed during configuration:

- When setting up the individual data areas, make them as large as necessary but as small as possible.
- Define data areas that belong together as contiguous areas. The real update time is improved by setting up one large are area instead of several small areas.

- Setting acquisition cycles which are too short unnecessarily impairs overall performance. Set the acquisition cycle to correspond to the modification time of the process values. The rate of change of temperature of a furnace, for example, is considerably slower than the acceleration curve of an electric motor.

  Guideline value for the acquisition cycle: 1 second.
- If necessary, dispense with cyclic transmission of user data areas (acquisition cycle = 0) in order to improve the update time. Instead, use PLC jobs to transfer the user data areas at random times.
- Store the tags for a message or a screen in a contiguous data area.
- In order that changes on the PLC are reliably detected, they must occur during the actual acquisition cycle at least.

Screens

The real screen updating rate which can be achieved is dependent on the type and quantity of data to be displayed.

In order to achieve short updating times, ensure that short acquisition cycles are only defined in the configuration for those objects which actually need to be updated quickly.

Trends

If, in the case of bit-triggered trends, the communication bit is set in the “trend transfer area”, the operating unit always updates all the trends whose bit is set in that area. It resets the bits afterwards.

The communication bit in the PLC program can only be set again after all the bits have been reset by the operating unit.

PLC jobs

If large numbers of PLC jobs are sent to the operating unit in quick succession, communication between the operating unit and PLC may become overloaded.

If the operating unit enters the value 0 in the first data word of the job mailbox, it signifies that the operating unit has accepted the job. It then processes the job, for which it requires a certain amount of time. If a new PLC job is then immediately entered in the job mailbox, it may take some time before the operating unit executes the next PLC job. The next PLC job is only accepted when sufficient computer performance is available.

Connection via NITP

12

This chapter describes the communication between the operating unit and SIMATIC 505 PLC using the serial connection via NITP.

Operating units

The following operating unit can be connected to the SIMATIC 505 using the serial connection via NITP:

- Panel PC
- Standard PC
- MP 370
- MP 270, MP 270B
- TP 270, OP 270
- TP 170B, OP 170B
- TP 170A

Installation

The drivers for the connection to a SIMATIC 505 PLC are a component part of the ProTool configuration software and are installed automatically.

Connection of the operating unit to the PLC is basically restricted to the physical connection of the operating unit. Special function blocks for connection to the PLC are not required.

Connection

No additional communication modules are required in order to connect the operating unit to the SIMATIC 505. Communication can be performed via one of the standard ports provided in the system. This relates to the interface COM 1 or 2 in the case of a Panel PC and standard PC, and interface IF1 in the case of all other operating units. On the PLC side, the operating unit should be connected to the CPU programming interface (RS 232 or RS 422). Please refer to Table 12-1 for information on which connection cables to use.

Note

Details of which interface to use on the operating unit are provided in the relevant equipment manual.

Table 12-1 Applicable connection cables (refer to Appendix, Part C Interface Assignment)

Operating unit	**SIMATIC 505**			
	RS 232, 9-pin	RS 232, 25-pin	RS 422, 9-pin[1]	RS 422, 9-pin[2]
MP 270B, OP 270, TP 270, xP 170x RS 232, 9-pin	SIMATIC 505 standard cable PPX 260 1090001	SIMATIC 505 standard cable PPX 260 1090001	–	–
MP 370, MP 270 RS 232, 15-pin	6XV1 4402K_ _ _	6VX1 4402L_ _ _	–	–
All, except Panel PC, standard PC RS 422, 9-pin	–	–	6XV1 4402M_ _ _	6XV1 4401M_ _ _
Panel PC, standard PC, FI 25/45 COM 1, COM 2	SIMATIC 505 standard cable PPX 260 1090001	SIMATIC 505 standard cable PPX 260 1090001	Commercially available V.24/RS 422-converter	Commercially available V.24/RS 422-converter

'_' Length code
1 for SIMATIC 505 (PLC 535, PLC 545 – 1101, PLC 565T)
2 for SIMATIC 505 (PLC 545-1102, PLC 555)

12.1 Basic Functioning Method

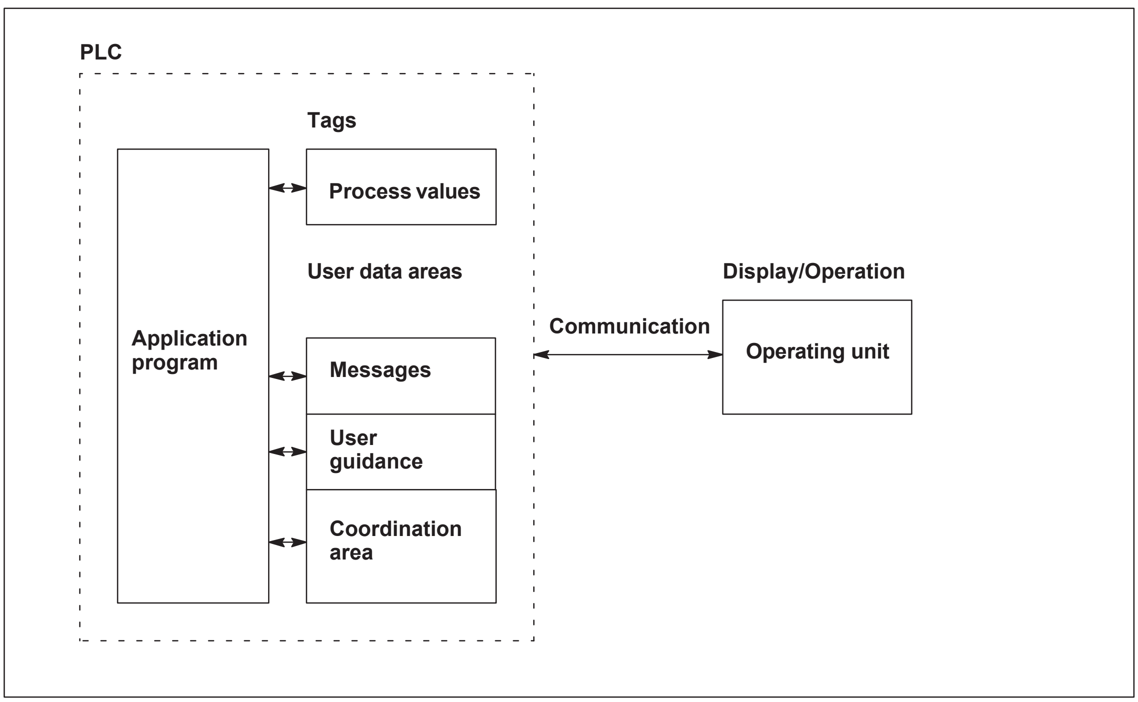


Figure 12-1 Communication structure

Task of the tags

The general exchange of data between the PLC and operating unit is performed by means of the process values. To do this, tags must be specified in the configuration which point to an address in the PLC. The operating unit reads the value from the specified address and displays it. In the same way, the operator can enter a value on the operating unit, which is then written to the address in the PLC.

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

User data area are required, for example, for:

- Trends
- PLC jobs
- Controlling LEDs
- Life bit monitoring

A detailed description of the user data areas is provided in Chapter 14.

12.2 Configuring ProTool for NITP

When creating a new project, the project assistant requests the definition of the PLC. First of all, select the protocol `SIMATIC 500/505` and then define the following parameters after clicking on the *Parameters* button. For any subsequent parameter modifications, select the item *PLC* in the project window.

Define the following parameters for the PLC:

Table 12-2 PLC parameters

Parameters	Explanation
Interface	The operating unit interface to which the SIMATIC 505 is connected must be set here. – In the case of Panel PC, standard PC, FI 25/45 this can be COM 1 or COM 2. – In the case of OP 37/Pro, MP 370, MP 270, MP 270B, TP 270, OP 270, TP 170B, OP 170B, TP 170A this can be interface `IF1A`, `IF1B` or `IF2`, according to the physical conditions which prevail. Also, in the case of the OP 37/Pro, the interface actually used must be set in the BIOS. If the IF1A interface is used with RS 232, no modification is necessary. f the IF1B interface is used with RS 422, select the mask *Integrated Peripherals* in the BIOS. Select the entry *Serial 1* and set the physics to `RS422/RS485 (IF1B)`.
Interface type	Select either RS 232 or RS 422.

Table 12-2 PLC parameters

Parameters	Explanation
Data bits	Set `7` here.
Parity	Set `ODD` here.
Stop bits	Set `1` here.
Baud rate	Set the transmission rate between operating unit and SIMATIC 505. Communication is possible at a maximum of 38,400 baud.

PROFIBUS-DP Connection to SIMATIC 505 13

This chapter describes the communication between the operating unit and SIMATIC 505 using the PROFIBUS-DP.

Definition

PROFIBUS-DP is a master-slave field bus with up to 122 slaves. The PROFIBUS-DP network is normally operated by one master. This master polls all the slaves cyclically. The master is, for example, a PLC with a standard DP-compatible connection module. Each operating unit is a slave and explicitly assigned to a master PLC.

The connection of the PROFIBUS-DP slave is compatible to PROFIBUS-DP Norm EN 50170, Volume 2.

Operating units

The following operating units can be connected to the SIMATIC 505 via the PROFIBUS-DP:

- Panel PC
- Standard PC with communication processor CP 5611 or CP 5511
- MP 370
- MP 270, MP 270B
- TP 270, OP 270
- TP 170B, OP 170B

Hardware requirements

The following hardware components are required in order to integrate operating units in an existing PROFIBUS-DP network:

- In the PLC:

  CP 5434 DP (annex card)

- For each unit (operating unit or PLC):

  A PROFIBUS-DP bus connector or a different component approved for this installation (except FSK bus terminal, refer to Configuration in SIMATIC HMI Catalog ST80.1).

Software requirements

The following software components are also required for the PROFIBUS-DP connection:

- ProTool configuration software, from Version 5.1.
- Specific configuration software for standard DP-compatible configuration of the connection module.

Installation

The drivers for the connection to a SIMATIC 505 PLC are a component part of the ProTool configuration software and are installed automatically.

Both the physical connection and a PLC program in the PLC are required for connection of the operating unit to the PLC. An example program is supplied with ProTool/Pro.

System limits

Within a network established via the PROFIBUS-DP, a maximum of 120 of the 122 slaves may be an operating unit. These values are theoretical limits. The real limits are determined by the memory capacity and performance capability of the PLC.

13.1 Basic Functioning Method

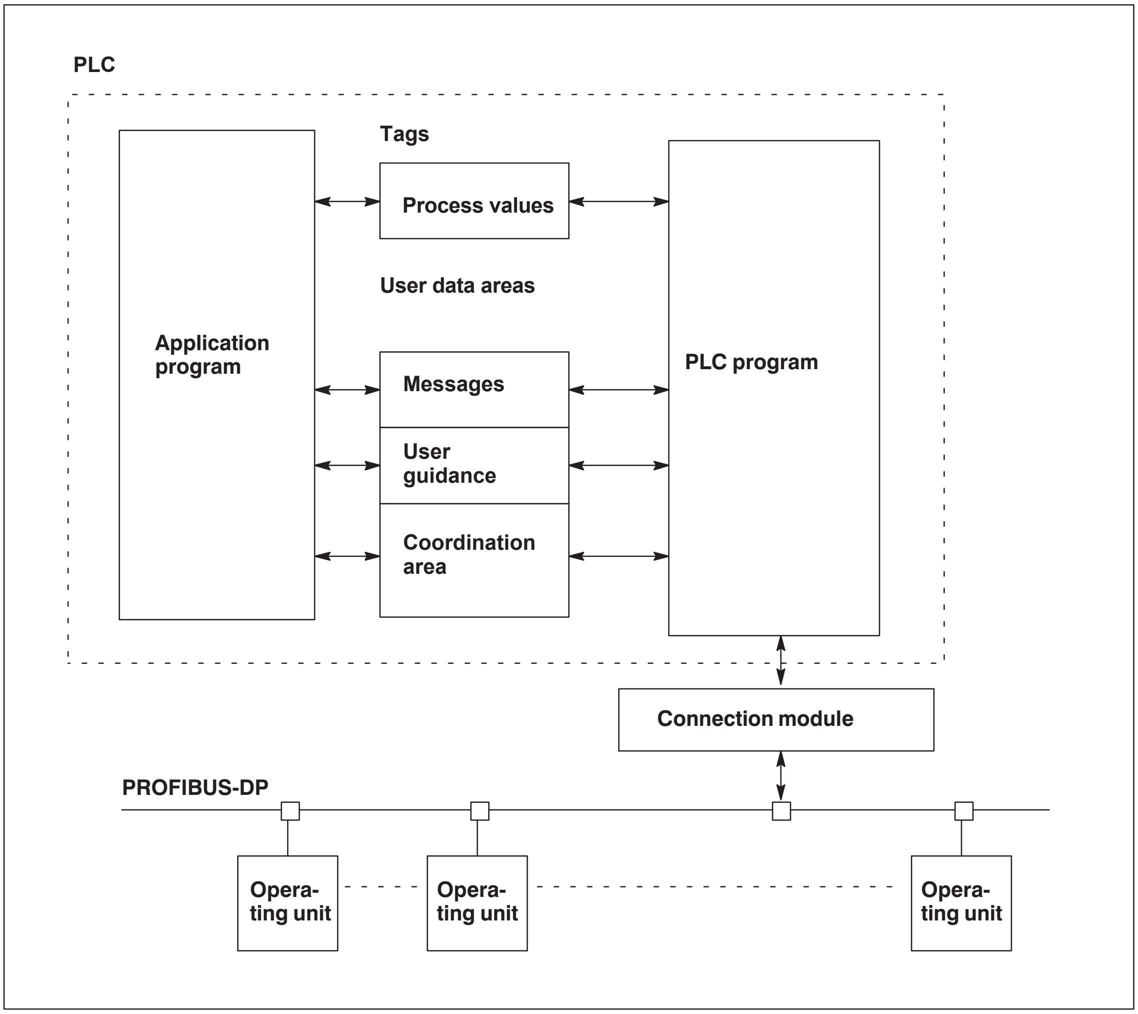


Figure 13-1 Communication structure

Task of the tags

The general exchange of data between the PLC and operating unit is performed by means of the process values. To do this, tags must be specified in the configuration which point to an address in the PLC. The operating unit reads the value from the specified address and displays it. In the same way, the operator can enter a value on the operating unit, which is then written to the address in the PLC.

User data areas

User data areas are used for the exchange of special data and must only be set up when the data concerned is used.

User data area are required, for example, for:

- Trends
- PLC jobs
- Controlling LEDs
- Life bit monitoring

A detailed description of the user data areas is provided in Chapter 14.

Program for controlling the DP driver

A PLC program is required, which processes the protocol, for PROFIBUS-DP. An example program is supplied with ProTool (written in LADDER) which can be adapted for individual requirements. The example program supports linear P-addressing. The example program is located in the directory `PROTOOL\PLCPROG\ SIMATIC505`.

The example program is designed for the CPU 545 and CPU 555 which are connected to the PROFIBUS-DP network via the CP 5434-DP (annex card). The following settings are defined in the example program and must be set identically in the configuration:

Table 13-1 Example program for a standard PC project

Program	Parameters	Value
ProTool	Operating unit	PC
	Protocol	SIMATIC 505 DP
	OP address	3
	Interface	DP/MPI
	Baud rate	1.5 MBaud
	Block length	Class B middle
COM Profibus	Master station type	505-CP5434-DP
	Type of addressing	Linear
	Slave address	3
	Station type	Appropriate operating unit
	Set configuration	Class B middle
	Configured to E-address	P000-P048
	Configured to A-address	P000-P016
TISOFT	I/O address	0100 for WX32 and WY16
	Area for data exchange	V900-V1020

Setting up the interface

The interface is set up as follows under Windows: *Settings → Control Panel → Set PU/PC interface*.

Access point of the application	DPSONLINE
Module configuration used	PROFIBUS DP slave

No settings need to be made for operating units using the Windows CE operating system.

13.2 Configuration of ProTool for PROFIBUS-DP

Parameters

When creating a new project, the project assistant requests the definition of the PLC. First of all, select the protocol `SIMATIC 500/505-DP` and then define the following parameters after clicking on the *Parameters* button. For any subsequent parameter modifications, select the item *PLC* in the project window.

Define the following parameters for the PLC:

Table 13-2 PLC parameters

Parameters	Explanation
OP address	PROFIBUS-DP address of the operating unit. Value range 3 to 125
Interface	Select the interface on the operating unit via which connection to the PLC is to be established. In the case of Panel PC, standard PC and FI 25/45, this is `DP/MPI`. In the case of OP 37/Pro, MP 370, MP 270, MP 270B, TP 270, OP 270, TP 170B and OP 170B, this is `IF1B`. In the case of the OP37/Pro, ASPC2 must also be activated in the BIOS. In the *Integrated Peripherals* mask, set the BIOS entry*ASPC2* to `Enabled`.

Table 13-2 PLC parameters

Parameters	Explanation
Baud rate	The baud rate at which communication takes place over the network. The baud rate must be set identically for all the units in the network. The following baud rates are possible: – 93.75 kBit/s – 187.5 kBit/s – 500 kBit/s – 1.5 MBit/s (default) – 12 MBit/s
Set configuration	Used to define the I/O area implemented for the communication area between the operating unit and PLC. The size of the I/O area influences the performance. The set configuration must be realized according to Class B (basic DP slave complying to EN 50170). Four different set configurations can be selected: – Class B tiny – Class B small – Class B middle – Class B big Table 13-3 indicates the assignment of the I/O area.

The settings in ProTool must correspond to configuration specifications of the connection module CP 5434 DP.

Set configuration

The assignment of the I/O areas is defined with the four different settings. Table 13-3 provides details of the I/O area assignment.

Table 13-3 Assignment of the I/O areas for Class B

Class	Inputs (Byte)	Outputs (Byte)
Class B tiny	32	22
Class B small	42	22
Class B middle	64	32
Class B big	128	64

In order to download large quantities of data, it is recommended to set up a large I/O area. This ensures the screen displays on the operating unit are updated more quickly because the data is retrieved in one cycle.

13.3 Configuring the PROFIBUS-DP Network

Connection module CP 5434 DP

The COM PROFIBUS configuration software packet is necessary in order to configure the CP 5434 DP. The GSD files for the operating unit slaves are supplied with ProTool. These GSD files are located in the directory `\PROTOOL\PLCPROG\GSD`.

Different GSD files are required according to the various operating units. Table 13-4 indicates the assignment.

Table 13-4 Assignment of GSD files and operating units

GSD files	Manufacturer ID	Operating unit
SIEM8076.GSD	0x8076	Panel PC, standard PC, FI 25/45
SIEM8077.GSD	0x8077	OP37/Pro
SIEM80BE.GSD	0x80BE	MP 370
SIEM8078.GSD	0x8078	MP270
SIEM80E4.GSD	0x80E4	MP 270B, OP 270, TP 270
SIEM80B3.GSD	0x80B3	TP 170B, OP 170B

If the GSD files in the COM PROFIBUS directory `\PROTOOL\PLCPROG\GSD` are older than the GSD files supplied with ProTool, or the COM PROFIBUS does not support a new operating unit, copy the files from ProTool to COM PROFIBUS. Then restart the COM PROFIBUS and select `Read GSD files`.

If a COM PROFIBUS configuration was created previously with an older file but the new GSD files are now required for use, the configuration must be recreated.

Parameters

In order that the CP 5434 DP and operating unit can communicate with each other, the following parameters must be set in COM PROFIBUS:

- **Station type**: *HMI*
- **Station number**: 3–125

  The value entered here must correspond with the OP address specified in the operating unit configuration.

- **Set configuration:**

  The set configuration is defined by selecting the class and symbolic name of the configuration. The following set configurations can be set:

  – Class B tiny

  – Class B small

  – Class B middle

  – Class B big

- **Address ID**:

  The address ID is automatically assigned by the set configuration and must not be modified.

- **I and O address**:

  The address must correspond to that stored in the PLC program.

Integrating the COM PROFIBUS configuration in TISOFT

The TISOFT documentation provides detailed information on how to integrate the COM PROFIBUS configuration in the TISOFT program. The basic steps are explained here briefly:

1. Generate a binary file in COM PROFIBUS using *Export*.
2. Integrate the binary file in the TISOFT program using *CONFIO* → *PRO-DP* → *MERGE*.
3. Set the CPU to *ONLINE PLC Mode*.
4. Define the I/O addresses in TISOFT using *CONFIO* → *PRO-DP* → *CONFIG*.
5. Download the program to the CPU using *UPDATE*.

14 User Data Areas for SIMATIC 505

Overview

User data areas are used for data exchange between the PLC and operating unit.

The user data areas are written to and read by the operating unit and the application program alternately during the process of communication. By analyzing the data stored there, the PLC and operating unit reciprocally initiate predefined actions.

This chapter describes the function, layout and special features of the various user data areas.

14.1 User Data Areas Available

Definition

The user data areas can be set up in various data areas in the PLC, such as the V-memory for example.

Set up the user data areas both in the ProTool project and in the PLC.

The user data areas can be set up and modified in the ProTool project using the menu items *Insert* → *Area Pointers*.

Function range

The user data areas available are dependent on the operating unit used. The tables 14-1 and 14-2 provide an overview of the functional range of the individual operating units.

Table 14-1 User data areas available, Part 1

User data area	Panel PC	Standard PC	MP 370
User version	x	x	x
Job mailbox	x	x	x
Event messages	x	x	x
Screen number	x	x	x
Data mailbox	x	x	x
Date/Time	x	x	x
Date/Time PLC	x	x	x
Coordination	x	x	x
Trend request	x	x	x
Trend transfer 1, 2	x	x	x
LED assignment [1]	x	–	x
OP/PLC acknowledgement	x	x	x
Alarm messages	x	x	x

[1] Only possible using operating units with keyboard.

Table 14-2 User data areas available, Part 2

User data area	MP 270 MP 270B	TP 270 OP 270	TP 170B OP 170B	TP 170A
User version	x	x	x	–
Job mailbox	x	x	x	–
Event messages	x	x	x	x
Screen number	x	x	x	–
Data mailbox	x	x	x	–
Date/Time	x	x	x	–
Date/Time PLC	x	x	x	x
Coordination	x	x	x	–
Trend request	x	x	–	–
Trend transfer 1, 2	x	x	–	–
LED assignment [1]	x	x	x	–
OP/PLC acknowledgement	x	x	x	–
Alarm messages	x	x	x	–

[1] Only possible using operating units with keyboard.

Table 14-3 illustrates the way in which the PLC and operating unit access the individual user data areas – Read (R) or Write (W).

Table 14-3 Application of the user data areas

User data area	Necessary for	Operating unit	PLC
User version	ProTool Runtime checks whether the ProTool project version and the project in the PLC are consistent.	R	W
Job mailbox	Triggering of functions on the operating unit by PLC program	R/W	R/W
Event messages	Bit reporting process arrival and departure of event messages	R	W
Screen number	Evaluation by the PLC as to which screen is currently open	W	R
Data mailbox	Downloading of data records with synchronization	R/W	R/W
Date/Time	Transfer of date and time from the operating unit to the PLC	W	R
PLC date/time	Transfer of date and time from the PLC to the operating unit.	R	W
Coordination	Operating unit status polled by the PLC program	W	R
Trend request	Configured trends with “Triggering via bit” or configured history trends	W	R
Trend transfer area 1	Configured trends with “Triggering via bit” or configured history trends	R/W	R/W
Trend transfer area 2	Configured history trend with “switch buffer”	R/W	R/W
LED assignment	LED triggered by the PLC	R	W
Operating unit acknowledgement	Message from the operating unit to the PLC indicating an alarm message has been acknowledged	W	R
PLC acknowledgement	Alarm message acknowledgement from the PLC	R	W
Alarm messages	Bit reporting process arrival and departure of alarm messages	R	W

The user data areas and their associated area pointers are explained in the following chapters.

