

SIMATIC HMI

Communication for Windows-based Systems

User's Guide
Part 2

Preface, Contents	
Part I Introduction	1
Part II Connection via OPC	2 ▼
Part III Connection to Allen-Bradley	4 ▼
Part IV Connection to GE Fanuc Automation	7 ▼
Part V Connection to LG Industrial Systems/IMO	9 ▼
Part VI Connection to Mitsubishi Electric	11 ▼
Part VII Connection to OMRON	14 ▼
Part VIII Connection to Modicon	16 ▼
Part IX Connection to Telemecanique	18 ▼
Part X Appendix	A ▼
Abbreviations, Index	

This documentation is a component part
of the Communication for Windows-based Systems
User's Guide,
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.

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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 2, provides descriptions on:

- connection via OPC,
- connection to Allen-Bradley PLCs,
- connection to GE Fanuc Automation PLCs,
- connection to LG Industrial Systems/IMO PLCs,
- connection to Mitsubishi Electric and Melsec PLCs,
- connection to OMRON PLCs,
- connection to Schneider Automation PLCs (Modicon and Telemecanique),

Part 1 contains descriptions of the connections to SIMATIC PLCs.

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, MitsubishiFX 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 is divided into Part 1 and Part 2.

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- SIMATIC Panel PC®
- MP 270® , MP 370®
- ProTool® , ProTool/Lite® , ProTool/Pro® , ProAgent®

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 - 8, N, 1, ANSI, or
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- Your contact partner for Automation & Drives can be found in the contact partner database
 - in the **Internet** under <http://www3.ad.siemens.de/partner/search.asp>

Notation

The following notation is used throughout this manual:

<code>VAR_23</code>	Screen texts, such as commands, file names, entries in dialog boxes and system messages, are displayed in this font.
<i>Tag</i>	Dialog box names and the fields and buttons contained in them appear in this font.
<i>File → Edit</i>	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 I Introduction

1	Introduction	1-1
1.1	Connections and Protocols	1-1
1.2	Operating Unit and Possible Protocols	1-4
1.3	Conversion on Changing PLCs	1-6

Part II Connection via OPC

2	Network Connection with OPC	2-1
2.1	Possible Configurations	2-2
2.2	Starting Up the OPC	2-5
2.3	OPC Client Parameters	2-6
2.4	OPC Client Tag Parameters	2-7
2.5	Server Parameters – OPC	2-9
3	Settings for DCOM	3-1

Part III Connection to Allen-Bradley via DF1 and DH485

4	Communication Management for Allen-Bradley PLCs via DF1	4-1
4.1	Basic Methods of Functioning	4-4
4.2	Configuration in ProTool	4-5
4.3	Data Types	4-7
4.4	Optimization	4-8
5	Communication Management for Allen-Bradley PLCs via DH485	5-1
5.1	Basic Methods of Functioning	5-3
5.2	Configuration in ProTool	5-4
5.3	Data Types	5-5
5.4	Optimization	5-7

6	User Data Areas for Allen-Bradley PLCs	6-1
6.1	User Data Areas Available	6-1
6.2	User Data Area, User Version	6-4
6.3	User Data Area, Job Mailbox	6-4
6.4	User Data Areas, Event and Alarm Messages and Acknowledgement ..	6-5
6.5	User Data Area, Screen Number	6-10
6.6	User Data Area, Date/Time	6-11
6.7	User Data Area, Date/Time PLC	6-12
6.8	User Data Area, Coordination	6-13
6.9	User Data Areas, Trend Request and Trend Transfer	6-14
6.10	User Data Area, LED Assignment	6-16
6.11	Recipes	6-18
6.11.1	Asynchronous data transfer	6-19
6.11.2	Synchronous data transfer	6-20
6.11.3	Data mailbox for synchronized data transfer	6-20
6.11.4	Synchronization process	6-21
6.11.5	PLC jobs with recipes	6-25

Part IV Connection to GE Fanuc Automation PLCs

7	Communication Management for GE Fanuc PLCs	7-1
7.1	Basic Methods of Functioning	7-3
7.2	Configuration in ProTool	7-4
7.3	Data Types	7-5
7.4	Optimization	7-6
8	User Data Areas for GE Fanuc PLCs	8-1
8.1	User Data Areas Available	8-1
8.2	User Data Area, User Version	8-4
8.3	User Data Area, Job Mailbox	8-4
8.4	User Data Areas, Event and Alarm Messages and Acknowledgement ..	8-5
8.5	User Data Areas, Screen Numbers	8-10
8.6	User Data Area, Date/Time	8-11
8.7	User Data Area, Date/Time PLC	8-12
8.8	User Data Area, Coordination	8-13
8.9	User Data Areas, Trend Request and Trend Transfer	8-14
8.10	User Data Area, LED Assignment	8-16

8.11	Recipes	8-18
8.11.1	Asynchronous data transfer	8-19
8.11.2	Synchronous data transfer	8-20
8.11.3	Data mailbox for synchronized data transfer	8-20
8.11.4	Synchronization process	8-21
8.11.5	PLC jobs with recipes	8-25

Teil V Connection to LG Industrial Systems/IMO PLCs

9	Communication Management for LG Industrial Systems/IMO PLCs	9-1
9.1	Basic Methods of Functioning	9-3
9.2	Configuration in ProTool	9-4
9.3	Data types	9-5
9.4	Optimization	9-6
10	User Data Areas for LG Industrial Systems/IMO PLCs	10-1
10.1	User Data Areas Available	10-1
10.2	User Data Area, User Version	10-4
10.3	User Data Area, Job Mailbox	10-4
10.4	User Data Area, Event and Alarm Messages and Acknowledgement ...	10-5
10.5	User Data Area, Screen Number	10-10
10.6	User Data Area, Date/Time	10-11
10.7	User Data Area, Date/Time PLC	10-12
10.8	User Data Area, Coordination	10-13
10.9	User Data Areas, Trend Request and Trend Transfer	10-14
10.10	User Data Area, LED Assignment	10-16
10.11	Recipes	10-18
10.11.1	Asynchronous data transfer	10-19
10.11.2	Synchronous data transfer	10-20
10.11.3	Data mailbox for synchronous data transfer	10-20
10.11.4	Synchronization process	10-21
10.11.5	PLC jobs with recipes	10-25

Part VI Connection to Mitsubishi Electric PLCs

11	Communication Management for Mitsubishi PLCs via PU Protocol	11-1
11.1	Basic Methods of Functioning	11-3
11.2	Configuration in ProTool	11-4
11.3	Data Types	11-5
11.4	Optimization	11-6

12	Communication Management for Mitsubishi PLCs via Protocol 4	12-1
12.1	Basic Methods of Functioning	12-3
12.2	Configuration in ProTool	12-4
12.3	Data Types	12-6
12.4	Optimization	12-7
13	User Data Areas for Mitsubishi PLCs	13-1
13.1	User Data Areas Available	13-1
13.2	User Data Area, User Version	13-4
13.3	User Data Area, Job Mailbox	13-4
13.4	User