14.2 User Data Area, User Version

Usage

When starting up the operating unit, it is possible to check whether the operating unit is connected to the correct PLC. This is important when several operating units are used.

To do this, the operating unit compares a value stored in the PLC with the value defined in the configuration. In this way, the compatibility of the configuration data with the PLC program is ensured. If there is a mismatch, a system message appears on the operating unit and the runtime configuration is terminated.

In order to use this user data area, set up the following during the configuration:

- Specify the configuration version – value between 1 and 255.

  ProTool: *System* → *Settings*
- Data address of the value for the version stored in the PLC:

  ProTool: *Insert* → *Area Pointers*, available types: *User version*

Danger

The user version is only checked while the connection is being established when ProTool Runtime is started. If the PLC is subsequently changed, the user version is not checked.

14.3 User Data Area, Job Mailbox

Description

The job mailbox can be used to send PLC jobs to the operating unit, thus initiating actions on the operating unit. These functions include:

- displaying screens
- setting date and time

The job mailbox is set up under *Area Pointer* and has a length of four data words.

The first word of the job mailbox contains the job number. Depending on the PLC job in question, up to three parameters can then be specified.

Data Word	1 16
n+0	Job no.
n+2	Parameter 1
n+4	Parameter 2
n+6	Parameter 3

Figure 14-1 Structure of the user data area, job mailbox

If the first word of the job mailbox is not equal to zero, the operating unit analyzes the PLC job. The operating unit then sets this data word to zero again. For this reason, the parameters must be entered in the job mailbox first and then the job number.

The possible PLC jobs, including job number and parameters, are provided in the “ProTool Online Help” and the Appendix, Part B.

14.4 User Data Area, Event and Alarm Messages and Acknowledgement

Definition

Messages consist of a static text and/or tags. The text and tags can be defined by the user.

Messages are subdivided into event messages and alarm messages. The programmer defines the event message and alarm message.

Event messages

An event message indicates a status, e.g.

- `Motor switched on`
- `PLC in manual mode`

Alarm messages

An alarm message indicates an operational fault, e.g.

- `Valve not opening`
- `Motor temperature too high`

Acknowledgement

Since alarm messages indicate an abnormal operational status, they must be acknowledged. They can be acknowledged either by

- operator input on the operating unit
- setting a bit in the PLC acknowledgement area.

Triggering messages

A message is triggered by setting a bit in one of the message areas on the PLC. The location of the message areas is defined by means of the configuration software. The corresponding area must also be set up in the PLC.

As soon as the bit in the PLC event/alarm message area has been set and that area has been transferred to the operating unit, the operating unit detects that the relevant message has “arrived”.

Conversely, when the same bit is reset on the PLC by the operating unit, the message is registered as having “departed”.

Message areas

Table 5-4 indicates the number of message areas for event and alarm messages, for alarm acknowledgement OP (Operating unit→ PLC) and for alarm acknowledgement PLC (PLC → Operating unit) and the number of words for the various operating units.

Table 14-4 Partitioning of the message areas

Operating unit	Event message area, Alarm message area Acknowledgement area OP, Acknowledgement area PLC	
	Number of data areas, maximum	Words in data area, total
Panel PC	8	125
Standard PC	8	125
MP 370	8	125
MP 270, MP 270B	8	125
TP 270, OP 270	8	125
TP 170B, OP 170B	8	125
TP 170A	8	125[1]

1 Only possible for event messages.

Assignment of message bit to message number

A message can be assigned to each bit in the configured message area. The bits are assigned to the message numbers in ascending order.

Example:

The following event message area has been configured in the PLC:

`V 43` `Length 5` (in words)

Figure 14-2 shows the assignment of all 80 (5 x 16) message numbers to the individual bit numbers in the PLC event message area. The assignment is performed automatically on the operating unit.

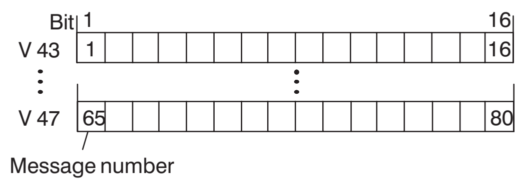


Figure 14-2 Assignment of message bit and message number

User data areas, acknowledgement

If the PLC should be informed of an alarm message acknowledgement on the operating unit or the acknowledgement should be initiated on the PLC itself, the relevant acknowledgement areas must also be set up in the PLC. These acknowledgement areas must also be specified in the ProTool project under *Area Pointers*.

- **Acknowledgement area Operating Unit → PLC**:

  This area is used to inform the PLC when an alarm message has been acknowledged by means of operator input on the operating unit. The “Alarm Ack. OP” area pointer must be created or configured for this.

- **Acknowledgement area PLC → Operating Unit**:

  This area is used when an alarm message is acknowledged by the PLC. In this case, the area pointer “PLC acknowledgement” must be set.

These acknowledgement areas must also be specified in the configuration under *Area Pointers*.

Figure 14-3 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 14-5 and 14-6.

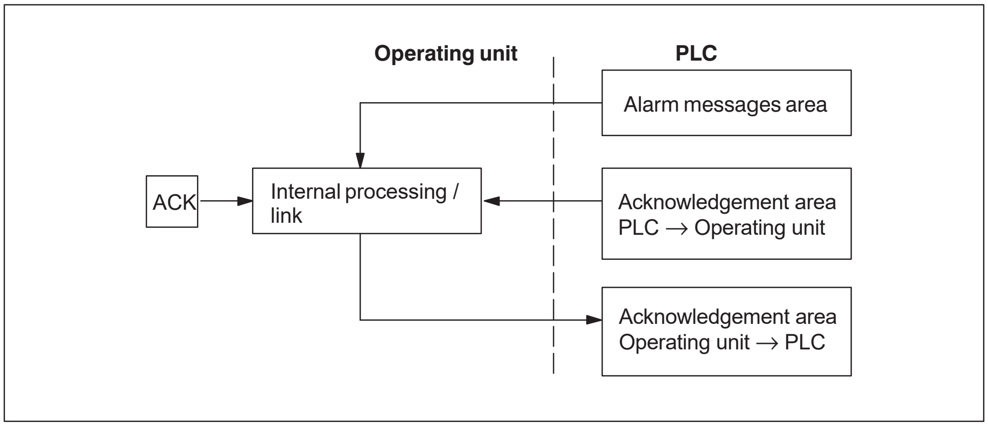


Figure 14-3 Alarm message and acknowledgement areas

Assignment of acknowledgement bit to message number

Each alarm message is assigned a message number. The message number is assigned the same bit number in the alarm messages area as that assigned in the acknowledgement area. Under normal circumstances, the acknowledgement area is the same length as the associated alarm messages area.

If the length of an acknowledgement area is not equal to the overall length of the associated alarm messages area, and there are succeeding alarm messages and acknowledgement areas, the following assignment applies:

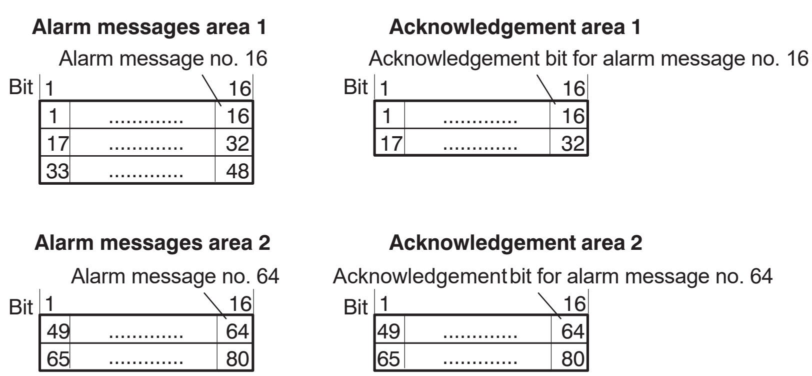


Figure 14-4 Assignment of acknowledgement bit and message number

Acknowledgement area PLC → Operating unit

A bit set in this area by the PLC initiates the acknowledgement of the corresponding alarm message in the operating unit, thus fulfilling the same function as pressing the ACK button. Reset the bit before setting the bit in the alarm message area again. Figure 14-5 shows the signal diagram.

The acknowledgement area PLC → Operating Unit

- must follow on immediately from the associated alarm messages area,
- must have precisely the same polling time and
- may not be any longer than the associated alarm messages area.

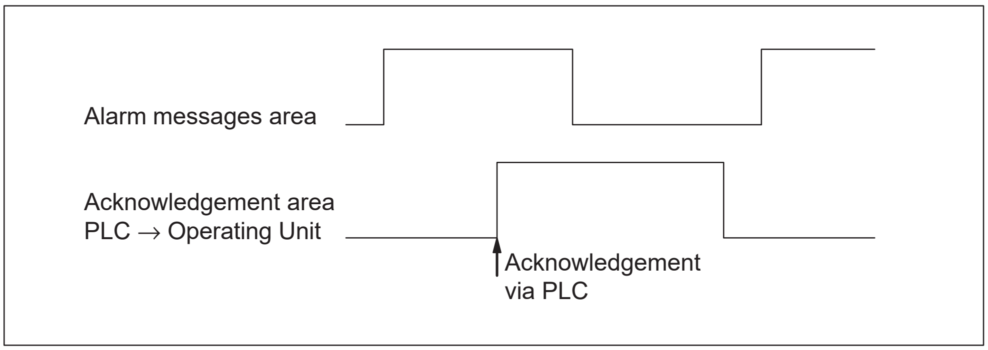


Figure 14-5 Signal diagram for acknowledgement area PLC → Operating Unit

Acknowledgement area Operating Unit → PLC

When a bit is set in the alarm message area, the operating unit resets the associated bit in the acknowledgement area. As a result of processing by the operating unit, the two processes indicate a slight difference with regard to time. If the alarm message is acknowledged on the operating unit, the bit in the acknowledgement area is set. In this way, the PLC can detect that the alarm message has been acknowledged. Figure 14-6 illustrates the signal diagram.

The acknowledgement area Operating Unit → PLC must be no longer than the associated alarm messages area.

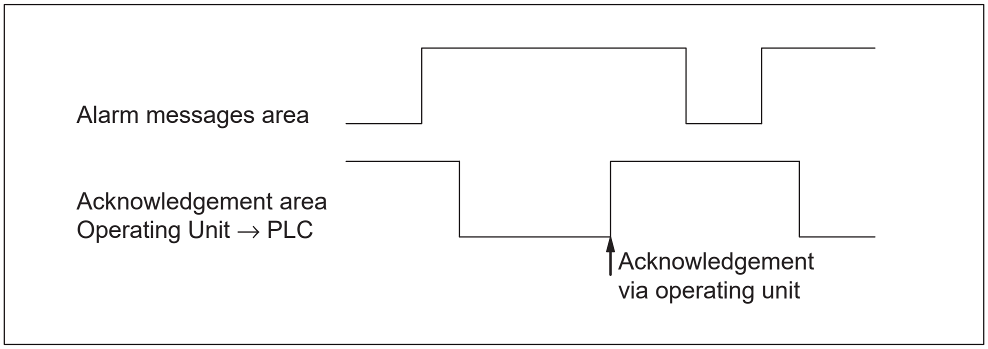


Figure 14-6 Signal diagram for acknowledgement area Operating Unit → PLC

Acknowledgement area size

The acknowledgement areas PLC → Operating Unit and Operating Unit → PLC must not be any longer than the associated alarm message areas. The acknowledgement area, however, be smaller if acknowledgement by the PLC is not required for all alarm messages. This is also valid when the acknowledgement need not be detected in the PLC for all alarm messages. Figure 14-7 illustrates such a case.

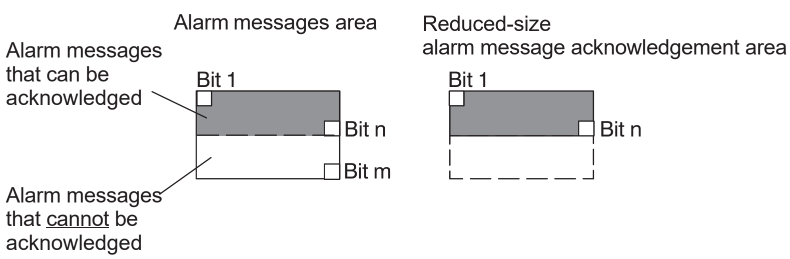


Figure 14-7 Reduced-size acknowledgement area

Note

Place important alarm messages in the alarm messages area starting at Bit 1 in ascending order.

14.5 User Data Area, Screen Numbers

Application

The operating units store information concerning the screen currently open on the unit in the screen number user data area.

This enables the transfer of data regarding the current operating unit display content to the PLC which, in turn, can trigger certain reactions; e.g. call in a different screen.

Requirements

If the screen number area should be used, it must be specified in the ProTool project as an *Area Pointer*. It can only be stored in one PLC and only once.

The screen number area is downloaded to the PLC spontaneously, i.e. the transfer is always initiated when a change is selected on the operating unit. Therefore, it is not necessary to configure an acquisition cycle.

Structure

The screen number area is a data area with a fixed length of 5 data words.

The structure of the screen number area in the PLC memory is illustrated below.

	1 ... 16
1st Word	Current screen type
2nd Word	Current screen number
3rd Word	Reserved
4th Word	Current field number
5th Word	Reserved

Entry	Assignment
Current screen type	1 for basic screen or 4 for fixed window
Current screen number	1 to 65535
Current field number	1 to 65535

14.6 User Data Area, Date/Time

Transferring date and time

Transfer of date and time from the operating unit to the PLC can be triggered by PLC job 41. PLC job 41 writes the date and time to the Date/Time data area where they can be analyzed by the PLC program. Figure 14-8 illustrates the structure of the data area. All data is in BCD format.

DW	DL 1 … 8	DR 9 … 16	
n+0	Reserved	Hour (0–23)	Time
n+1	Minute (0–59)	Second (0–59)	Time
n+2	Reserved		Time
n+3	Reserved	Weekday (1–7, 1=Sun)	Date
n+4	Day (1–31)	Month (1–12)	Date
n+5	Year (80–99/0–29)	Reserved	Date

Figure 14-8 Structure of data area **Time** and **Date**

Note

When entering data in the year data area, please note that the values 80–99 represent 1980 to 1999 and 0–29 the years 2000 to 2029.

14.7 User Data Area, Date/Time PLC

Transfer of date and time to the operating unit

The downloading of date and time to the operating unit is generally useful when the PLC is master for time.

The TP 170A operating unit represents a special case here:

Synchronization with the PLC system time is necessary when a `Single message display` screen object is to be inserted in a ProTool screen. The `Single message display` screen object is the only TP 170A screen object which has access to the unit's system time. This restriction only applies to the TP 170A.

Structure (BCD-coded)

<table>
<tr><th></th><th>DL</th><th colspan="2">DR</th></tr>
<tr><th>DW</th><th>1 … 8</th><th colspan="2">9 … 16</th></tr>
<tr><td>n+0</td><td>Year (80–99/0–29)</td><td colspan="2">Month (1–12)</td></tr>
<tr><td>n+1</td><td>Day (1–31)</td><td colspan="2">Hour (0–23)</td></tr>
<tr><td>n+2</td><td>Minute (0–59)</td><td colspan="2">Second (0–59)</td></tr>
<tr><td>n+3</td><td>Reserved</td><td>Reserved</td><td>Weekday (1–7, 1=Sun)</td></tr>
</table>

Figure 14-9 Structure of data area Date/Time in DATE_AND_TIME format

The structure corresponds to that of STW141-STW144. Enter STW141 as the address for this area pointer.

Note

When entering data in the year data area, please note that the values 80–99 represent 1980 to 1999 and 0–29 the years 2000 to 2029.

The PLC writes cyclically to the data area, whereby the operating unit reads and synchronizes (refer to the ProTool User's Guide).

Note

In the configuration, do not select too small an acquisition cycle for the Date/Time area pointer because this affects the operating unit performance.

Recommendation: Acquisition cycle of 1 minute, if permitted by the process.

14.8 User Data Area, Coordination

The coordination user data area is two data words long. It serves to realize the following functions:

- Detection of operating unit startup by the PLC program,
- Detection of the current operating unit operating mode by the PLC program,
- Detection by the PLC program that the operating unit is ready to communicate.

Note

Each time the coordination area is updated by the operating unit, the entire coordination area is written.

Therefore, the PLC program must not execute any modifications in the coordination area.

Bit assignment in coordination area

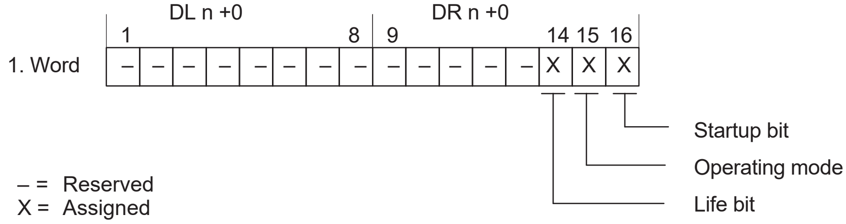


Figure 14-10 Significance of the bits in the coordination area

Startup bit

The startup bit is set to 0 for a short time during the start-up routine by the operating unit. After the startup routine has been completed, the bit is set permanently to 1.

Operating mode

As soon as the operating unit has been switched offline by the operator, the operating mode bit is set to 1. When the operating unit is working in normal operation, the operating mode bit is set to 0. The PLC program can be used to poll this bit and thus establish the current operating mode of the operating unit.

Life bit

The life bit is inverted by the operating unit at intervals of approx. one second. The PLC program can be used to poll this bit to check whether connection to the operating unit still exists.

14.9 User Data Area, Trend Request and Trend Transfer

Trends

A trend is the graphical representation of a value from the PLC. Reading of the value can be time-triggered or bit-triggered, depending on the configuration.

Time-triggered trends

The operating unit reads the trend values cyclically according to the cycle interval defined in the configuration. Time-triggered trends are suitable for continuous progressions such as the operating temperature of a motor.

Bit-triggered trends

By setting a trigger bit in the trend transfer area pointer, the operating unit reads in either a trend value or the entire trend buffer. This is specified in the configuration. Bit-triggered trends are normally used to display values of an area subject to rapid variation. An example of this is the injection pressure for plastic moldings.

In order to be able to activate bit-triggered trends, corresponding data areas have to be specified in the ProTool project (under *Area Pointers*) and set up on the PLC. The operating unit and the PLC communicate with one another via those areas.

The following areas are available for trends:

- Trend request area
- Trend transfer area 1
- Trend transfer area 2 (required with switch buffer only)

Assign a trend to a bit in the configuration. This ensures the bit assignment is unique for all areas.

Switch buffer

The switch buffer is a second buffer for the same trend and can be set up during the configuration.

While the operating unit reads the value from Buffer 1, the PLC writes it in Buffer 2. If the operating unit reads from Buffer 2, the PLC writes to Buffer 1. This prevents the trend value being overwritten by the PLC when being read by the operating unit.

Partitioning of the area pointers

The trend request and trend transfer 1 and 2 area pointers can be divided into separate data areas with a predefined maximum number and length (Table 14-5).

Table 14-5 Partitioning of the area pointer

	Data area		
	Trend request	**Trend transfer**	
		1	**2**
Number of data areas, maximum	8	8	8
Words in data area, total	8	8	8

Trend request area

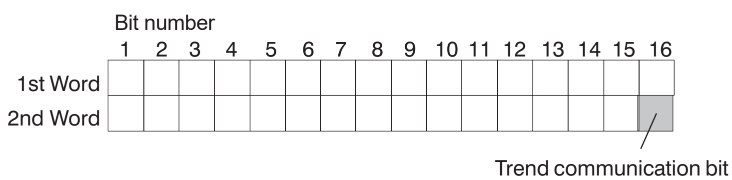
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

The trend request area can be used by the PLC to ascertain which trend is currently being displayed on the operating unit. Trends can also be triggered without analysis of the trend request area.

Trend request area 1

This area serves for triggering trends. In the PLC program, set the bit assigned to the trend in the trend transfer area and the trend communication bit. The operating unit detects triggering and reads in either a trend value or the entire buffer. It then resets resets the trend bit and the trend communication bit.

Trend transfer area(s)



The trend transfer area must not be altered by the PLC program until the trend communication bit has been reset.

Trend transfer area 2

Trend transfer area 2 is necessary for trends that are configured with a switch buffer. Its layout is precisely the same as that of trend transfer area 1.

14.10 User Data Area, LED Assignment

Application

The Operator Panel (OP), Multi Panel (MP) and Panel PC have function keys with Light Emitting Diodes (LEDs) integrated in them. These LEDs can be controlled from the PLC. This means, for example, that in specific situations, it is possible to indicate to the operator which key should be pressed by switching on an LED.

Requirements

In order to control LEDs, corresponding data areas, so-called LED assignments, must be set up in the PLC and defined in the configuration as *Area Pointers*.

Partitioning of the area pointer

The LED assignment area pointer can be divided into separate data areas, as illustrated in the following table.

Table 14-6 Partitioning of the area pointer

Operating unit	Number of data areas, maximum	Words in data area, total
Panel PC	8	16
MP 370	8	16
MP 270, MP 270B	8	16
OP 270	8	16
OP 170B	8	16

Note

The area pointer in question can no longer be selected in the *Insert new area pointer* window when the maximum number has been reached. Area pointers of the same type appear gray.

LED assignment

The assignment of the individual LEDs to the bits in the data areas is defined when the function keys are configured. This involves specifying a bit number within the assignment area for each LED.

The bit number (n) identifies the first of two successive bits which control the following LED states (refer to Table 14-7):

Table 14-7 LED states

Bit n + 1	Bit n	LED function
0	0	Off
0	1	Flashes
1	0	Flashes
1	1	Permanently on

14.11 Recipes

Description

During the transfer of data records between the operating unit and PLC, both communication peers alternately access common communication areas in the PLC. The function and structure of the recipe-specific communication area (“data mailbox”) and the mechanisms involved in synchronized transfer of data records are the subject of this chapter.

Information on setting up the data mailbox in ProTool is provided in the online help.

Downloading methods

There are two methods of downloading data records between operating unit and PLC:

- Asynchronous transfer (Page 14-19)
- Synchronized transfer using the data mailbox (Page 14-20)

Data records are always transferred directly, i.e. the tag values are read or written directly from or to the address configured for the tag without being stored intermediately.

Trigger downloading of data records

There are three methods of triggering the transfer of data:

- By operator input on the recipe display (Page 14-21)
- By PLC jobs (Page 14-22)
- By activating configured functions (Page 14-23)

If transfer of data records is initiated by a configured function or a PLC job, the recipe display on the operating unit remains fully functional as the data records are transferred in the background.

Simultaneous processing of multiple transfer jobs is not possible, however. In such cases, the operating unit returns a system message refusing additional transfer requests.

A list of the most important system messages together with notes on the possible causes of the associated errors and remedies for them is provided in Appendix, Part A.

14.11.1 Asynchronous data transfer

Purpose

In the case of asynchronous transfer of data records between operating unit and PLC, there is **no** coordination of the communication areas commonly used. For this reason, there is no need to set up a data mailbox during the configuration process.

Application

The **asynchronous** transfer of data records is applicable, for example, when the

- uncontrolled overwriting of data by the communication peers can be reliably prevented by the system,
- the PLC does not require any details of the recipe and data record numbers, or
- transfer of data records is initiated by operator input on the operating unit.

Read values

On triggering a read transfer, the values are read from the PLC addresses and downloaded to the operating unit.

- **Transfer initiated by operator input on recipe display**:

  Data is uploaded to the operating unit. There it can be processed, e.g. values can be modified and the changes saved.
- **Transfer initiated by function or PLC job**:

  The data is saved directly to the storage medium.

Write values

On triggering a write transfer, the values are written to the PLC addresses.

- **Transfer initiated by operator input on recipe display**:

  The current values are written to the PLC.
- **Transfer initiated by function or PLC job**:

  The values on the storage medium are written to the PLC.

14.11.2 Synchronous data transfer

Purpose

In the case of synchronous data transfer, both the communication peers set status bits in the commonly used data mailbox. In this way, the PLC program can prevent uncontrolled overwriting of each other's data by the two units.

Application

The **synchronous** transfer of data records is applicable, for example, when

- the PLC is the "active partner" for transfer of data records,
- details of the recipe and data record numbers are to be analyzed on the PLC, or
- transfer of data records is initiated by PLC job.

Requirements

In order to synchronize the transfer of data records between the operating unit and PLC, the following conditions must be fulfilled in the configuration:

- the data mailbox must have been set up in *System* → *Area Pointer*;
- the recipe properties must specify the PLC with which the operating unit has to synchronize transfer of data records.

  The PLC is specified in the recipe editor in *Properties* → *Transfer*.

Detailed information on this is provided in *ProTool Configuring Windows-based Systems* User Guide.

14.11.3 Data mailbox for synchronized data transfer

Structure

The data mailbox has a defined length of 5 words. Its structure is as follows:

	1 16
1st Word	Current recipe number (1 — 999)
2nd Word	Current data record number (0 — 65,535)
3rd Word	Reserved
4th Word	Status (0, 2, 4, 12)
5th Word	Reserved

Status word

The status word (Word 4) can assume the following values:

Value		Explanation
Decimal	**Binary**	
0	0000 0000	Transfer permitted, data mailbox is accessible
2	0000 0010	Transfer in progress
4	0000 0100	Transfer completed without errors
12	0000 1100	Errors occurred during transfer

14.11.4 Synchronization process

Read from the PLC by operating the recipe view

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe number to be read and the status “Transfer in progress” in the data mailbox and sets the data record number to zero.	Operation cancelled and system message returned
3	The operating unit reads the values from the PLC and displays them on the recipe display. In the case of recipes with synchronous tags, the values from the are also written in the tags.	
4	The operating unit sets the status to “Transfer completed”.	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Write in the PLC by operating the recipe view

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number to be written and the status "Transfer in progress" in the data mailbox.	Operation cancelled and system message returned
3	The operating unit writes the current values to the PLC. In the case of recipes with synchronized tags, the modified values between the recipe views and tags are compared and then written to the PLC.	
4	The operating unit sets the status to "Transfer completed".	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Read from the PLC by PLC job "PLC → DAT" (no. 69)

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the job and the status "Transfer in progress" in the data mailbox.	Operation cancelled and no message returned
3	The operating unit reads the value from the PLC and saves the value in the data record specified by the job.	
4	• If the option "Overwrite" has been specified for the job, existing data records are overwritten without prior warning. The operating unit sets the status to "Transfer completed". • If "Do not overwrite" was specified in the job and the data record already exists, the operating unit terminates the process and enters `0000 1100` in the status word of the data mailbox.	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Details of the structure of the PLC job are provided on Page 14-25.

Write in the PLC by PLC job “DAT → PLC” (no. 70)

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the job and the status “Transfer in progress” in the data mailbox.	Operation cancelled and no message returned
3	The operating unit retrieves the value from the data record specified in the job from the data medium and writes that value in the PLC.	
4	The operating unit sets the status to “Transfer completed”.	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Details of the structure of the PLC job are provided on Page 14-25.

Read from the PLC by configured function

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the function and the status “Transfer in progress” in the data mailbox.	Operation cancelled and system message returned
3	The operating unit reads the data from the PLC and saves it to the data record specified by the function.	
4	• If the option “Overwrite” has been specified for the function, existing data records are overwritten without prior warning. The operating unit sets the status to “Transfer completed”. • If “Do not overwrite” was specified in the job and the data record already exists, the operating unit terminates the process and enters `0000 1100` in the status word of the data mailbox.	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Write in the PLC by configured function

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the function and the status “Transfer in progress” in the data mailbox.	Operation cancelled and system message returned
3	The operating unit retrieves the value from the data record specified in the function from the data medium and writes that value in the PLC.	
4	The operating unit sets the status to “Transfer completed”.	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Note

For reasons of data consistency, analysis of the recipe and data record number on the PLC cannot be performed until the status in the data mailbox is set to “Transfer completed” or “Errors occurred during transfer”.

Possible causes of errors

If the downloading of data records is terminated due to errors, it may be due to one of the following reasons:

- Tag address not set up on PLC,
- Overwriting of data records not possible,
- Recipe number not available
- Data record number not available

A list of the most important system messages together with notes on the possible causes of the associated errors and corrective measures for them is provided in Appendix, Part A.

Response to error-based termination

The operating unit responds as follows when the downloading of data records is terminated due to an error:

- **Transfer initiated by operator input in recipe view**

  Indication on the status bar on the recipe display and issue of system messages.

- **Transfer initiated by function**

  System messages issued.

- **Transfer initiated by PLC job**

  No feedback of information on operating unit

Regardless of the response of the operating unit, the status of the transfer can be checked by reading the status word in the data mailbox.

14.11.5 PLC jobs for recipes

Purpose

The transfer of data records between operating unit and PLC can be triggered by the PLC program. This requires no operator input on the operating unit.

The two PLC jobs **No. 69** and **No. 70** can be used for this.

No. 69: Read data record from PLC ("PLC → DAT")

PLC Job **No. 69** downloads data records from the PLC to the operating unit. The structure of this PLC job is as follows:

Word 1	69
Word 2	Recipe number (1 to 999)
Word 3	Data record number (1 – 65,535)
Word 4	Do not overwrite existing data record: 0 Overwrite existing data record: 1

No. 70: Write data record to PLC (“DAT → PLC”)

PLC Job **No. 70** downloads data records from the operating unit to the PLC. The structure of this PLC job is as follows:

Word 1	70
Word 2	Recipe number (1 to 999)
Word 3	Data record number (1 – 65,535)
Word 4	—

Part VI Integration in SIMATIC iMap

Integration of the HMI Configuration in SIMATIC iMap

15

General Information

The ProTool/Pro CS configuration software can be set up and called in as a CBA component in SIMATIC iMap. To do this, addressing information for data access in SIMATIC iMap is available in order to configure tags in ProTool/Pro.

The ProTool/Pro RT process visualization software enables address information for data access in iMap to be visualized and modified in ProTool/Pro by means of tags.

Setup and documentation

The tasks involved in setting up the ProTool CBA component and more detailed documentation are provided on the iMap product CD.

Part VII Connection to SIMOTION

Communication Management with SIMOTION

16

This chapter describes the communication between the operating unit and the SIMOTION product range. All the network configurations are explained in which the operating unit can be integrated.

General Information

The driver for connection to the SIMOTION is supplied with the configuration and runtime software and is automatically installed.

The connection of the operating unit to the SIMOTION CPUs is mainly restricted to the physical connection of the operating unit. Special function blocks for connection to the PLC are not required.

Software requirements

The following applications are required in order to create a project for a SIMOTION PLC:

- SIMATIC STEP 7 configuration software from V5.1 + SP2,
- SIMOTION SCOUT configuration software,
- ProTool/Pro CS configuration software from V5.2 + SP3.

The following ProTool/Pro CS versions are supported by SIMOTION SCOUT:

- ProTool/Pro CS V5.2 SP3 with SIMOTION SCOUT V1.1.x,
- ProTool/Pro CS V6.0 and SIMOTION SCOUT V2.0.

Note

The ProTool V6.0 configuration software has not been approved for SIMOTION V1.1. Its use requires the installation of the update to SIMOTION V2.0.

Operating unit

The following operating units can be connected to a SIMOTION PLC:

Table 16-1 Connectable operating units

	Operating unit	Operating system
Panel PC	Panel PC 870 Panel PC 670	Windows NT with SP6a Windows 2000
	Panel PC IL	Windows NT with SP6a Windows 2000
Standard PC	–	Windows NT with SP6a Windows 2000
Multi Panel	MP 370 MP 270B MP 270	Windows CE
Panel	TP 270 OP 270 TP 170B OP 170B	Windows CE
SIMOTION Panel	P012K P015K P012T P015T	Windows NT with SP6a

Selecting a PLC in ProTool

When creating a new project, the project assistant requests the definition of the PLC. Select the PLC with the corresponding protocol and then press the *Parameters* button to define the parameters for communication. For any subsequent modifications, select *PLC* in the project window.

The network configuration parameters are defined in STEP 7 and displayed in ProTool. Select the protocol for the SIMOTION PLC.

Note

No HMI units can be connected to an isochronous PROFIBUS.

16.1 Basic Functioning Method

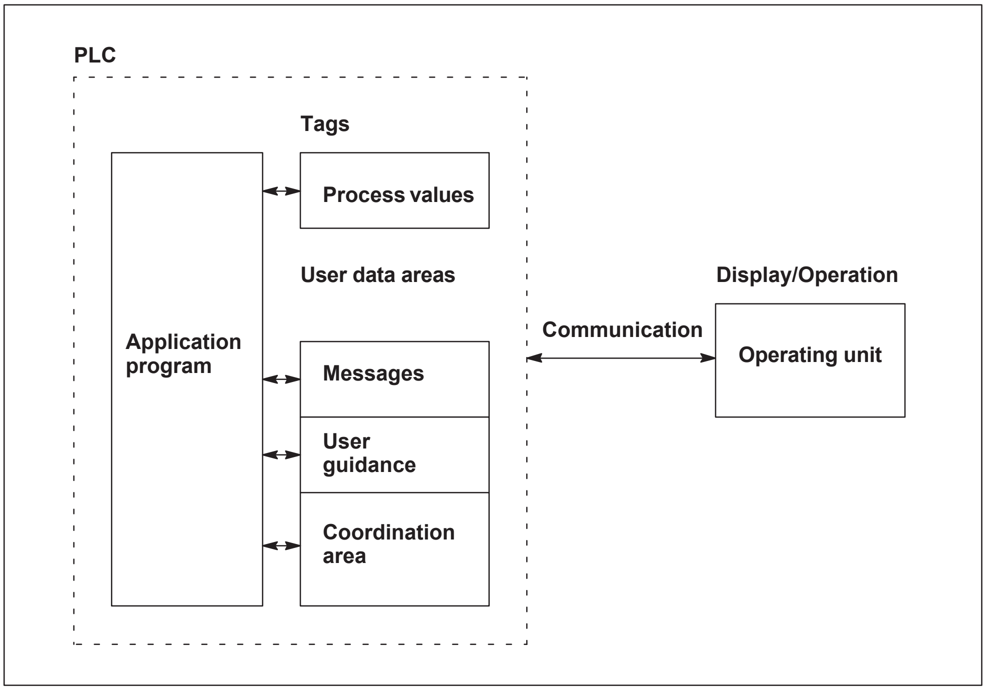


Figure 16-1 Communication structure

Task of the tags

The general exchange of data between the PLC and operating unit is performed by means of the process values. To do this, tags must be specified in the configuration which point to an address in the PLC. The operating unit reads the value from the specified address and displays it. In the same way, the operator can enter a value on the operating unit, which is then written to the address in the PLC.

Caution

The second digits in the numbers related to diagnostics messages of a SIMOTION PLC which appear on the ProTool user interface do not correspond to the event ID indicated in the SIMOTION SCOUT. This concerns both 4-digit and 8-digit IDs.

Example of an 8-digit ID:
The message `Operating status STOP` has the ID ’F363:0002’ in the SIMOTION SCOUT. This is displayed on the user interface as f0630002.

Representation of the tags in ProTool

Tags which are to be used for a SIMOTION PLC in ProTool must be created in SIMOTION SCOUT as:

- System tags of the unit and the technological object,
- Global unit tags,
- Symbolic input/output tags,
- Interface tags of application programs.

These tags are then displayed under their **symbolic names** in ProTool and can be selected in the Tag dialog under *Symbol*.

The full symbolic name from SIMOTION SCOUT is displayed. The Max. Value/Min. Value display the permissible value range defined in SIMOTION SCOUT and whether write access can be made to the tag. This is important in the case of tags which can be configured in an input field.

Note

No longer valid for ProTool from V6.0:
Tag arrays for area pointers and trends may not exceed a maximum size of 100 words (200 bytes).

Example:

```
Array [0...99] of INT;
Array [0...49] of REAL;
```

If other tags are configured, or existing ones modified, using the configuration software for SIMOTION SCOUT, use the Tag dialog *Update* button in ProTool to update the tag display.

If the names of SIMOTION icons, e.g. technological objects, are modified, the link of the ProTool tag to the icon is disconnected. The ProTool tags must then be reconfigured or restored and relinked using the *Edit* → *Restore Symbolism* dialogs.

Enter a prefix and a stop in the *Prefix to replace* field.

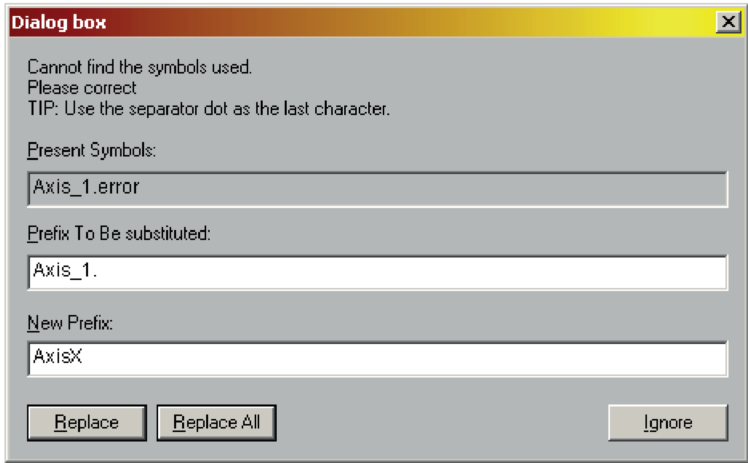


Figure 16-2 Dialog which appears after selecting *Replace All*

Select *Replace*. The symbolism is restored in the *New Prefix* field. *Axis_1.error* becomes *AxisX.error*. Only one disconnected symbol is relinked.

Select *Replace*. The symbolism is restored in the *New Prefix* field. *Axis_1.** becomes *AxisX.**. All disconnected symbols are relinked.

Consistency check

From V6.0, ProTool executes a consistency check. In this case, the runtime project versions from ProTool and SIMOTION are compared.

The consistency check is performed once following each:

- start-up or connection establishment,
- download

If inconsistency is detected, the operating unit displays a system message and does not go online. This should prevent erroneous read and write accesses being caused by address information through changes in the SIMOTION SCOUT and through loading modified programs.

Note

The consistency check can be deactivated in SIMOTION SCOUT for commissioning.

Caution

The following applies for previous versions of ProTool V6.0 and deactivated consistency check using ProTool V6.0:

If technological objects are modified in a SIMOTION project (add, rename or delete axes), or interface area of the application program, for example, the tags in ProTool/Pro CS must be updated and the project generated again.

If this process is not observed, it may, under certain circumstances, lead to impermissible operating statuses.

The following procedure must be adhered to in the case of modification:

If tags are modified in the application program for the PLC and, at the same time, an operating unit is connected, proceed as follows:

1. Switch off the operating unit, switch it offline or disconnect it from the bus.
2. Download the application program to the PLC.
3. Compile the ProTool projects affected anew in order to synchronize the tags again. Download the projects to the respective operating units.

The operating unit can then be used, without restriction, for the process operation.

User data areas

The user data areas are configured in ProTool under *Insert* → *Area Pointers*. At the same time, they must be set up in the PLC with the corresponding address area.

User data areas which are to be used for a SIMOTION PLC, must be defined using SIMOTION SCOUT. The address area must be of the type INT or WORD. Address areas with a length larger than 1 word must be defined as an array of the type INT or WORD.

User data areas are used for the exchange of special data and must only be set up when the data concerned is used. User data areas are necessary for e.g.:

- Trends (bit-triggered/event-controlled)
- Recipes
- PLC jobs
- Controlling LEDs

16.2 Connection to SIMOTION via PROFIBUS

Configuration

Within a PROFIBUS network, an operating unit can be connected to all modules that have an integrated PROFIBUS or PROFIBUS-DP interface and support the S7 protocol Several operating units can be connected to one PLC and several PLCs to one operating unit.

Figure 16-3 illustrates a possible network configuration. The numbers 1, 2, ... are examples of addresses. The addresses of the PLC nodes are assigned via the STEP 7 hardware configuration or network configuration.

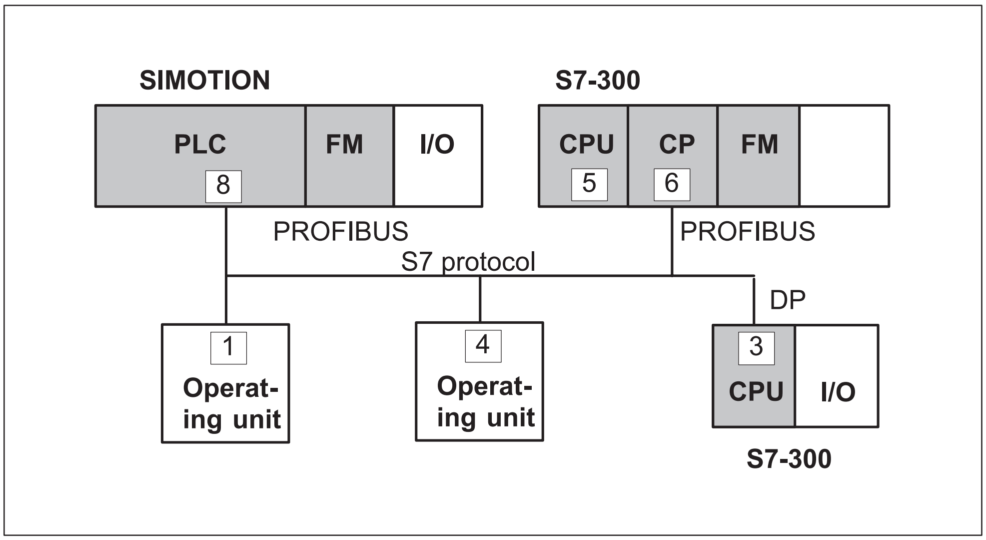


Figure 16-3 Connection via PROFIBUS

Using a standard PC as operating unit

When using a standard PC as the operating unit, a communication processor (CP) is also required for connection to the SIMOTION PLC.

The following table lists the permissible CPs.

Table 16-2 Approved communication processors

Communication Processor	Windows NT	Windows 2000
CP 5511	x	–
CP 5611	x	x
CP 5613/CP 5614[1]	x	x

1 Software for configuration is required.

Example of a network configuration

The operating units communicate with the CPU via S7 protocol. The connection is made via the PROFIBUS interface of the CPU. The simplest network configuration consists of one CPU and one operating unit. A more complex configuration might consist of a CPU and several operating units, for example.

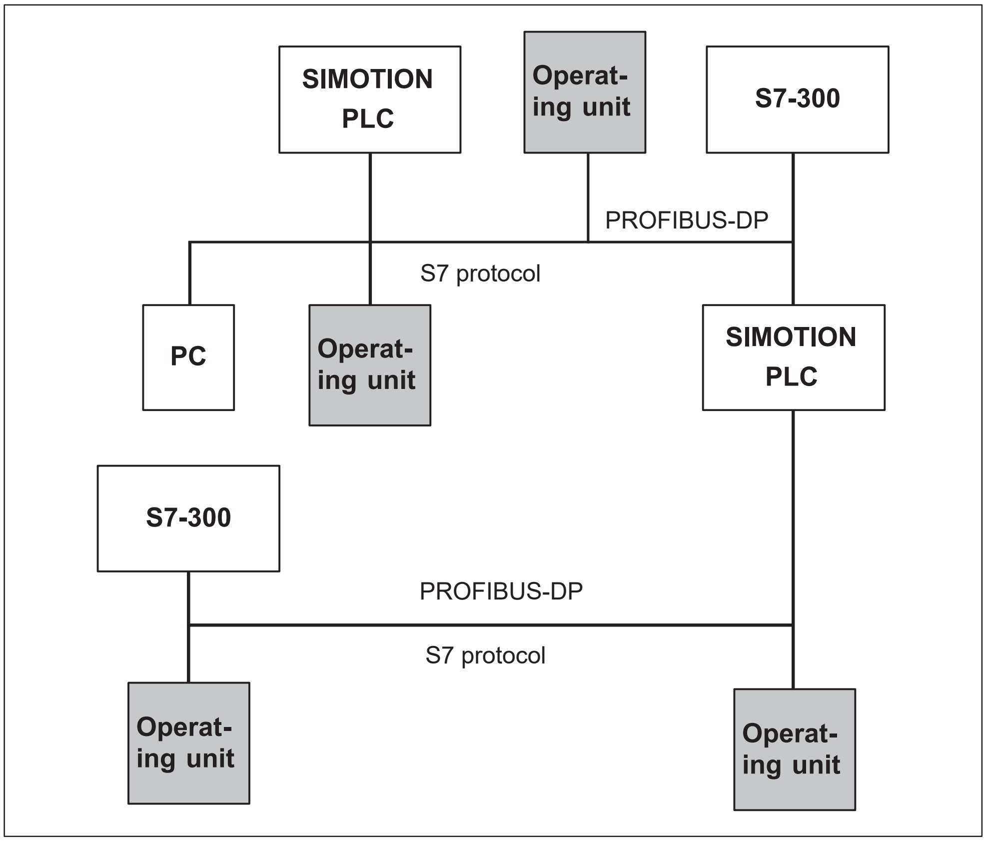


Figure 16-4 Example of a network configuration

Note

No HMI units can be connected to an isochronous PROFIBUS.

16.3 Setting Parameters for SIMOTION

Configuring the operating unit

In order that the operating unit can communicate and exchange data with a PLC, it must be correctly configured. Select the required CPU in the *Communication Peer* field.

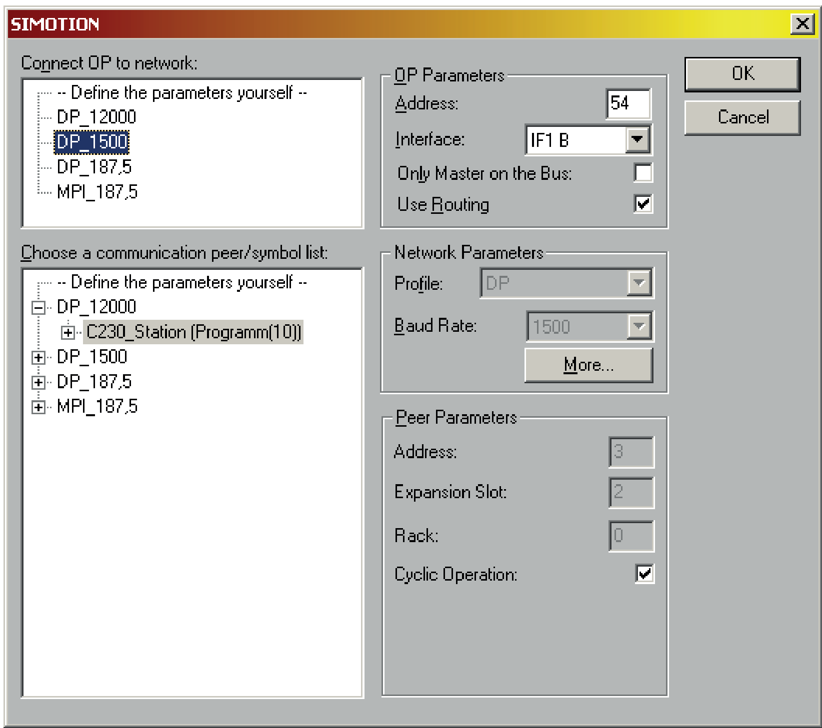


Figure 16-5 Peer parameters

Note

Configuration made by means of input in the *Peer Parameters* field does not guarantee reliable communication. Use the *Communication Peer* field.

When creating a new project, the project assistant requests the definition of the PLC. First of all, select the SIMOTION protocol and then define the parameters, specified below, after clicking on the Parameters button. For any subsequent parameter modifications, select the item PLC in the project window.

The parameters are divided into three groups for the SIMOTION PLC:

- **OP parameters**

  Use OP Parameters to enter the parameters for the operating unit in the network configuration. This is done only once. Any alteration of the OP parameters applies to all communication peers.

Table 16-3 OP Parameter

Parameters	Explanation
Address	Select the PROFIBUS-DP address of the operating unit.
Interface	Select the interface on the operating unit via which the unit is connected to the network.
Only once master on the bus	This deactivates an additional protection function against bus faults when connecting the operating unit to the network. A passive station (slave) can only transmit data when requested to by an active station (master). If only slaves are connected to the operating unit, this protection function must be deactivated by activating the option *Only once master on the bus*.
Use routing	Activate this check box in order to reach participants on another subnet. **Requirements:** The station modules must be “routing-capable” (CPUs or CPs). Further information is available in the *STEP 7 Online Help*.

- **Network parameters**

  Use *Network Parameters* to select the network, e.g. PROFIBUS; the parameter settings from the STEP 7 network configuration are then displayed and accepted for the operating unit.

  Click the *More* button to display the further network parameters.

- **Peer parameters**

  Use *Peer Parameters* to address the modules with which the operating unit should exchange data. A symbolic name has to be defined for each communication peer.

Table 16-4 Peer parameters

Parameters	Explanation
Cyclical operation	If cyclical operation is activated, the PLC optimizes data transfer between the operating unit and PLC. This achieves a better performance.

Example for the addressing

A communication-capable module is addressed by means of the following parameters:

Address: PROFIBUS address of the SIMOTION CPU
Slot: S7 module slot
Rack: Rack in which the S7 module is installed.

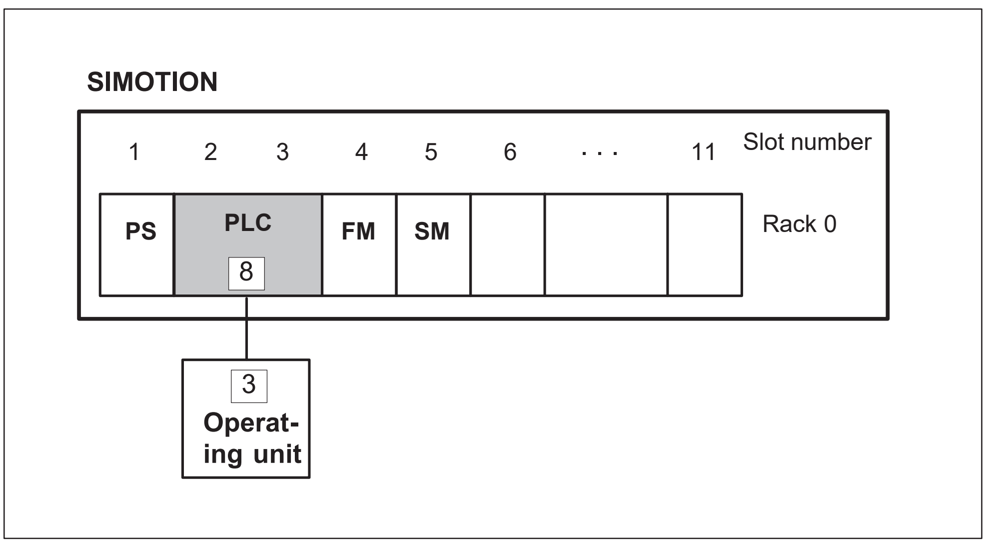


Figure 16-6 Network configuration with SIMOTION CPU and operating unit – PROFIBUS-DP profile

The CPU illustrated in the Figure is addressed as follows:
Address: 8
Slot: 2
Rack: 0

16.4 Data Types Approved for SIMOTION

If SIMOTION is selected in *PLC*, the data types listed in Table 16-5 are available for the configuration of tags and area pointers.

Table 16-5 Permissible data types

SIMOTION	ProTool	Bit width	Sign
BOOL	BOOL	Bit 1	No
BYTE/USINT	Byte	8 Bit	No
SINT	CHAR	8 Bit	Yes
WORD/UINT	Word	Bit 16	No
INT	INT	Bit 16	Yes
DINT	DINT	Bit 32	Yes
DWORD/UDINT	DWORD	Bit 32	No
REAL	REAL	Bit 32	Yes
LREAL	LREAL	Bit 64	Yes

Note

Since data types can be defined in a SIMOTION PLC which correspond to another data type in ProTool, the SIMOTION data types in question are mapped to ProTool data types.

16.5 Optimization

Acquisition cycle and update time

The acquisition cycles defined in the configuration software for the area pointers and the acquisition cycles for the tags are major factors in respect of the real update times which are achieved.

The update time is the acquisition cycle plus transmission time plus processing time.

In order to achieve optimum update times, the following points should be observed during configuration:

- When setting up the individual data areas, make them as large as necessary but as small as possible.
- Define data areas that belong together as contiguous areas. The real update time is improved by setting up one large are area instead of several small areas.
- Setting acquisition cycles which are too short unnecessarily impairs overall performance. Set the acquisition cycle to correspond to the modification time of the process values. The rate of change of temperature of a furnace, for example, is considerably slower than the acceleration curve of an electric motor.

  Guideline value for the acquisition cycle: 1 second
- If necessary, dispense with cyclic transmission of user data areas (acquisition cycle = 0) in order to improve the update time. Instead, use PLC jobs to transfer the user data areas at random times.
- Store the tags for a message or a screen in a contiguous data area.
- In order that changes on the PLC are reliably detected, they must occur during the actual acquisition cycle at least.
- Set the baud rate to the highest possible value.

Screens

The real screen updating rate which can be achieved is dependent on the type and quantity of data to be displayed.

In order to achieve short updating times, ensure that short acquisition cycles are only defined in the configuration for those objects which actually need to be updated quickly.

Trends

If, in the case of bit-triggered trends, the communication bit is set in the “trend transfer area”, the operating unit always updates all the trends whose bit is set in that area. It resets the bits afterwards.

The communication bit in the PLC program can only be set again after all the bits have been reset by the operating unit.

PLC jobs

If large numbers of PLC jobs are sent to the operating unit in quick succession, communication between the operating unit and PLC may become overloaded.

If the operating unit enters the value 0 in the first data word of the job mailbox, it signifies that the operating unit has accepted the job. It then processes the job, for which it requires a certain amount of time. If a new PLC job is then immediately entered in the job mailbox, it may take some time before the operating unit executes the next PLC job. The next PLC job is only accepted when sufficient computer performance is available.

User Data Areas for SIMOTION 17

Overview

User data areas are used for data exchange between the PLC and operating unit.

The user data areas are written to and read by the operating unit and the application program alternately during the process of communication. By analyzing the data stored there, the PLC and operating unit reciprocally initiate predefined actions.

This chapter describes the function, layout and special features of the various user data areas.

17.1 User Data Areas Available

Requirements

In order to set up area pointers in ProTool, the user data areas must also be configured in SIMOTION SCOUT. The following options are available for this:

- Device-global user tags,
- Symbolic input/output tags,
- Interface tags of application programs.

User data areas include messages and trends. Set up user data areas both in the ProTool project using the *Area Pointers* project window and in the PLC.

Note

No longer valid for ProTool from V6.0:

Tag arrays for area pointers and trends may not exceed a maximum size of 100 words (200 bytes). Example:

```
Array [0...99] of INT;
Array [0...49] of REAL;
```

Function range

The user data areas available are dependent on the operating unit used. The tables 17-1 and 17-2 provide an overview of the functional range of the individual operating units.

Table 17-1 User data areas available, Part 1

User data area	Panel PC	Standard PC
User version	x	x
Job mailbox	x	x
Event messages	x	x
Screen number	x	x
Data mailbox	x	x
Date/Time	x	x
Date/Time PLC	x	x
Coordination	x	x
Trend request	x	x
Trend transfer 1, 2	x	x
LED assignment [1]	x	–
OP/PLC acknowledgement	x	x
Alarm messages	x	x

[1] Only possible using operating units with keyboard.

Table 17-2 User data areas available, Part 2

User data area	MP 370	MP 270 MP 270B	TP 270 OP 270	TP 170B OP 170B
User version	x	x	x	x
Job mailbox	x	x	x	x
Event messages	x	x	x	x
Screen number	x	x	x	x
Data mailbox	x	x	x	x
Date/Time	x	x	x	x
Date/Time PLC	x	x	x	x
Coordination	x	x	x	x
Trend request	x	x	x	–
Trend transfer 1, 2	x	x	x	–
LED assignment [1]	x	x	x	x
OP/PLC acknowledgement	x	x	x	x
Alarm messages	x	x	x	x

[1] Only possible using operating units with keyboard.

Table 17-3 illustrates the way in which the PLC and operating unit access the individual user data areas – Read (R) or Write (W).

Table 17-3 Application of the user data areas

User data area	Necessary for	Operating unit	PLC
User version	ProTool Runtime checks whether the ProTool project version and the project in the PLC are consistent.	R	W
Job mailbox	Triggering of functions on the operating unit by PLC program	R/W	R/W
Event messages	Bit reporting process arrival and departure of event messages	R	W
Screen number	Evaluation by the PLC as to which screen is currently open	W	R
Data mailbox	Downloading of data records with synchronization	R/W	R/W
Date/Time	Transfer of date and time from the operating unit to the PLC	W	R
, Date/Time PLC	Transfer of date and time from the PLC to the operating unit.	R	W
Coordination	Operating unit status polled by the PLC program	W	R
Trend request	Configured trends with “Triggering via bit” or configured history trends	W	R
Trend transfer 1	Configured trends with “Triggering via bit” or configured history trends	R/W	R/W
Trend transfer area 2	Configured history trend with “switch buffer”	R/W	R/W
LED assignment	LED triggered by the PLC	R	W
Operating unit acknowledgement	Message from the operating unit to the PLC indicating an alarm message has been acknowledged	W	R
PLC acknowledgement[1]	Alarm message acknowledgement from the PLC	R	W
Alarm messages	Bit reporting process arrival and departure of alarm messages	R	W

1 When using ProTool from V6.0, the user data area “Alarm Ack. PLC” must be set up the “Alarm Messages” area pointer.

The user data areas and their associated area pointers are explained in the following chapters.

17.2 User Data Area, User Version

Usage

When starting up the operating unit, it is possible to check whether the operating unit is connected to the correct PLC. This is important when several operating units are used.

To do this, the operating unit compares a value stored in the PLC with the value defined in the configuration. In this way, the compatibility of the configuration data with the PLC program is ensured. If there is a mismatch, a system message appears on the operating unit and the runtime configuration is terminated.

In order to use this user data area, set up the following during the configuration:

- Specify the configuration version – value between 1 and 255.

  ProTool: *System* → *Settings*
- Data address of the value for the version stored in the PLC:

  ProTool: *Insert* → *Area Pointers*, available types: *User version*

Danger

The user version is only checked while the connection is being established when ProTool Runtime is started. If the PLC is subsequently changed, the user version is not checked.

17.3 User Data Area, Job Mailbox

Description

The job mailbox can be used to send PLC jobs to the operating unit, thus initiating actions on the operating unit. These functions include:

- displaying screens
- setting date and time

The job mailbox is set up under *Area Pointer* and has a length of four data words.

The first word of the job mailbox contains the job number. Depending on the PLC job in question, up to three parameters can then be specified.

Word	Left byte (LB)	Right byte (RB)
n+0	0	Job no.
n+2	Parameter 1	
n+4	Parameter 2	
n+6	Parameter 3	

Figure 17-1 Structure of the user data area, job mailbox

If the first word of the job mailbox is not equal to zero, the operating unit analyzes the PLC job. The operating unit then sets this data word to zero again. For this reason, the parameters must be entered in the job mailbox first and then the job number.

The possible PLC jobs, including job number and parameters, are provided in the “ProTool Online Help” and the Appendix, Part B.

17.4 User Data Area, Event and Alarm Messages and Acknowledgement

Definition

Messages consist of a static text and/or tags. The text and tags can be defined by the user.

Messages are subdivided into event messages and alarm messages. The programmer defines the event message and alarm message.

Event messages

An event message indicates a status, e.g.

- `Motor switched on`
- `PLC in manual mode`

Alarm messages

An alarm message indicates an operational fault, e.g.

- `Valve not opening`
- `Motor temperature too high`

Acknowledgement

Since alarm messages indicate an abnormal operational status, they must be acknowledged. They can be acknowledged either by

- operator input on the operating unit
- setting a bit in the PLC acknowledgement area.

Triggering messages

A message is triggered by setting a bit in one of the message areas on the PLC. The location of the message areas is defined by means of the configuration software. The corresponding area must also be set up in the PLC.

As soon as the bit in the PLC event/alarm message area has been set and that area has been transferred to the operating unit, the operating unit detects that the relevant message has "arrived".

Conversely, when the same bit is reset on the PLC by the operating unit, the message is registered as having "departed".

Message areas

Table 17-4 indicates the number of message areas for event and alarm messages, for alarm acknowledgement OP (Operating unit → PLC) and for alarm acknowledgement PLC (PLC → Operating unit) and the number of words for the various operating units.

Table 17-4 Message areas

Operating unit	Event message area, Alarm message area Acknowledgement area OP, Acknowledgement area PLC	
	Number of data areas, maximum	Words in data area, total
Panel PC	8	125
Standard PC	8	125
MP 370	8	125
MP 270, MP 270B	8	125
TP 270, OP 270	8	125
TP 170B, OP 170B	8	125

Note

No longer valid for ProTool from V6.0:

Tag arrays for area pointers and trends may not exceed a maximum size of 100 words (200 bytes).

Example:

```
Array [0...99] of INT;
Array [0...49] of REAL;
```

Assignment of message bit to message number

A message can be assigned to each bit in the configured message area. The bits are assigned to the message numbers in ascending order.

Example:

The following event message area has been configured in the PLC:

```
Event message: Array[0..4] of Word;
```

Figure 17-2 shows the assignment of all 80 (5 x 16) message numbers to the individual bit numbers in the PLC event message area. The assignment is performed automatically on the operating unit.

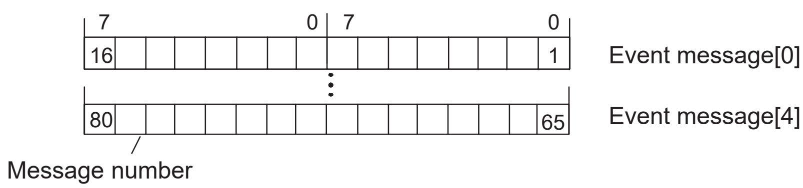


Figure 17-2 Assignment of message bit and message number

User data areas, acknowledgement

If the PLC should be informed of an alarm message acknowledgement on the operating unit or the acknowledgement should be initiated on the PLC itself, the relevant acknowledgement areas must also be set up in the PLC. These acknowledgement areas must also be specified in the ProTool project under *Area Pointers*.

- **Acknowledgement area Operating Unit → PLC**:

  This area is used to inform the PLC when an alarm message has been acknowledged by means of operator input on the operating unit. The “Alarm Ack. OP” area pointer must be created or configured for this.

- **Acknowledgement area PLC → Operating Unit**:

  This area is used when an alarm message is acknowledged by the PLC. A value must be entered in the *Acknowledgement length* field of the “Alarm Messages” area pointer. The available number of words for acknowledgement and message are displayed in the *Total length* field.

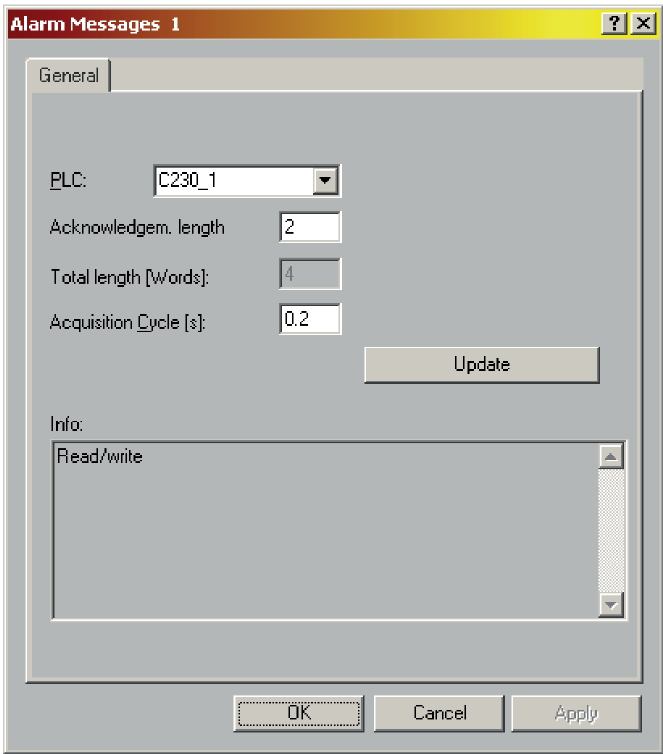


Figure 17-3 Set acknowledgement length

Note

The acknowledgement and message areas are combined. An entry in the *Acknowledgement length* field reduces the possible *Total length* for the alarm messages.

An example is provided in Figure 17-5. Two words are assigned for acknowledgement area 1. Assuming a total length of 5 words means the a maximum of 3 words remain for the alarm message area.

Figure 17-4 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 17-7 and 17-6.

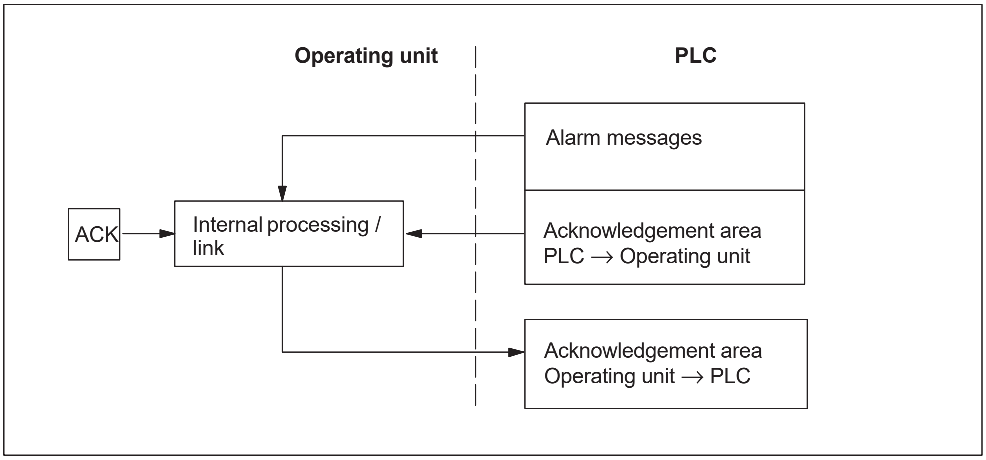


Figure 17-4 Alarm message and acknowledgement areas

Assignment of acknowledgement bit to message number

Each alarm message is assigned a message number. The message number is assigned the same bit number in the alarm messages area as that assigned in the acknowledgement area. Under normal circumstances, the acknowledgement area is the same length as the associated alarm messages area.

If the length of an acknowledgement area is not equal to the overall length of the associated alarm messages area, and there are succeeding alarm messages and acknowledgement areas, the following assignment applies:

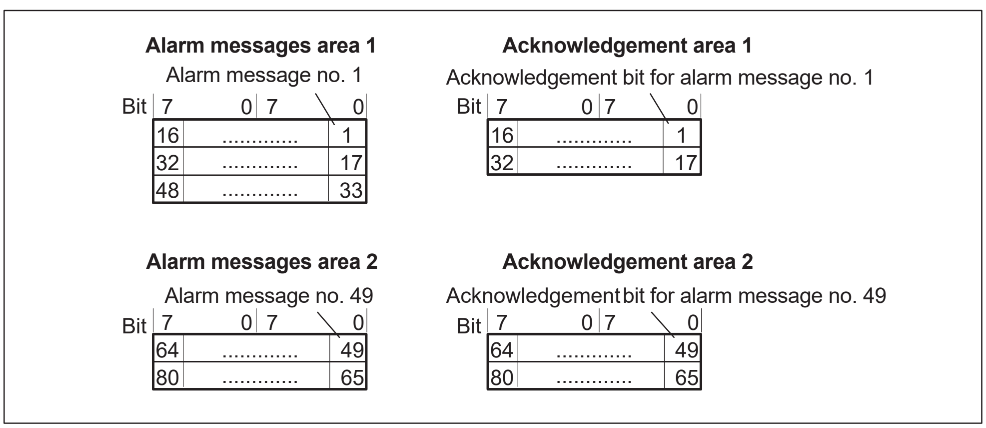


Figure 17-5 Assignment of acknowledgement bit and message number

Acknowledgement area Operating Unit ” PLC

When a bit is set in the alarm message area, the operating unit resets the associated bit in the acknowledgement area. As a result of processing by the operating unit, the two processes indicate a slight difference with regard to time. If the alarm message is acknowledged on the operating unit, the bit in the acknowledgement area is set. In this way, the PLC can detect that the alarm message has been acknowledged. Figure 17-6 illustrates the signal diagram.

The acknowledgement area Operating Unit → PLC must be no longer than the associated alarm messages area.

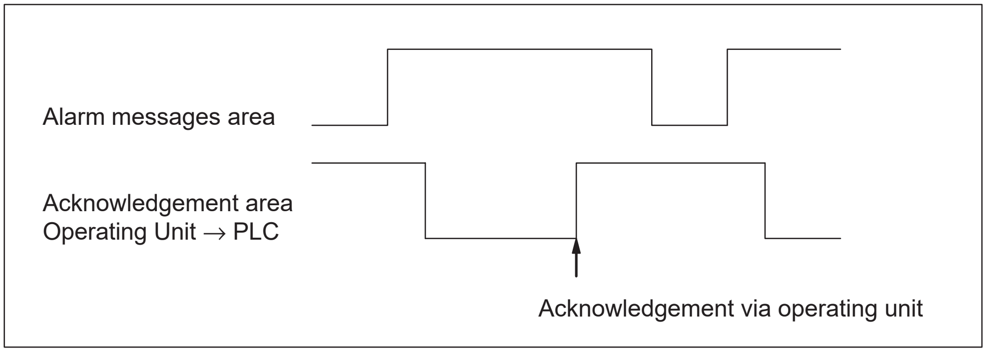


Figure 17-6 Signal diagram for acknowledgement area Operating Unit → PLC

Acknowledgement area PLC→ Operating Unit

Applies for ProTool from V6.0:

A bit set in this area by the PLC initiates the acknowledgement of the corresponding alarm message in the operating unit, thus fulfilling the same function as pressing the ACK button. Reset the bit before setting the bit in the alarm message area again. Figure 17-7 illustrates the signal diagram.

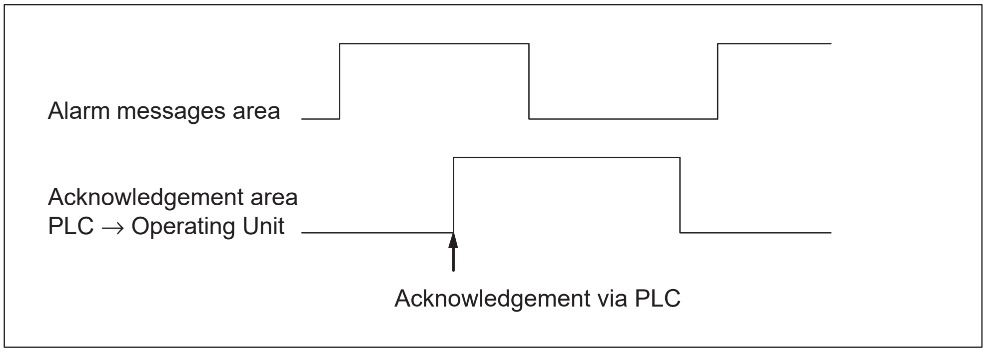


Figure 17-7 Signal diagram for acknowledgement area PLC → Operating Unit

The acknowledgement area PLC → Operating Unit

- is set in the “Alarm Messages“ area pointer, and
- may not be any longer than the associated alarm messages area.

Acknowledgement area size

The acknowledgement areas PLC → Operating Unit and Operating Unit → PLC must not be any longer than the associated alarm message areas. The acknowledgement area, however, be smaller if acknowledgement by the PLC is not required for all alarm messages. This is also valid when the acknowledgement need not be detected in the PLC for all alarm messages. Figure 17-8 illustrates such a case.

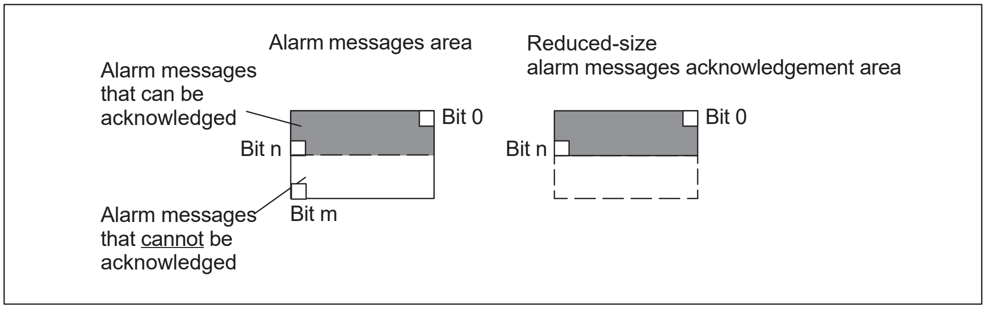


Figure 17-8 Reduced-size acknowledgement area

Note

Place important alarm messages in the alarm messages area starting at Bit 0 in ascending order.

17.5 User Data Area, Screen Numbers

Application

The operating units store information concerning the screen currently open on the unit in the screen number user data area.

This enables the transfer of data regarding the current operating unit display content to the PLC which, in turn, can trigger certain reactions; e.g. call in a different screen.

Requirements

If the screen number area should be used, it must be specified in the ProTool project as an *Area Pointer*. It can only be stored in one PLC and only once.

The screen number area is downloaded to the PLC spontaneously, i.e. the transfer is always initiated when a change is selected on the operating unit. Therefore, it is not necessary to configure an acquisition cycle.

Structure

The screen number area is a data area with a fixed length of 5 data words.

The structure of the screen number area in the PLC memory is illustrated below.

	7 0	7 0
1st Word	Current screen type	
2nd Word	Current screen number	
3rd Word	Reserved	
4th Word	Current field number	
5th Word	Reserved	

Entry	Assignment
Current screen type	1 for basic screen or 4 for fixed window
Current screen number	1 to 65535
Current field number	1 to 65535

17.6 User Data Area, Date/Time

Transferring date and time

The transfer of date and time from the operating unit to the PLC can be triggered by PLC jobs 40 and 41. Both can be used to read the date and time from the operating unit and write it to the Date/Time data area. They can be analyzed by the PLC program in this area.

The jobs differ in respect of the format in which the information is stored. PLC job 40 writes in the format S7 DATE_AND_TIME, and PLC job 41 uses the same format as the operating unit. Both formats are in BCD code.

Format S7 DATE_AND_TIME (BCD-coded)

The format used by PLC Job 40 has the following structure:

Byte	7 … 4	3 … 0
n+0	Year (80–99/0–29)	
n+1	Month (1–12)	
n+2	Day (1–31)	
n+3	Hour (0–23)	
n+4	Minute (0–59)	
n+5	Second (0–59)	
n+6	Reserved	Reserved
n+7	Reserved	Weekday (1–7, 1=Sun)

Figure 17-9 Structure of data area Date/Time in DATE_AND_TIME format

Note

When entering data in the year data area, please note that the values 80–99 represent 1980 to 1999 and 0–29 the years 2000 to 2029.

Operating unit format

The format used by PLC Job 41 has the following structure:

Byte	7 … 0
n+0	Reserved
n+1	Hour (0–23)
n+2	Minute (0–59)
n+3	Second (0–59)
n+4	Reserved
n+5	Reserved
n+6	Reserved
n+7	Weekday (1–7, 1=Sun)
n+8	Day (1–31)
n+9	Month (1–12)
n+10	Year (80–99/0–29)
n+11	Reserved

Figure 17-10 Structure of the Date/Time data area in operating unit format

Note

When entering data in the year data area, please note that the values 80–99 represent 1980 to 1999 and 0–29 the years 2000 to 2029.

Differences in the S7 format as compared to the operating unit format

The S7 DATE_AND_TIME format differs from the operating unit format in the following ways:

- Different sequence of entries
- Memory requirements reduced from 12 to 8 bytes

17.7 User Data Area, Date/Time PLC

Transfer of date and time to the operating unit

The downloading of date and time to the operating unit is generally useful when the PLC is master for time.

DATE_AND_TIME format (BCD coded)

Byte	7 … 4	3 … 0
n+0	Year (80–99/0–29)	
n+1	Month (1–12)	
n+2	Day (1–31)	
n+3	Hour (0–23)	
n+4	Minute (0–59)	
n+5	Second (0–59)	
n+6	Reserved	Reserved
n+7	Reserved	Weekday (1–7, 1=Sun)

Figure 17-11 Structure of data area Date/Time in DATE_AND_TIME format

Note

When entering data in the year data area, please note that the values 80–99 represent 1980 to 1999 and 0–29 the years 2000 to 2029.

The PLC writes cyclically to the data area, whereby the operating unit reads and synchronizes (refer to the ProTool User's Guide).

Note

In the configuration, do not select too small an acquisition cycle for the Date/Time area pointer because this affects the operating unit performance.

Recommendation: Acquisition cycle of 1 minute, if permitted by the process.

17.8 User Data Area, Coordination

The coordination user data area is two data words long. It serves to realize the following functions:

- Detection of operating unit startup by the PLC program,
- Detection of the current operating unit operating mode by the PLC program,
- Detection by the PLC program that the operating unit is ready to communicate.

Note

Each time the coordination area is updated by the operating unit, the entire coordination area is written.

Therefore, the PLC program must not execute any modifications in the coordination area.

Bit assignment in coordination area

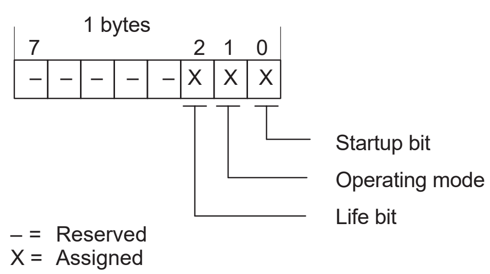


Figure 17-12 Significance of the bits in the coordination area

Startup bit

The startup bit is set to 0 for a short time during the start-up routine by the operating unit. After the startup routine has been completed, the bit is set permanently to 1.

Operating mode

As soon as the operating unit has been switched offline by the operator, the operating mode bit is set to 1. When the operating unit is working in normal operation, the operating mode bit is set to 0. The PLC program can be used to poll this bit and thus establish the current operating mode of the operating unit.

Life bit

The life bit is inverted by the operating unit at intervals of approx. one second. The PLC program can be used to poll this bit to check whether connection to the operating unit still exists.

17.9 User Data Areas, Trend Request and Trend Transfer

Trends

A trend is the graphical representation of a value from the PLC. Reading of the value can be time-triggered or bit-triggered, depending on the configuration.

Time-triggered trends

The operating unit reads the trend values cyclically according to the cycle interval defined in the configuration. Time-triggered trends are suitable for continuous progressions such as the operating temperature of a motor.

Bit-triggered trends

By setting a trigger bit in the trend transfer area pointer, the operating unit reads in either a trend value or the entire trend buffer. This is specified in the configuration. Bit-triggered trends are normally used to display values of an area subject to rapid variation. An example of this is the injection pressure for plastic moldings.

In order to be able to activate bit-triggered trends, corresponding data areas have to be specified in the ProTool project (under *Area Pointers*) and set up on the PLC. The operating unit and the PLC communicate with one another via those areas.

The following areas are available for trends:

- Trend request area
- Trend transfer area 1
- Trend transfer area 2 (required with switch buffer only)

Assign a trend to a bit in the configuration. This ensures the bit assignment is unique for all areas.

Switch buffer

The switch buffer is a second buffer for the same trend and can be set up during the configuration.

While the operating unit reads the value from Buffer 1, the PLC writes it in Buffer 2. If the operating unit reads from Buffer 2, the PLC writes to Buffer 1. This prevents the trend value being overwritten by the PLC when being read by the operating unit.

Partitioning of the area pointers

The trend request and trend transfer 1 and 2 area pointers can be divided into separate data areas with a predefined maximum number and length (Table 17-5).

Table 17-5 Partitioning of the area pointer

	Data area		
	Trend request	Trend transfer	
		1	2
Number of data areas, maximum	8	8	8
Words in data area, total	8	8	8

Trend request area

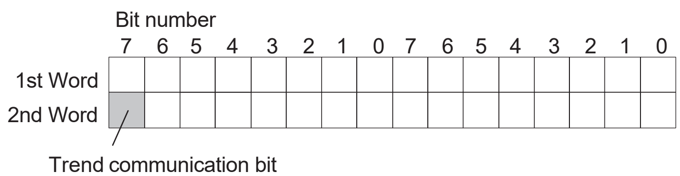
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

The trend request area can be used by the PLC to ascertain which trend is currently being displayed on the operating unit. Trends can also be triggered without analysis of the trend request area.

Trend transfer area 1

This area serves for triggering trends. In the PLC program, set the bit assigned to the trend in the trend transfer area and the trend communication bit. The operating unit detects triggering and reads in either a trend value or the entire buffer. It then resets resets the trend bit and the trend communication bit.

Trend transfer area(s)



The trend transfer area must not be altered by the PLC program until the trend communication bit has been reset.

Trend transfer area 2

Trend transfer area 2 is necessary for trends that are configured with a switch buffer. Its layout is precisely the same as that of trend transfer area 1.

17.10 User Data Area, LED Assignment

Application

The Operator Panel (OP), Multi Panel (MP) and Panel PC have function keys with Light Emitting Diodes (LEDs) integrated in them. These LEDs can be controlled from the PLC. This means, for example, that in specific situations, it is possible to indicate to the operator which key should be pressed by switching on an LED.

Requirements

In order to control LEDs, corresponding data areas, so-called LED assignments, must be set up in the PLC and defined in the configuration as *Area Pointers*.

Partitioning of the area pointer

The LED assignment area pointer can be divided into separate data areas, as illustrated in the following table.

Table 17-6 Partitioning of the area pointer

Operating unit	Number of data areas, maximum	Words in data area, total
Panel PC	8	16
MP 370	8	16
MP 270, MP 270B	8	16
OP 270	8	16
OP 170B	8	16

Note

The area pointer in question can no longer be selected in the *Insert new area pointer* window when the maximum number has been reached. Area pointers of the same type appear gray.

LED assignment

The assignment of the individual LEDs to the bits in the data areas is defined when the function keys are configured. This involves specifying a bit number within the assignment area for each LED.

The bit number (n) identifies the first of two successive bits which control the following LED states (refer to Table 17-7):

Table 17-7 LED states

Bit n + 1	Bit n	LED function
0	0	Off
0	1	Flashes
1	0	Flashes
1	1	Permanently on

17.11 Recipes

Description

During the transfer of data records between the operating unit and PLC, both communication peers alternately access common communication areas in the PLC. The function and structure of the recipe-specific communication area (“data mailbox”) and the mechanisms involved in synchronized transfer of data records are the subject of this chapter.

Information on setting up the data mailbox in ProTool is provided in the online help.

Downloading methods

There are two methods of downloading data records between operating unit and PLC:

- Asynchronous transfer (Page 17-21)
- Synchronized transfer using the data mailbox (Page 17-22)

Data records are always transferred directly, i.e. the tag values are read or written directly from or to the address configured for the tag without being stored intermediately.

Trigger downloading of data records

There are three methods of triggering the transfer of data:

- By operator input on the recipe display (Page 17-23)
- By PLC jobs (Page 17-24)
- By activating configured functions (Page 17-25)

If transfer of data records is initiated by a configured function or a PLC job, the recipe display on the operating unit remains fully functional as the data records are transferred in the background.

Simultaneous processing of multiple transfer jobs is not possible, however. In such cases, the operating unit returns a system message refusing additional transfer requests.

A list of the most important system messages together with notes on the possible causes of the associated errors and remedies for them is provided in Appendix, Part A.

17.11.1 Asynchronous data transfer

Purpose

In the case of asynchronous transfer of data records between operating unit and PLC, there is **no** coordination of the communication areas commonly used. For this reason, there is no need to set up a data mailbox during the configuration process.

Application

The **asynchronous** transfer of data records is applicable, for example, when the

- uncontrolled overwriting of data by the communication peers can be reliably prevented by the system,
- the PLC does not require any details of the recipe and data record numbers, or
- transfer of data records is initiated by operator input on the operating unit.

Read values

On triggering a read transfer, the values are read from the PLC addresses and downloaded to the operating unit.

- **Transfer initiated by operator input on recipe display**:

  Data is uploaded to the operating unit. There it can be processed, e.g. values can be modified and the changes saved.
- **Transfer initiated by function or PLC job**:

  The data is saved directly to the storage medium.

Write values

On triggering a write transfer, the values are written to the PLC addresses.

- **Transfer initiated by operator input on recipe display**:

  The current values are written to the PLC.
- **Transfer initiated by function or PLC job**:

  The values on the storage medium are written to the PLC.

17.11.2 Synchronous data transfer

Purpose

In the case of synchronous data transfer, both the communication peers set status bits in the commonly used data mailbox. In this way, the PLC program can prevent uncontrolled overwriting of each other's data by the two units.

Application

The **synchronous** transfer of data records is applicable, for example, when

- the PLC is the "active partner" for transfer of data records,
- details of the recipe and data record numbers are to be analyzed on the PLC, or
- transfer of data records is initiated by PLC job.

Requirements

In order to synchronize the transfer of data records between the operating unit and PLC, the following conditions must be fulfilled in the configuration:

- the data mailbox must have been set up in *System* → *Area Pointer*;
- the recipe properties must specify the PLC with which the operating unit has to synchronize transfer of data records.

  The PLC is specified in the recipe editor in *Properties* → *Transfer*.

Detailed information on this is provided in ProTool Configuring Windows-based Systems User Guide.

17.11.3 Data mailbox for synchronized data transfer

Structure

The data mailbox has a defined length of 5 words. Its structure is as follows:

	7	0	7	0
1st Word	Current recipe number (1 – 999)			
2nd Word	Current data record number (0 – 65,535)			
3rd Word	Reserved			
4th Word	Status (0, 2, 4, 12)			
5th Word	Reserved			

Status word

The status word (Word 4) can assume the following values:

Value		Explanation
Decimal	Binary	
0	0000 0000	Transfer permitted, data mailbox is accessible
2	0000 0010	Transfer in progress
4	0000 0100	Transfer completed without errors
12	0000 1100	Errors occurred during transfer

17.11.4 Synchronization process

Read from the PLC by operating the recipe view

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe number to be read and the status “Transfer in progress” in the data mailbox and sets the data record number to zero.	Operation cancelled and system message returned
3	The operating unit reads the values from the PLC and displays them on the recipe display. In the case of recipes with synchronous tags, the values from the are also written in the tags.	
4	The operating unit sets the status to “Transfer completed”.	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Write in the PLC by operating the recipe view

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number to be written and the status “Transfer in progress” in the data mailbox.	Operation cancelled and system message returned
3	The operating unit writes the current values to the PLC. In the case of recipes with synchronized tags, the modified values between the recipe views and tags are compared and then written to the PLC.	
4	The operating unit sets the status to “Transfer completed”.	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Read from the PLC by PLC job “PLC → DAT” (no. 69)

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the job and the status “Transfer in progress” in the data mailbox.	Operation cancelled and no message returned
3	The operating unit reads the value from the PLC and saves the value in the data record specified by the job.	
4	• If the option “Overwrite” has been specified for the job, existing data records are overwritten without prior warning. The operating unit sets the status to “Transfer completed”. • If “Do not overwrite” was specified in the job and the data record already exists, the operating unit terminates the process and enters `0000 1100` in the status word of the data mailbox.	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Details of the structure of the PLC job are provided on Page 17-27.

Write in the PLC by PLC job "DAT → PLC" (no. 70)

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the job and the status "Transfer in progress" in the data mailbox.	Operation cancelled and no message returned
3	The operating unit reads the value from the data record specified in the job from the data medium and writes that value in the PLC.	
4	The operating unit sets the status to "Transfer completed".	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Details of the structure of the PLC job are provided on Page 17-27.

Read from the PLC by configured function

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the function and the status "Transfer in progress" in the data mailbox.	Operation cancelled and system message returned
3	The operating unit reads the data from the PLC and saves it to the data record specified by the function.	
4	• If the option "Overwrite" has been specified for the function, existing data records are overwritten without prior warning. The operating unit sets the status to "Transfer completed". • If "Do not overwrite" was specified in the job and the data record already exists, the operating unit terminates the process and enters `0000 1100` in the status word of the data mailbox.	
5	In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Write in the PLC by configured function

Step	Action	
1	Check status word = 0?	
	Yes	**No**
2	The operating unit enters the recipe and data record number specified by the function and the status “Transfer in progress” in the data mailbox.	Operation cancelled and system message returned
3	The operating unit reads the value from the data record specified in the function from the data medium and writes that value in the PLC.	
4	The operating unit sets the status to “Transfer completed”.	
5	The PLC program can now analyze the data transferred as required. In order to enable another transfer operation, the PLC program has to reset the status word to zero.	

Note

For reasons of data consistency, analysis of the recipe and data record number on the PLC can not be performed until the status in the data mailbox is set to “Transfer completed” or “Errors occurred during transfer”.

Possible causes of errors

If the downloading of data records is terminated due to errors, it may be due to one of the following reasons:

- Tag address not set up on PLC,
- Overwriting of data records not possible,
- Recipe number not available
- Data record number not available

A list of the most important system messages together with notes on the possible causes of the associated errors and remedies for them is provided in Appendix, Part A.

Response to error-based termination

The operating unit responds as follows when the downloading of data records is terminated due to an error:

- **Transfer initiated by operator input in recipe view**

  Indication on the status bar on the recipe display and issue of system messages.

- **Transfer initiated by function**

  System messages issued.

- **Transfer initiated by PLC job**

  No feedback of information on operating unit

Regardless of the response of the operating unit, the status of the transfer can be checked by reading the status word in the data mailbox.

17.11.5 PLC jobs for recipes

Purpose

The transfer of data records between operating unit and PLC can be triggered by the PLC program. This requires no operator input on the operating unit.

The two PLC jobs **No. 69** and **No. 70** can be used for this.

No. 69: Read data record from PLC ("PLC → DAT")

PLC Job **No. 69** downloads data records from the PLC to the operating unit. The structure of this PLC job is as follows:

	Left byte (LB)	Right byte (RB)
Word 1	0	69
Word 2	Recipe number (1 to 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	Do not overwrite existing data record: 0 Overwrite existing data record: 1	

No. 70: Write data record to PLC (“DAT → PLC”)

PLC Job **No. 70** downloads data records from the operating unit to the PLC. The structure of this PLC job is as follows:

	Left byte (LB)	Right byte (RB)
Word 1	0	70
Word 2	Recipe number (1 to 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	—	

Part VIII Appendix

System Messages

A

In this chapter

This section of the Appendix contains a selection of important system messages for Windows-based systems. The table indicates when the messages occur and how they, or their cause, can be cleared. Not every message is relevant for each operating unit.

System message parameters

The system messages may contain parameters which are not decoded for the user but which are relevant in respect of the cause of an error since they provide a reference to the source code of the runtime software. These parameters are issued according to the text `Error code:`.

Note

System messages are issued in the language currently set on the operating unit.

Number	Effect/Cause	Remedy
10000	The print job could not be started or was terminated for an unknown reason. The printer is incorrectly configured. Or: There are no rights for a network printer available.	Check the printer settings and cable connections. If a fault occurs repeatedly, contact the hotline.
10001	No printer has been installed or no standard printer configured.	Install a printer and/or mark one as standard printer.
10002	The intermediate buffer for printing graphics is full. Up to two graphics can be buffered.	Do not issue print jobs so quickly in succession.
10003	Graphics can be buffered again.	–
10004	The intermediate buffer for printing lines in text mode (e.g. messages) is full. Up to 1000 lines can be buffered.	Do not issue print jobs so quickly in succession.
10005	Lines of text can be buffered again.	–
10006	The Windows print system reports an error. For information on the cause, refer to the text printed and, if available, the error number. Printing is not performed or it is incorrect.	Repeat the action, if necessary.
20010	A fault has occurred in the script line called in from the specified script. Execution of the script function was, therefore, terminated. In this case, it is advisable to check any previous system messages too.	Select the specified script line in the configuration. Check tags, whether the types used are permissible. Check Functions, whether the number and types of parameter are correct.
20011	An error has occurred in a script called in by the script specified. Execution of the script function has, therefore, been terminated in the subscript. In this case, it is advisable to check any previous system messages too.	Select the scripts from the configuration which are called in directly or indirectly via the specified script. Check tags, whether the types used are permissible. Check Functions, whether the number and types of parameter are correct.
20012	Inconsistent configuration data is present. Therefore, the script could not be created.	Compile the configuration again.
20013	VBScript.dll is not correctly installed. Therefore, no scripts can be executed.	Re-install ProTool/Pro RT.
20014	A value is returned by the script function which is not written in any configured return tag.	Select the specified script in the configuration. Check whether the script name has been assigned a value.
20015	Too many scripts have been triggered in quick succession. If more than 20 scripts are queued to be processed, any subsequent scripts are rejected. In this case, the script indicated in the message is not executed.	Check where the scripts are being triggered from. Extend the times, e.g. the polling time of the tags, which trigger the scripts.
30010	The tag could not accept the function result, e.g. in the case of exceeding the value range.	Check the tag type of the function parameter.

Number	Effect/Cause	Remedy
30011	A function could not be executed because the function was assigned an invalid value or type in the parameter.	Check the parameter value and tag type of the invalid parameter. If a tag is used as a parameter, check its value.
40010	The function could not be executed since the parameters could not be converted to a common tag type.	Check the parameter types in the configuration.
40011	The function could not be executed since the parameters could not be converted to a common tag type.	Check the parameter types in the configuration.
50000	The operating unit receives data faster than it is capable of processing. Therefore, no further data is received until the data currently available has been processed. Data exchange then resumes.	–
50001	Data exchange has been resumed.	–
60000	This message is generated by the function “Display system messages”. The text to be displayed is transferred to the function as a parameter.	–
60010	The file could not be copied in the direction defined because one of the two files is currently open or the source/target path is not available. It is possible that the Windows NT user has no access rights to one of the two files.	Restart the function or check the paths of the source/target files. Using Windows NT with NTFS: The user executing ProTool/Pro RT must be granted access rights for the files.
60011	An attempt was made to copy a file to itself. It is possible that the Windows NT user has no access rights to one of the two files.	Check the path of the source/target file. Using Windows NT with NTFS: The user executing ProTool/Pro RT must be granted access rights for the files.
70010	The application could not be started because it could not be found in the path specified or insufficient memory space was available.	Check whether the application exists in the specified path or close other applications.
70011	The system time could not be modified. The error message only appears in connection with area pointer Date/Time PLC. Possible causes: • an impermissible time was transferred in the PLC job, • the Windows NT user has no user rights to modify the system time. If the first parameter in the system message is displayed with the value 13, the second parameter indicates the byte containing the incorrect value.	Check the time which is to be set. Under Windows NT: The user executing ProTool/Pro RT must be assigned the rights to modify the system time from Windows NT (administration/user manager, guidelines).

Number	Effect/Cause	Remedy
70012	An error occurred when executing the function ”Exit Runtime” with the option ”Exit also Windows”. Windows and ProTool/Pro RT are not terminated. A possible cause is that other applications cannot be terminated.	Terminate all applications currently running. Then terminate Windows.
70013	The system time could not be modified because an invalid value was entered. Incorrect separators may have been used.	Check the time which is to be set.
70014	The system time could not be modified. Possible causes: • an impermissible time was transferred • the Windows NT user has no user rights to modify the system time, • Windows rejects the setting request.	Check the time which is to be set. Under Windows NT: The user executing ProTool/Pro RT must be assigned the rights to modify the system time from Windows NT (administration/user manager, guidelines).
70015	The system time could not be read because Windows rejects the reading function.	–
70016	An attempt was made to select a screen by means of a function or job. This is not possible because the screen number specified does not exist. Or: a screen could not be generated due to insufficient system memory.	Check the screen number in the function or job with the screen numbers configured. Refer the number to a screen, if necessary.
70017	Date/Time is not read from the area pointer because the address set in the PLC is either not available or has not been set up.	Change the address or set up the address in the PLC.
70018	Acknowledgement that the password list has been successfully imported.	–
70019	Acknowledgement that the password list has been successfully exported.	–
70020	Acknowledgement for activation of message recording.	–
70021	Acknowledgement for deactivation of message recording.	–
70022	Acknowledgement to starting the *Import Password List* action.	–
70023	Acknowledgement to starting the *Export Password List* action.	–
70027	Backing up the RAM file system has been started.	–
70028	Backing up of the RAM file system has been completed successfully. The files from the RAM have been copied in the Flash memory. Following a restart, these saved files will be copied back in the RAM file system.	–

Number	Effect/Cause	Remedy
70029	Backup of the RAM file system has failed. No backup copy of the RAM file system has been made.	Check the settings in the *OP Properties* dialog and save the RAM file system using the Save Files button in the *Persistent Storage* tab control.
70030	The parameters configured for the function are faulty. The connection to the new PLC was not established.	Compare the parameters configured for the function with the parameters configured for the PLC and correct them as necessary.
70031	The PLC configured in the function is not an S7 PLC. The connection to the new PLC was not established.	Compare the *S7 PLC name* parameter configured for the function with the parameters configured for the PLC and correct them as necessary.
80001	The archive specified is filled to the size defined (in percent) and must be stored elsewhere.	Store the file or table by executing a 'move' or 'copy' function.
80002	A line is missing in the specified archive.	–
80003	The copying process for archiving was not successful. In this case, it is advisable to check any subsequent system messages, too.	–
80006	Since archiving is not possible, this causes a permanent loss of the functionality.	In the case of databases, check whether the corresponding data source exists and start up the system again.
80009	A copying action has been completed successfully.	–
80010	Since the path was incorrectly entered in ProTool, this causes a permanent loss of the functionality.	Configure the path for the respective archive again and restart the system when the full functionality is required.
80012	Archive values are stored in a buffer. If the values are read to the buffer faster than they can be physically written (e.g. using a hard disk), overloading may occur and recording is then stopped.	Archive less values. Or increase the recording interval.
80013	The overload status no longer applies. Archiving resumes the recording of all values.	–
80014	The same action was triggered twice in quick succession. Since the process is already in operation, the action is only carried out once.	–
80016	The archives are separated by the function *Close archive* and the incoming entries exceed the defined buffer size. All the jobs in the buffer are deleted.	Reconnect the archives.
80017	The incoming entries cause the defined buffer size to be exceeded. This can be caused, e.g. by several copying actions being activated at the same time. All the copy jobs in the buffer are deleted.	Terminate the copy process.

Number	Effect/Cause	Remedy
80018	All the archives are reconnected by means of the DB layer, e.g. after executing the function *Open_archive*. Values are then written back into the tables.	–
80019	All the archives are separated from the DB layer and all connections terminated, e.g. after executing the function *Close_archive*. Values are temporarily buffered and written in the tables when the connection is re-established. There is no connection to the storage medium and a change can take place.	–
80020	The max. number of simultaneously activated copy actions has been exceeded. Copying is not executed.	Wait until the current copying actions have been completed and restart the last copy action.
80021	An attempt was made to delete an archive which is still involved with a copy action. Deletion has not been executed.	Wait until the current copying action has been completed and restart the last action.
80022	An attempt was made to start a sequence archive, which is not a sequence archive, from an archive using the function *Start_sequence_archive*. No sequence archive is created.	Check the project for the following: • the function *Start_sequence_archive* is correctly configured. • the variable parameters are being correctly provided at the operating unit.
80023	An attempt was made to copy an archive to itself. The archive is not copied.	Check the project for the following: • the function *Copy_archive* is correctly configured. • the variable parameters are being correctly provided at the operating unit.
80024	The function *Copy_archive* is configured not to permit copying when the target archive already contains data (Parameter: *Write mode*). The archive is not copied.	Modify the function *Copy_archive* in the project, if necessary. Before initiating the function, delete the target archive.
80025	The copy action is interrupted. Data written up to this point is retained. Deletion of the target table (if configured) is not executed. The cancellation is documented by an error entry *RT_ERR* at the end of the target table.	–
80026	The message is issued after all the archives have been successfully initialized. Values are written in the archives from this moment on. Prior to this, no values are archived even though the runtime software is operating.	–

Number	Effect/Cause	Remedy
80027	The internal Flash memory has been specified as the memory location for an archive. This is not permissible. No values will be archived for this archive and the archive will not be created.	Configure ”Storage Card” as the memory location or a network path.
80028	The message serves as a status acknowledgment that initialization of the archives is currently running. No values are archived until system message 80026 is issued.	–
80029	The number of archives specified in the message could not be initialized. Initialization of the archives has been completed. The faulty archives are not available for archiving jobs.	Evaluate the additional system message, related to this message, which is also issued. Check the configuration, the ODBC (Open Database Connectivity) and the specified drive.
80030	The structure of the table(s) available does not match the archiving structure expected. The archiving process is stopped for this archive.	Delete the existing tables manually, in advance.
80032	Archives can be configured with a function trigger. This is triggered as son as the archive is full. If runtime is started and the archive is already full, the trigger function will not be initiated. The archive specified no longer archives data since it is full.	Stop the runtime, delete the archive and restart the runtime again. Or: Configure a button in the runtime which contains the same actions as the function trigger and press it.
110000	The operating mode status has been changed. The operating mode is now *offline*.	–
110001	The operating mode status has been changed. The operating mode is now *online*.	–
110002	The operating mode status has not been changed.	Check the connection to the PLCs. Check whether the address area for the area pointer “Coordination” in the PLC is available.
110003	The operating status of the PLC specified is changed by the function *Connect/Disconnect PLC*. The operating mode is now *offline*.	–
110004	The operating status of the PLC specified is changed by the function *Connect/Disconnect PLC*. The operating mode is now *online*.	–
110005	An attempt was made to use the function *Connect/Disconnect PLC* to switch the specified PLC to operating mode *online* although the entire system is in operating mode *Offline*. This switch-over is not permissible. The PLC remains in operating mode *offline*.	Switch the complete system to operating mode *online* and execute the function again.

Number	Effect/Cause	Remedy
110006	system has been extended by the addition of the User Version area pointer. If the user version is not correct, the runtime is stopped.	Check the user versions. Either the wrong version was entered in the PLC or configuration or the wrong configuration was started for the PLC user version.
120000	The trend is not displayed because an incorrect axis to the trend, or incorrect trend, has been configured.	Change the configuration.
120001	The trend is not displayed because an incorrect axis to the trend, or incorrect trend, has been configured.	Change the configuration.
120002	The trend is not displayed because the tag assigned tries to access an invalid PLC address.	Check whether the data area for the tag exists in the PLC, the configured address is correct or the value range for the tag is correct.
130000	The action was not executed.	Close other applications. Delete files no longer required from the hard disk.
130001	The action was not executed.	Delete files no longer required from the hard disk.
130002	The action was not executed.	Close other applications. Delete files no longer required from the hard disk.
130003	No target data carrier is inserted. The process is stopped.	Check, for example, whether: • access has been made to the correct data carrier • the data carrier has been inserted
130004	The target data carrier is write-protected. The process is stopped.	Check whether access has been made to the correct data carrier. Remove the write protection.
130005	The file is write-protected. The process is stopped.	Check whether access has been made to the correct file. Modify the file attributes, if necessary.
130006	No access to file is possible. The process is stopped.	Check, for example, whether: • access has been made to the correct file • the file exists • a different action prevents simultaneous access to the file
140000	Online connection to the PLC has been successfully established.	–
140001	Online connection to the PLC has been disconnected.	–
140003	No tag updating or writing is executed.	Check the connection and whether the PLC is switched on. Check the parameter definitions in the Control Panel using “Set PU/PC interface”. Restart the system.

Number	Effect/Cause	Remedy
140004	No tag updating or writing is executed because the access point or the subrack configuration is incorrect.	Check the connection and whether the PLC is switched on. Check the access point or the subrack configuration (MPI, PPI, PROFIBUS) in the Control Panel with “Set PU/PC interface”. Restart the system.
140005	No tag updating or writing is executed because the address of the operating unit is incorrect (possibly too high).	Use a different operating unit address. Check the connection and whether the PLC is switched on. Check the parameter definitions in the Control Panel using “Set PU/PC interface”. Restart the system.
140006	No tag updating or writing is executed because the baud rate is incorrect.	Select a different baud rate in ProTool/Pro (according to subrack, profile, communication peer, etc.).
140007	No tag updating or writing is executed because the bus profile is incorrect (see %1). The following parameters could not be entered in the registry: 1: Tslot 2: Tqui 3: Tset 4: MinTsdr 5: MaxTsdr 6: Trdy 7: Tid1 8: Tid2 9: Gap Factor 10: Retry Limit	Check the user defined bus profile. Check the connection and whether the PLC is switched on. Check the parameter definitions in the Control Panel using “Set PU/PC interface”. Restart the system.
140008	No tag updating or writing is executed because the configuration data is incorrect: The following parameters could not be entered in the registry: 0: General errors 1: Incorrect version 2: Profile cannot be entered in the registry. 3: Sub-network type cannot be entered in the registry. 4: Target rotation time cannot be entered in the registry. 5: Highest address (HSA) incorrect.	Check the connection and whether the PLC is switched on. Check the parameter definitions in the Control Panel using “Set PU/PC interface”. Restart the system.
140009	No tag updating or writing is executed because the module for the S7 communication was not found.	Re-install the module in the Control Panel using “Set PU/PC interface”.

Number	Effect/Cause	Remedy
140010	No S7 communication peer could be found because the PLC is switched off. DP/T: The option “PU/PC is the only master on bus” has not been set in the Control Panel under Set PU/PC Interface”.	Switch the PLC on. DP/T: If only one master is connected to the network, select “Set PU/PC Interface” and activate the option “PU/PC is only master on bus”. If the network has more than one master, switch this master on. Do not modify any settings here, otherwise a bus fault may occur.
140011	No tag updating or writing is executed because communication is interrupted.	Check the connection and that the communication peer is switched on.
140012	There is an initialization problem (e.g. when ProTool/Pro RT has been terminated in the Task Manager). Or: another application (e.g. STEP7, WINCC) is active with different bus parameters and the driver cannot be started with the new bus parameters (e.g. baud rate).	Restart the operating unit. Or start ProTool/Pro RT first and then the other applications.
140013	The MPI cable is not plugged in and, thus, there is no power supply.	Check the connections.
140014	–	Modify the operating unit address in the configuration in *PLC*.
140015	Incorrect baud rate Or: incorrect bus parameter (e.g. HSA) Or: OP address HSA Or: incorrect interrupt vector (interrupt does not arrive at the driver)	Correct the incorrect parameters.
140016	–	Change the interrupt number.
140017	–	Change the interrupt number.
140018	The consistency check was deactivated by Simotion Scout. Only one appropriate note appears.	Activate the consistency check with Simotion Scout again and load the configuration in the project once more.
140019	Simotion Scout loads a new project in the PLC. Connection to the PLC is interrupted.	Wait until the end of the reconfiguration.
140020	The version in the PLC and that in the configuration (FWD file) do not match. Connection to the PLC is interrupted.	The following options are available: • Load the current version in the PLC using Simotion Scout. • Generate the project anew using ProTool CS, end ProTool RT and start with the new configuration.

Number	Effect/Cause	Remedy
150000	No more data is read or written. Possible causes: • The cable is defective. • The PLC does not respond, is defective, etc. • Connection is established via the wrong interface. • The system is overloaded.	Check that the cable is plugged in, the PLC is operational, the correct interface is used. Reboot the system if the system message is displayed continuously.
150001	Connection is re-established because the cause of the interruption has been eliminated.	–
160000	No more data is read or written. Possible causes: • The cable is defective. • The PLC does not respond, is defective, etc. • Connection is established via the wrong interface. • The system is overloaded.	Check that the cable is plugged in, the PLC is operational, the correct interface is used. Reboot the system if the system message is displayed continuously.
160001	Connection is re-established because the cause of the interruption has been eliminated.	–
160010	There is no connection to the server because the server identification (CLS-ID) cannot be established. Values cannot be read or written.	Check the access rights.
160011	There is no connection to the server because the server identification (CLS-ID) cannot be established. Values cannot be read or written.	Check, for example, whether: • the server name is correct • the computer name is correct • the server is registered
160012	There is no connection to the server because the server identification (CLS-ID) cannot be established. Values cannot be read or written.	Check, for example, whether: • the server name is correct • the computer name is correct • the server is registered Information for experienced users: Interpret the value from HRESULT.
160013	The specified server was started as InProc Server. This has not been released and may possibly lead to incorrect behavior because the server is running in the same process area as the ProTool/Pro RT runtime software.	Configure the server as OutProc Server or Local Server.

Number	Effect/Cause	Remedy
160014	Only one OPC server project can be started on a PC/MP. An error message appears when an attempt is made to start a second project. The second project has no OPC server functionality and cannot be located as an OPC server from external sources.	Do not start a second project with OPC server functionality on the computer.
170000 [1)]	S7 diagnostics messages are not displayed because it is not possible to logon to the S7 diagnostics with this unit. The service program is not supported.	–
170001 [1)]	The S7 diagnostics buffer cannot be displayed because communication with the PLC has been switched off.	Switch the PLC *online*
170002 [1)]	The S7 diagnostics buffer cannot be displayed because reading in the diagnostics buffer (SZL) was terminated due to an error.	–
170003 [1)]	The display of an S7 diagnostics message is not possible. An internal error %2 has been reported.	–
170004 [1)]	The display of an S7 diagnostics message is not possible. An internal error with error class %2, error number %3 has been reported.	–
170007 [1)]	It is not possible to read in the S7 diagnostics buffer (SZL) because it was terminated with an internal error with error class %2 and error code %3.	–
180000	A component/OCX receives configuration data with a version identification which is not supported.	Install a newer component.
180001	The system is overloaded because too many actions have been activated simultaneously. Not all the actions can be executed, some are rejected.	There are several options available: • Increase the configured cycle times or basic clock. • Generate the messages slower (polling). • Trigger the scripts and functions at greater intervals. • If the message appears more frequently: Restart the operating unit.
180002	The screen keyboard could not be activated. Possible causes: • The screen keyboard is not generally supported under Windows 95. • The file “TouchInputPC.exe” was not registered due to an incorrectly executed Setup.	If Windows 95 is not available: Install the runtime software again.
190000	It is possible that the tag will not be updated.	–
190001	The tag is updated following an error status after the cause of the last error state has been eliminated (return to normal operation).	–

Number	Effect/Cause	Remedy
190002	The tag is not updated because communication to the PLC has been switched off.	Switch on communication via the function “Set Online”.
190004	The tag is not updated because the configured address is not available for this tag.	Check the configuration.
190005	The tag is not updated because the configured PLC type does not exist for this tag.	Check the configuration.
190006	The tag is not updated because it is not possible to map the PLC type in the tag type.	Check the configuration.
190007	The tag values are not modified because the connection to the PLC has been terminated or the tag is offline.	Switch *Online* or re-establish connection to the PLC.
190008	The threshold values configured for the tag have been violated, e.g. by • an entered value, • a function, • a script.	Observe the configured or current threshold value of the tag.
190009	An attempt has been made to assign a value to a tag which is outside the value range permitted for this type. E.g. a value of 260 entered for a byte tag or a value of -3 for a signless word tag.	Observe the value range for the tag type.
190010	The tag is described with values too often (e.g. in a loop triggered by a script). Values are lost because the maximum of 100 event have been stored in the buffer.	Increase the time interval between the multi-writing tasks.
190011	Possible cause 1 • The value entered could not be written to the configured PLC tag because it was either above or below the value range. • The input is rejected and the original value is reset. Possible cause 2: • Connection to the PLC has been interrupted.	Ensure that the value entered is within the value range of the PLC tags. Check the connection to the PLC.
190012	It is not possible to convert a value from a source format to a target format, e.g.: • A value should be assigned to a counter which is outside the valid, PLC-dependent value range. • A tag of the type *Integer* should be assigned a value of the type *String*.	Check the value range or type of the variable.

Number	Effect/Cause	Remedy
190100	The area pointer is not updated because the configured address for this area pointer is not available. Type: 1 Event messages 2 Alarm messages 3 PLC acknowledgment 4 Operating unit acknowledgment 5 LED assignment 6 Trend request 7 Trend transfer 1 8 Trend transfer area 2 No.: is the consecutive number displayed in ProTool/Pro.	Check the configuration.
190101	The area pointer is not updated because it is not possible to map the PLC type in the area pointer type. Parameter type and no.: See message 190100	–
190102	The area pointer is updated following an error status after the cause of the last error state has been eliminated (return to normal operation). Parameter type and no.: See message 190100	–
200000	Coordination is not executed because the address configured in the PLC does not exist/has not been set up.	Change the address or set up the address in the PLC.
200001	Coordination is not executed because the address configured in the PLC cannot be written.	Change the address or set up the address in the PLC in an area which can be written.
200002	Coordination is not carried out at the moment because the address format of the area pointer does not match the internal storage format.	Internal error
200003	Coordination can be executed again because the last error status has been eliminated (return to normal operation).	–
200004	It is possible that coordination is not executed.	–
200005	No more data is read or written. Possible causes: • The cable is defective. • The PLC does not respond, is defective, etc. • The system is overloaded.	Check that the cable is connected and the PLC is in order. Reboot the system if the system message is displayed continuously.
210000	Jobs are not processed because the address configured in the PLC does not exist/has not been set up.	Change the address or set up the address in the PLC.

Number	Effect/Cause	Remedy
210001	Jobs are not processed because the address configured in the PLC cannot be written to/read from.	Change the address or set up the address in the PLC in an area which can be written to/read from.
210002	Commands are not executed because the address format of the area pointer does not match the internal storage format.	Internal error
210003	The job mailbox is processed again because the last error status has been eliminated (return to normal operation).	–
210004	It is possible that the job mailbox is not processed.	–
210005	A PLC job was triggered by an impermissible number.	Check the PLC program.
210006	A fault occurred while attempting to execute the PLC job. The PLC job is, therefore, not executed. Observe the subsequent/previous system message, if appropriate.	Check the parameter types in the PLC job. Compile the configuration again.
220000 [2)]	–	–
220001	The tag is not downloaded because the associated channel/the unit does not support downloading the data type bool/bit.	Change the configuration.
220002	The tag is not downloaded because the associated channel/the unit does not support downloading the data type byte.	Change the configuration.
220003	The associated driver could not be uploaded. It is possible that the driver is not installed.	Install the driver by re-installing ProTool/Pro RT.
220004	Communication is terminated and no update is executed because the cable is not connected or is defect etc.	Check the connection.
220005	Communication is running.	–
220006	The connection is established to the specified PLC at the specified interface.	–
220007	The connection to the specified PLC at the specified interface is disconnected.	Check that: • the cable is plugged in • the PLC is OK • the correct interface is used • the configuration is OK (interface parameters, protocol settings, PLC address). Reboot the system if the system message is displayed continuously.
220008	The PLC driver cannot access the specified interface or open it. It is possible that another application is using this interface or an interface is used which is not available on the target device. There is no communication with the PLC.	Terminate all the programs which access the interface and reboot the computer. Use another interface which is available in the system.

Number	Effect/Cause	Remedy
230000	The value entered could not be accepted. The entered value is rejected and the previous value is specified again. Either the value range has been exceeded or impermissible characters were entered.	Enter a permissible value.
230002	Since the current password level is inadequate or the password dialog box was closed with ESC, the entry is rejected and the previous value is specified again.	Activate an adequate password level using Login.
230003	Changeover to the specified screen is not executed because the screen is not available/configured. The current screen remains selected.	Configure the screen. Check the selection function.
240000 3)	Runtime is operating in Demo mode. There is either no Stopcopy license or it is defect.	Load the license.
240001 3)	Runtime is operating in Demo mode. Too many tags are configured for the installed version.	Load an adequate license / powerpack.
240002 3)	Runtime is operating with a time-limited standby authorization.	Restore the full authorization.
240003	Authorization cannot be executed. ProTool/Pro RT is running in Demo mode.	Restart ProTool/Pro RT or reinstall it.
240004	Error during reading the standby authorization. ProTool/Pro RT is running in Demo mode.	Restart ProTool/Pro RT, install the authorization or repair the authorization (see Commissioning Instructions Software Protection).
250000	The tag in the specified line in Status/Control is not updated because the address configured for this tag is not available.	Check the set address and then check that the address has been set up in the PLC.
250001	The tag in the specified line in Status/Control is not updated because the PLC type configured for this tag is not available.	Check the set address.
250002	The tag in the specified line in Status/Control is not updated because it is not possible to map the PLC type in the tag type.	Check the set address.
250003	No connection could be established to the PLC. The tags will not be updated.	Check the connection to the PLC. Check that the PLC is switched on and *online* is activated.
260000	A password has been entered which is unknown to the system. Therefore, the lowest password level has been set. This corresponds to the status following *Logout*.	Enter a known password in the password input field (with corresponding level).
260001	A password has been entered whose assigned level does not permit execution of the function. The password level currently set is displayed for information purposes.	Modify the password level in the password input field enter a password with a sufficiently high level.

Number	Effect/Cause	Remedy
260003	The user has logged off from the system. If the password level is 0, no user is logged on.	–
270000	A tag is not displayed in the message because it attempts to access an invalid address in the PLC.	Check whether the data area for the tag exists in the PLC, the configured address is correct or the value range for the tag is correct.
270001	There is a unit-dependent limit as to how many messages may be queued simultaneously in order to be displayed (see Equipment Manual). This limit has been exceeded. The display no longer contains all the messages. However, all the messages are recorded in the message buffer.	–
270002	Messages are displayed from an archive are displayed for which there is no data in the current project. Placeholders are issued for the messages.	Delete older archive files, if necessary.
270003	The service cannot be set up because too many devices was to set up this service. A maximum of four devices can execute this action.	Connect fewer operating units which want to use the service.
280000	Connection is re-established because the cause of the interruption has been eliminated.	–
280001	No more data is read or written. Possible causes: • The cable is defective. • The PLC does not respond, is defective, etc. • Connection is established via the wrong interface. • The system is overloaded.	Check that the cable is plugged in, the PLC is operational, the correct interface is used. Reboot the system if the system message is displayed continuously.
280002	A connection is used which requires a function module in the PLC. The function block has replied. Communication can now proceed.	–

Number	Effect/Cause	Remedy
280003	A connection is used which requires a function module in the PLC. The function block does not reply.	Check that the cable is plugged in, the PLC is operational, the correct interface is used. Reboot the system if the system message is displayed continuously. The remedy is dependent on the error code: 1: The function block must set the COM bit in the response container. 2: The function block may not set the ERROR bit in the response container 3: The function block must respond within the specified time (timeout) 4: Establish an online connection to the PLC
280004	The online connection to the PLC has been interrupted. There is no data exchange at present.	Check the PLC parameters in ProTool Pro: baud rate, block length, station address. Check that the cable is plugged in, the PLC is operational, the correct interface is used. Reboot the system if the system message is displayed continuously.
290000	The tag could not be read or written. It is assigned the start value. The message can be entered in the message buffer for up to four more failed tags, if necessary. After that, the message number 290003 is issued.	Check in the configuration that the address has been set up in the PLC.
290001	An attempt has been made to assign a value to a tag which is outside the value range permitted for this type. The message can be entered in the message buffer for up to four more failed tags, if necessary. After that, the message number 290004 is issued.	Observe the value range for the tag type.
290002	It is not possible to convert a value from a source format to a target format. The message can be entered in the message buffer for up to four more failed tags, if necessary. After that, the message number 290005 is issued.	Check the value range or type of the variable.
290003	This message is issued when message number 290000 is triggered more than five times. In this case, no further individual messages are generated.	Check in the configuration that the tag addresses have been set up in the PLC.
290004	This message is issued when message number 290001 is triggered more than five times. In this case, no further individual messages are generated.	Observe the value range for the tag type.

Number	Effect/Cause	Remedy
290005	This message is issued when message number 290002 is triggered more than five times. In this case, no further individual messages are generated.	Check the value range or type of the variable.
290006	The threshold values configured for the tag have been violated by values entered.	Observe the configured or current threshold value of the tag.
290007	There is a difference between the source and target structure of the recipe currently being processed. The target structure contains an additional data record tag which is not available in the source structure. The data record tag specified is assigned its start value.	Insert the specified data record tag in the source structure.
290008	There is a difference between the source and target structure of the recipe currently being processed. The source structure contains an additional data record tag which is not available in the target structure and therefore cannot be assigned. The value is rejected.	Remove the specified data record tag in the specified recipe from the project.
290010	The storage location configured for the recipe is not permitted. Possible causes: Impermissible characters, write protected, data medium full or does not exist.	Check the path specification configured.
290011	The data record specified by the number does not exist.	Check the source for the number (constant or variable value).
290012	The recipe specified by the number does not exist.	Check the source for the number (constant or variable value).
290013	An attempt was made to save a data record under a data record number which already exists. The process is not executed.	The following options are available: • Check the source for the number (constant or variable value). • Delete the data record beforehand. • Change the function parameter “Overwrite”.
290014	The file specified to be imported could not be found.	Check the following: • Check the file name. • Ensure that the file is in the specified directory.
290020	Acknowledgement that downloading of data records from operating unit to PLC has started.	–
290021	Acknowledgement that downloading of data records from operating unit to PLC has been completed without any errors.	–

Number	Effect/Cause	Remedy
290022	Acknowledgement that downloading of data records from operating unit to PLC has been terminated due to an error.	Check the configuration: • have the tag addresses been set up in the PLC? • does the recipe number exist? • does the data record number exist? • has the function parameters ”Overwrite”?
290023	Acknowledgement that downloading of data records from the PLC to the operating unit has started.	–
290024	Acknowledgement that downloading data records from the PLC to the operating unit has been completed without any errors.	–
290025	Acknowledgement that downloading of data records from the PLC to the operating unit has been terminated due to an error.	Check the configuration: • have the tag addresses been set up in the PLC? • does the recipe number exist? • does the data record number exist? • has the function parameters ”Overwrite”?
290026	An attempt has been made to read/write a data record although the data mailbox is not free at present. This error may occur in the case of recipes for which downloading with synchronization has been configured.	Set the data mailbox status to zero.
290027	No connection to the PLC can be established at present. Therefore, the data record can neither be read nor written. Possible causes: No physical connection to the PLC (no cable plugged in, cable is defect) or the PLC is switched off.	Check the connection to the PLC.
290030	This message is issued after reselecting a screen that contains a recipe display in which a data record has already been selected.	Reload the data record from the data medium or retain the current values.
290031	While saving, it was detected that a data record with the specified number already exists.	Overwrite the data record or cancel the process.
290032	While exporting data records, it was detected that a file with the specified name already exists.	Overwrite the file cancel the process.
290033	Confirmation request before deleting data records.	–

Number	Effect/Cause	Remedy
290040	A data record error with error code %1 has occurred which cannot be described in more detail. The action was canceled. It might be that the data mailbox has not been installed correctly on the PLC.	Check that the data carrier, the data record, the data mailbox and, if necessary, the connection to the PLC. Trigger the action again after waiting a short period. If the error occurs again, please contact the Customer Support. Specify the error code displayed.
290041	A data record or file cannot be saved because the data medium is full.	Delete files no longer required.
290042	An attempt was made to execute several recipe actions simultaneously. The last action was not executed.	Trigger the action again after waiting a short period.
290043	Confirmation request before storing data records.	–
290044	The data store for the recipe has been destroyed and will be deleted.	–
290050	Acknowledgement that the exportation of data records has started.	–
290051	Acknowledgement that the exportation of data records has been completed successfully.	–
290052	Acknowledgement that the exportation of data records has been terminated due to errors.	Ensure that the structure of the data records on the data medium and the current recipe structure on the operating unit are identical.
290053	Acknowledgement that the importation of data records has been started.	–
290054	Acknowledgement that the importation of data records has been completed successfully.	–
290055	Acknowledgement that the importation of data records has been terminated due to errors.	Ensure that the structure of the data records on the data medium and the current recipe structure on the operating unit are identical.
290056	The value in the specified line/column could not be read/written without errors. The action was canceled.	Check the specified line/column.
290057	The tags of the recipe specified have been switched from operating mode “offline” to “online”. Each modification of a tag in this recipe is now immediately transferred to the PLC.	–
290058	The tags of the recipe specified were switched from operating mode “online” to “offline”. Modifications to tags in this recipe are no longer immediately transferred to the PLC but must be transferred there explicitly by means of downloading a data record, if necessary.	–

Number	Effect/Cause	Remedy
290059	Acknowledgement that the specified data record has been stored successfully.	–
290060	Check-back message that the data record memory has been successfully erased.	–
290061	Check-back message, that erasing the data record memory was aborted with errors.	–
290068	Request to confirm whether all data records in the recipe should be deleted.	–
290069	Request to confirm whether all data records of all recipes should be deleted.	–
290070	The data record specified is not contained in the import file.	Check the source of the data record number or data record name(constant or tag value).
300000	Process monitoring (e.g. using PDiag or S7-Graph) has been incorrectly programmed: More messages are queued than specified in the technical data of the CPU. No further ALARM_S messages can be managed by the CPU and reported to operating systems.	Change the CPU configuration.
310000	An attempt is being made to print too many protocols simultaneously. Since only one protocol can be printed at a time, the print job is rejected.	Wait until printout of the last active protocol has been concluded. Repeat the print job, if necessary.
310001	An error occurred on triggering the printer. The protocol is either not printed or printed with errors.	Evaluate the additional system message, related to this message, which is also issued. Repeat the print job, if necessary.
320000	The movements have already been indicated by another device. The movements can no longer be served.	Select the movements on the other display units and select the movement screen on the required display unit.
320001	The network is too complex. The defective operands cannot be displayed.	Display the network in AWL.
320002	No diagnostics-capable alarm messages have been selected. The units related to the alarm messages could not be selected.	Select a diagnostics-capable alarm message in the message screen ZP_ALARM.
320003	No alarm messages exist in respect of the selected unit. No network can be displayed in the detail display.	Select the defective unit in the general view screen.
320004	The required signal statuses could not be read by the PLC. The defective operands cannot be established.	Check the consistency between the configuration on the display unit and the PLC program loaded.
320005	The project contains ProAgent partitions which are not installed. No ProAgent diagnostics can be performed.	In order to run the project, install the ProAgent option packet.

Number	Effect/Cause	Remedy
320014	The selected PLC cannot be evaluated for ProAgent. The message display configured with the Evaluate_message_display_fault function could not be found.	Check the parameters of the Evaluate_message_display_fault function.

1) The optional parameter %1 at the start of the message may contain an identification for the S7 connection when several S7s are in parallel operation and are connected to diagnostics equipment.
2) A WinCC channel provides the message texts via an interface. This text is issued via this message. ProTool/Pro RT has no influence on this texts.
3) The specified text comes from the component resources.

Procedure in the case of “internal errors”

Please proceed as follows in the case of all system messages related to “internal errors”:

1. Start up the operating unit again.
2. Download the configuration again.
3. Switch the operating unit off, stop the PLC and then restart both.
4. If the error occurs again, please contact the SIMATIC Customer Support (refer to Preface). Make reference to the specified error number and message tags.

PLC Jobs

B

This section of the Appendix contains a list of all PLC jobs and their relevant parameters.

Description

PLC jobs can be used to initiate functions on the operating unit from the PLC, such as:

- displaying screens
- setting date and time

A PLC job consists of 4 data words. The first data word contains the job number. Data words 2 to 4 are used to transfer up to three parameters depending on the function in question. The basic structure of a PLC job is shown in Figure B-1.

Address	DL	DR
1. Data Word	0	Job number
2. Data Word	Parameter 1	
3. Data Word	Parameter 2	
4. Data Word	Parameter 3	

Figure B-1 Structure of a PLC job

List

All PLC jobs that are possible on the various operating units are listed below together with their parameters. The **No.** column indicates the PLC job number. In general, PLC jobs can only be initiated **by the PLC** when the operating unit is in online mode.

Note

There are no PLC jobs for the TP 170A operating unit.

No.	Function	PC[1]	OP37/Pro	Panel[2]
14	**Set Time (BCD format)** Parameter 1 DL: – DR: Hours (0–23) Parameter 2 DL: Minutes (0–59) DR: Seconds (0–59) Parameter 3 –	●	●	●
15	**Set Date (BCD format)** Parameter 1 DL: – DR: Weekday (1–7: Sunday–Saturday) Parameter 2 DL: Day of month (1–31) DR: Month (1–12) Parameter 3 DL: Year	●	●	●
23	**Set password level** Parameter 1 0–9 0 = lowest password level 9 = highest password level Parameter 2, 3 –	●	●	●
24	**Passwort Logout** Parameter 1, 2, 3 –	●	●	●
40	**Transfer date/time to PLC (Format: S7 DATE_AND_TIME)** There should be at least 5 seconds between two jobs or else the operating unit will become overloaded. Parameter 1, 2, 3 –	●	●	●
41	**Date/Time for PLC download (in OP/MP format)** There should be at least 5 seconds between two jobs or else the operating unit will become overloaded. Parameter 1, 2, 3 –	●	●	●
42	**Get LED area from PLC[3]** Parameter 1 Area pointer no.: 1–8 Parameter 2, 3 –	–	●	●
43	**Get event message area from PLC** Parameter 1 Area pointer no.: 1–8 Parameter 2, 3 –	●	●	●

1 Includes the operating units Panel PC, standard PC and FI 25/45.
2 Includes the operating units MP 370, MP 270, MP 270B, TP 270, OP 270, TP 170B, OP 170B.
3 Not possible with touch panels.

No.	Function	PC[1]	OP37/Pro	Panel[2]
44	**Retrieve alarm message area and acknowledgement area from the PLC** This PLC job is used to retrieve both the alarm message area and the acknowledgement area PLC → Operating Unit from the PLC. If no acknowledgement area has been set up, only the alarm message area is retrieved. Parameter 1: Area pointer no.: 1–8 Parameter 2, 3: –	●	●	●
49	**Clear event buffer** Parameter 1, 2, 3: –	●	●	●
50	**Clear alarm buffer** Parameter 1, 2, 3: –	●	●	●
51	**Select screen** Parameter 1: Screen number Parameter 2: – Parameter 3: Field number	●	●	●
69	**Read data record from PLC** Parameter 1: Recipe number (1 to 999) Parameter 2: Data record number (1–65535) Parameter 3: 0: Do not overwrite existing data records 1: Overwrite existing data records	●	●	●
70	**Write data record in PLC** Parameter 1: Recipe number (1 to 999) Parameter 2: Data record number (1–65535) Parameter 3: –	●	●	●

1 Includes the operating units Panel PC, standard PC and FI 25/45.
2 Includes the operating units MP 370, MP 270, MP 270B, TP 270, OP 270, TP 170B, OP 170B.

C

Interface Area Assignment

This section of the Appendix explains the interface assignment of the connection cables related to Part 1 of the “Communication for Windows-based Systems” User’s Guide.

The connection cables described on the following pages can be ordered from Siemens AG.

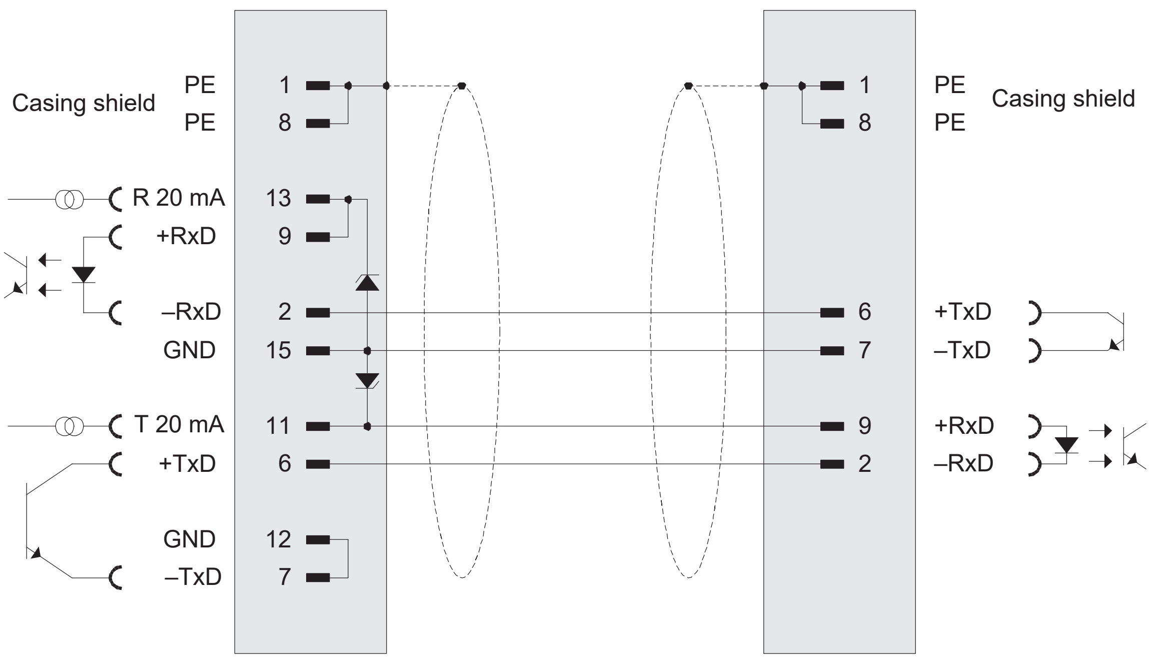
Note

The Siemens AG assumes no liability for damage resulting from the use of self-made connection cables.

Plug-in Connecting Cable Operating Unit – SIMATIC S5 with AS 511

PU Interface of CPU
6XV1440-2A_ _ _

Operating Unit	PLC
Connector 1	Connector 2
15-pin Sub D plug Secured by slide TTY active	15-pin Sub D plug Secured by slide TTY passive

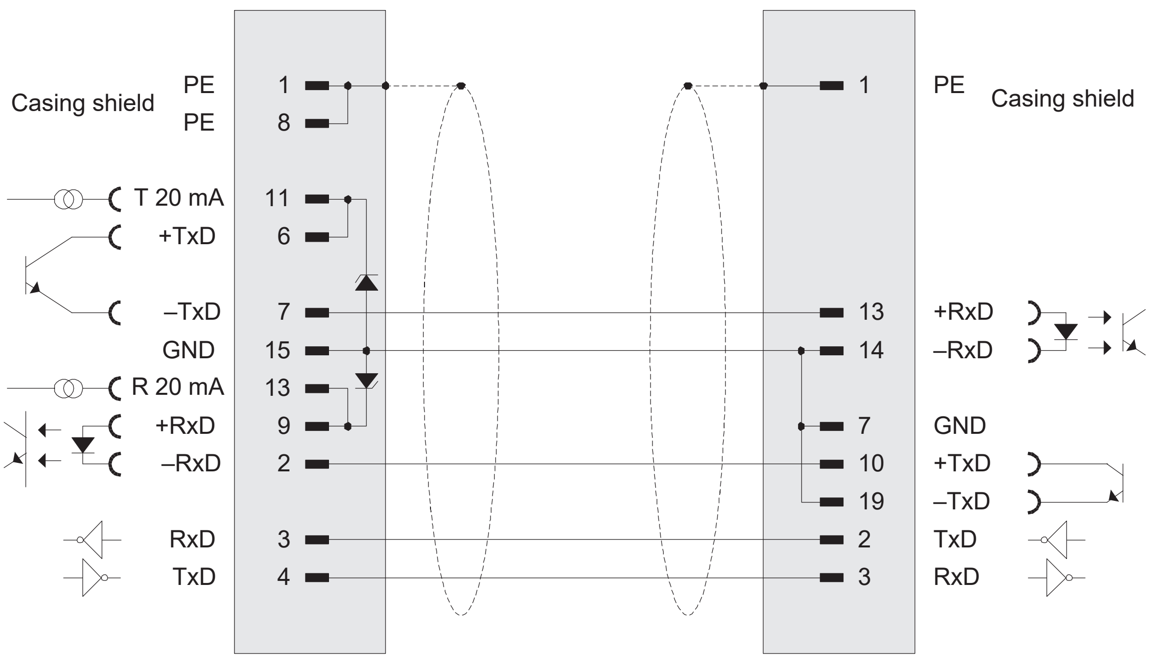


- For TTY cable in special lengths > 10 m, 2 Zener diodes (12 V) must be soldered in the 15-pin connector to the operating unit (TTY active):
  BZX 55 C12 ser. no. 30095128
- Cable: 5 x 0.14 mm^2, shielded; max length: 1000 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable
Operating Unit – CPU 928B/945

RS 232, TTY Interface
6XV1440-2J_ _ _

Operating Unit	CPU 928B/945
Connector 1	Connector 2
15-pin Sub D plug Secured by slide V 24, TTY active	25-pin Sub D plug Secured by slide V 24, TTY passive

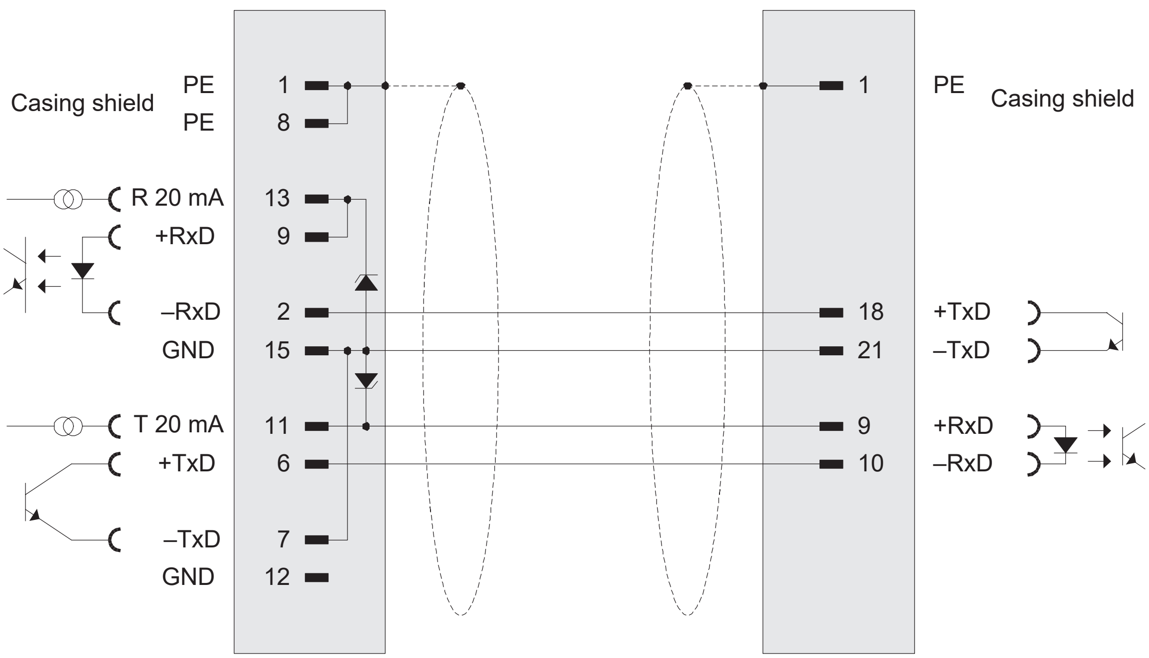


- For TTY cable in special lengths > 10 m, 2 Zener diodes (12 V) must be soldered in the 15-pin connector to the operating unit (TTY active):
  BZX 55 C12 ser. no. 30095128
- Cable: 5 x 0.14 mm^2, shielded; max length: 1000 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable
Operating Unit – CP 521 SI

TTY Interface of CP 521 SI
6XV1440-2G_ _ _

Operating Unit	CP 521 SI
Connector 1 15-pin Sub D plug Secured by slide TTY active	Connector 2 25-pin Sub D plug Secured by slide TTY passive

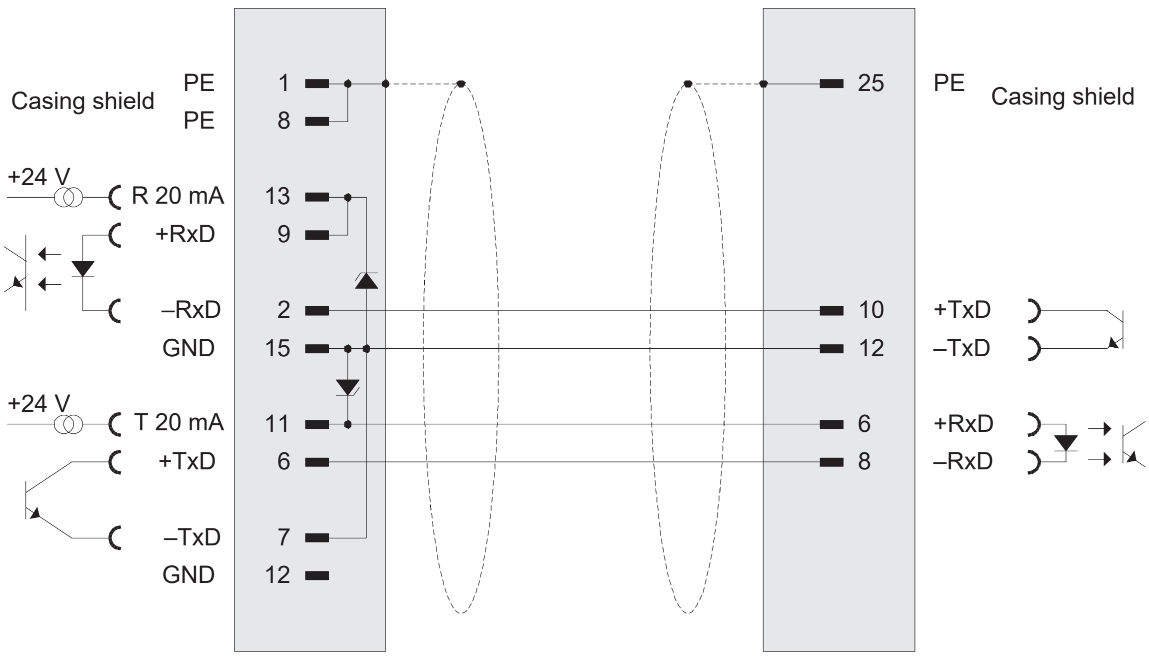


- For TTY cable in special lengths > 10 m, 2 Zener diodes (12 V) must be soldered in the 15-pin connector to the operating unit (TTY active): BZX 55 C12 ser. no. 30095128
- Cable: Liycy 5 x 0.14 mm^2, shielded; max. length: 1000 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable
Operating Unit – CP 523

TTY Interface of CP 523
6XV1440-2F_ _ _

Operating Unit	CP 523
Connector 1	Connector 2
15-pin Sub D plug Secured by slide TTY active	15-pin Sub D plug Secured by screws TTY passive

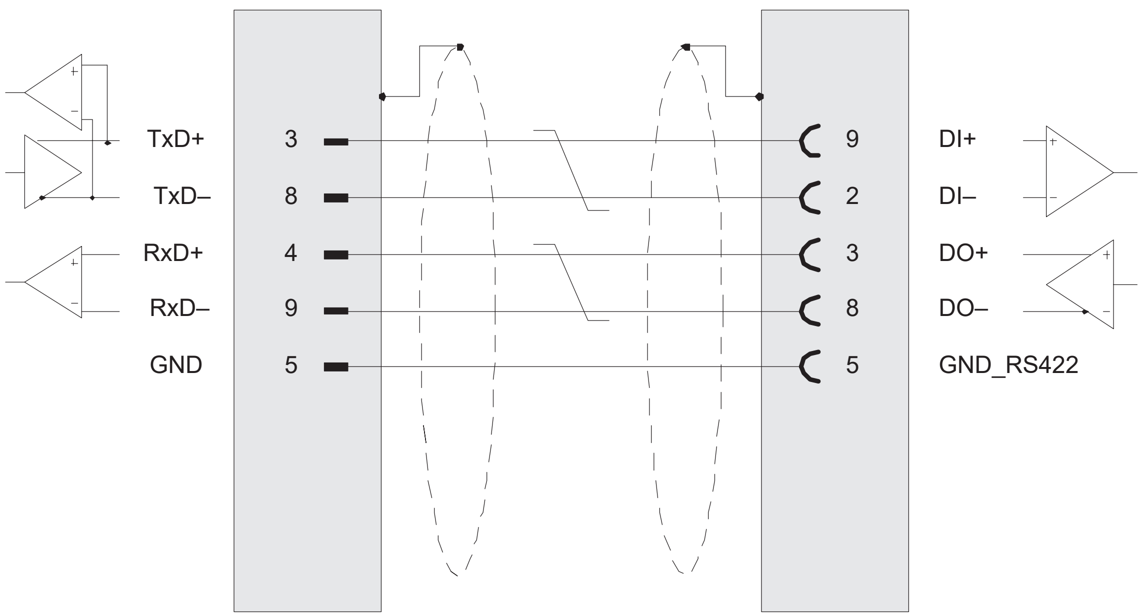


- For TTY cable in special lengths > 10 m, 2 Zener diodes (12 V) must be soldered in the 15-pin connector to the operating unit (TTY active):
  BZX 55 C12 ser. no. 30095128
- Cable: 5 x 0.14 mm^2, shielded; max length: 1000 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable
Operating Unit – SIMATIC 505

RS 422 Interface, 9/9-pin
6XV1440-1M_ _ _

Operating Unit	SIMATIC 505
Connector 1	Connector 2
9-pin Sub D plug Secured by screws Cable outlet at Pin 1 RS 422	9-pin Sub D socket connector Secured by screws Cable outlet at Pin 1 RS 422

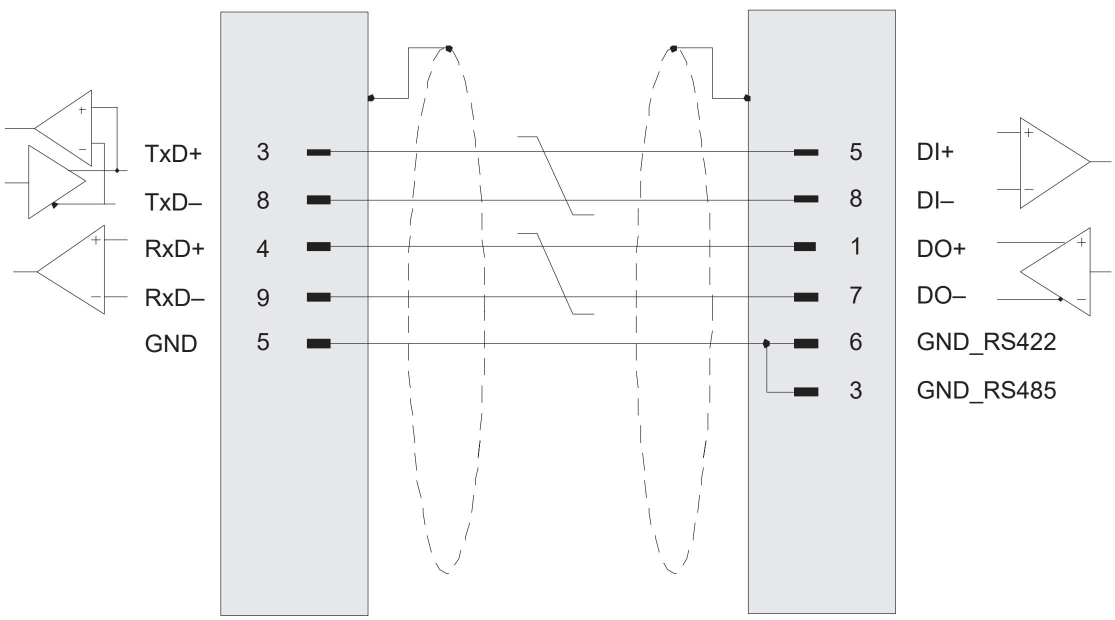


- Cable: 3 x 2 x 0.14 mm^2, shielded; max. length: 300 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable
Operating Unit – SIMATIC 500/505

RS 422 Interface, 9/9-pin
6XV1440-2M_ _ _

Operating Unit	SIMATIC 505/505
Connector 1	Connector 2
9-pin Sub D plug Secured by screws Cable outlet at Pin 1 RS 422	9-pin Sub D plug Secured by screws Cable outlet at Pin 1 RS 422

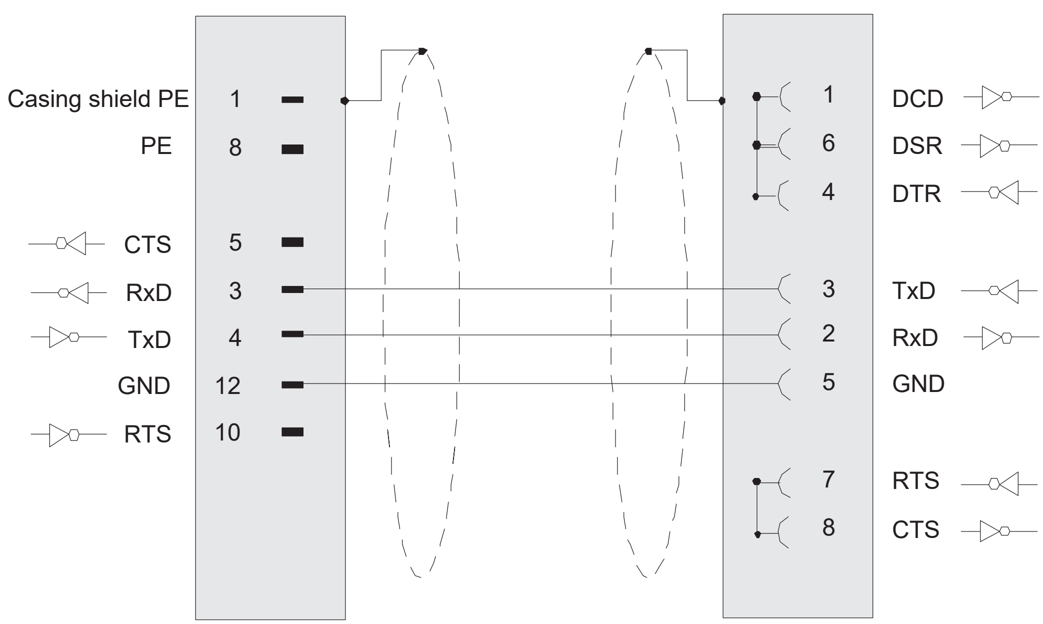


- Cable: 3 x 2 x 0.14 mm^2, shielded; max. length: 300 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable
Operating Unit – SIMATIC 500/505

RS 232 Interface, 15/9-pin
6XV1440-2K_ _ _

Operating Unit	SIMATIC 500/505
Connector 1 15-pin Sub D plug Secured by slide Cable outlet at Pin 1 Solid metal cover V.24	Connector 2 9-pin Sub D socket connector Secured by screws Cable outlet at Pin 1 V.24

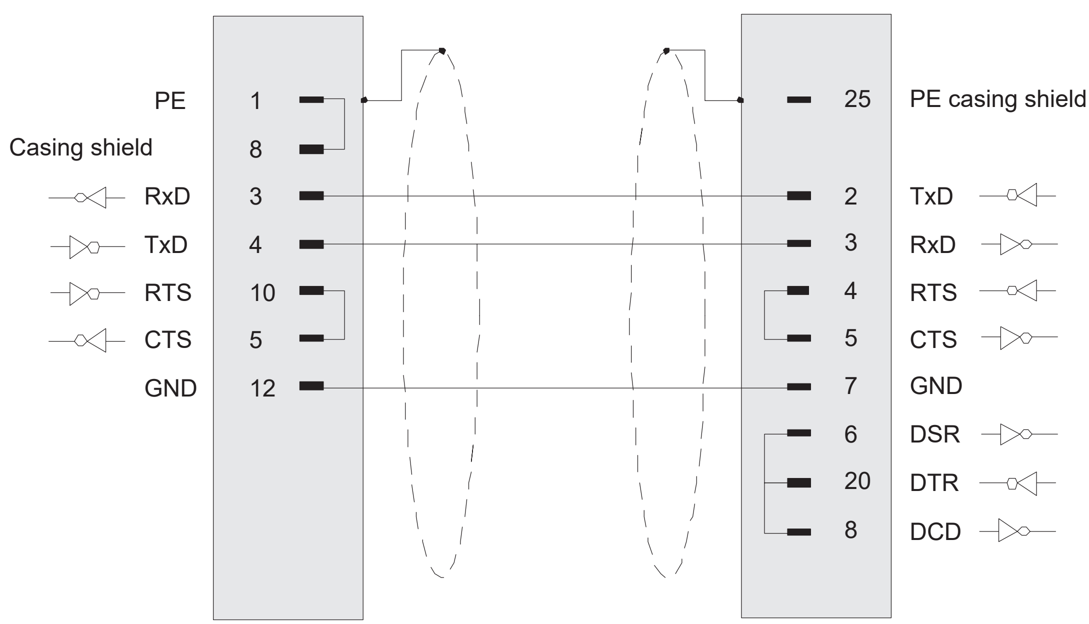


- Cable: 5 x 0.14 mm^2, shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable
Operating Unit – SIMATIC 500/505

RS 232 Interface, 15/25-pin
6XV1440-2L_ _ _

Operating Unit	SIMATIC 500/505
Connector 1 15-pin Sub D plug Secured by slide Cable outlet at Pin 1 Solid metal cover V.24	Connector 2 25-pin Sub D socket connector Secured by screws Cable outlet at Pin 1 V.24

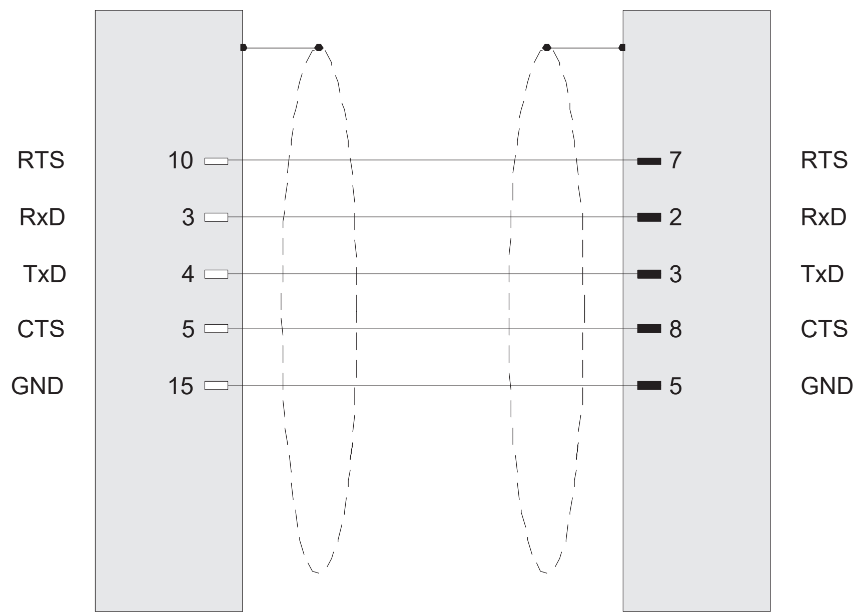


- Cable: 5 x 0.14 mm^2, shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Adapter
Operating Unit – AT-PC

15/9-pin
6XV1440-2UE32

Operating Unit	AT-PC
Connector 1	Connector 2
15-pin Sub D socket plug Secured by slide Cable outlet at Pin 1	9-pin Sub D plug Secured by screws Cable feed-out to rear

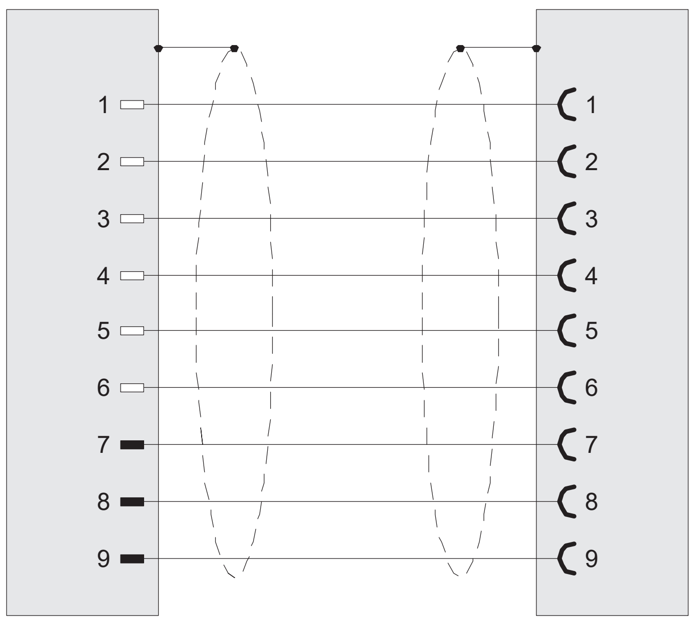


- Cable: 5 x 0.14 mm^2, shielded; max length: 32 cm
- Shielding connected at both ends to casing with large contact area

Adapter
PROFIBUS-DP Extension

6XV1440-2T_ _ _

Operating Unit	Bus Connector
Connector 1	Connector 2



- Cable: 9 x 0.14 mm^2, shielded; max length: 5 cm
- Shielding connected at both ends to casing with large contact area
- Installation of multiple OP 15 vertically arranged (e.g. 3 x 6 = 18 units at intervals of 3 cm) 6XV1440-2TE10 cannot be used.

SIMATIC HMI Documentation

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Target groups

This section of the Appendix ciontains the SIMATIC HMI documentation. The documentation is aimed at the following target groups:

- Newcomers
- Users
- Configurers
- Programmers
- Commissioning engineers

How the documentation is organized

The SIMATIC HMI documentation consists of the following components:

- User's Guides for:
  - Configuration software
  - Runtime software
  - Communication between PLCs and operating unit
- Equipment Manuals for the following operating units:
  - SIMATIC Panel PC
  - SIMATIC Multi Panel
  - Operator Panel
  - Touch Panel
  - Text Display
  - Push Button Panel
- Online Help on the configuration software
- Start-up Guides
- Product Brief

Overview of complete documentation

The following table provides an overview of the SIMATIC HMI documentation and shows you when you require the different documents.

Documentation	Target Group	Content
First Steps with ProTool Product Brief	Newcomers	This documentation guides you step by step through the configuration of • a screen with various objects • a screen change and • a message. This documentation is available for: • Text-based Displays • Graphics Displays • Windows-based Systems
ProTool Configuring Windows-based Systems User's Guide	Configurers	Contains information on the configuration software with regard to: • installation, • basic principles of configuration, and • a detailed description of configurable objects and functions. This documentation is valid for Windows-based systems.
ProTool Configuring Graphics Displays User's Guide	Configurers	Contains information on the configuration software with regard to: • installation, • basic principles of configuration, and • a detailed description of configurable objects and functions. This documentation is valid for graphic display operating units.
ProTool Configuring Text-based Displays User's Guide	Configurers	Contains information on the configuration software with regard to: • installation, • basic principles of configuration, and • a detailed description of configurable objects and functions. This documentation is valid for text-based display operating units.
ProTool Online Help	Configurers	Provides information on the configuration computer while working with ProTool. The online help contains: • What's this? (direct help) • detailed instructions and examples • detailed information • all the information from the user guide
ProTool/Pro Runtime User's Guide	Commissioning engineers, Users	Describes the installation of the ProTool/Pro RT visualization software and startup and operation of the software on Windows–based systems.

Documentation	Target Group	Content
Copy Protection Start-up Guide	Commissioning engineers, Users	The ProTool/Pro Runtime visualization software is a copyright product. This manual contains information on the installation, repair and uninstallation of authorizations.
Application Example Start-up Guide	Newcomers	ProTool is supplied with example configurations and the corresponding PLC programs. This documentation describes how you • load the examples onto the operating unit and PLC • operating the examples, and • upgrade the connection to the PLC to suit your own specific application.
SIMATIC Panel PC 670 Equipment Manual SIMATIC Panel PC870 Equipment Manual SIMATIC Panel PC IL Equipment Manual	Commissioning engineers, Users	Contains descriptions of computers and operating units for the SIMATIC Panel PC 670 and SIMATIC Panel PC 870 as well as a description of the SIMATIC Panel PC IL.
Equipment Manuals MP 370 MP270 MP 270B, OP 270, TP 270 TP 170B, OP 170B TP 170A TP070	Commissioning engineers, Users	Describes the hardware and the general operation of Windows-based units: • installation and startup guides • a description of the equipment • Operation • instructions for connecting the PLC, printer and programming computer, • maintenance instructions
OP37/Pro Equipment Manual	Commissioning engineers, Users	Describes the hardware, installation and inclusion of upgrades and options for the OP 37/Pro.
TP 27, TP 37 Equipment Manual OP 27, OP 37 Equipment Manual OP 25, OP 35, OP 45 Equipment Manual OP 7, OP 17 Equipment Manual OP 5, OP 15 Equipment Manual TD 17 Equipment Manual	Commissioning engineers, Users	Describes the hardware and general operation. It contains • installation and commissioning instructions • a description of the equipment • instructions for connecting the PLC, printer and programming computer, • operating modes • operating instructions • description of the standard screens supplied with the operating unit and how to use them • fitting options • maintenance and fitting of spare parts.
OP 3 Equipment Manual	Commissioning engineers, Users, Programmers	Describes the hardware of the OP3, its general operation and the connection to the SIMATIC S7.
PP 7, PP 17 Equipment Manual	Commissioning engineers, Users	Describes the hardware, installation and commissioning of push-button panels PP7 and PP17

Documentation	Target Group	Content
Communication User's Guide	Programmers	Provides information on connecting text-based and graphics displays to the following PLCs: • SIMATIC S5 • SIMATIC S7 • SIMATIC 500/505 • drivers for other PLCs This documentation describes the • configuration and parameters required for connecting the devices to the PLC and the network • user data areas used for exchanging data between operating unit and PLC.
Communication for Windows-based Systems User's Guide	Programmers	Provides information on connecting Windows-based systems to the following PLCs: • SIMATIC S5 • SIMATIC S7 • SIMATIC WinAC • SIMATIC 505 • Integration in SIMATIC iMap • SIMOTION • drivers for other PLCs This documentation describes the • configuration and parameters required for connecting the devices to the PLC and the network • user data areas used for exchanging data between operating unit and PLC.
Other PLCs Online Help	Programmers	Provides information on connecting the operating units to the OPC and PLCs from: • Allen Bradley • GE Fanuc • Lucky Goldstar GM • Mitsubishi • Modicon • Omron • Telemecanique When the drives are installed, the relevant Online Help is installed at the same time.
ProAgent for OP User's Guide ProAgent/PC and ProAgent/MP User's Guide	Configurers	Provides the following information about the ProAgent optional package (process diagnosis): • configuring system-specific process diagnosis • detecting process faults, locating the cause of faults and eliminating them, • customizing standard diagnostic screens supplied with the software

Abbreviations

The abbreviations used in this guide have the following meaning:

PLC	Programmable Logic Control
AS 511	Protocol of the PU interface to the SIMATIC S5
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
EM	Event Messages
CP	Communication Processor
CPU	Central Processing Unit
CS	Configuration
DB	Data block
DL	Data byte, left
DR	Data byte, right
DW	Data Word
DP	Decentralized Periphery
DX	Extended data block
EPROM	Erazable Programmable Read-only Memory
HSA	Highest Station Address
HMI	Human Machine Interface
FB	Function Block
FM	Function Module
FW	Firmware
I/O	Input/Output
IF	Interface
ISA	Integrated System Architecture
LED	Light Emitting Diode
MP	Multi Panel
MPI	Multipoint Interface (SIMATIC S7)
MW	Flag word
OB	Organization Block
OP	Operator Panel
PC	Personal Computer
PLC	Programmable Logic Control

PP	Push Button Panel
PPI	Point to Point Interface (SIMATIC S7)
PU	Random Access Memory
RT	Runtime
RAM	Random Access Memory (working memory)
PLC	Programmable Logic Control
SRAM	Static Read Only Memory (buffered)
STW	Status word
TD	Text Display
TP	Touch Panel
WinAC	Windows Automation Center

Index

B

C

D

E

F

G

H

I

J

L

M

N

O

P

T

U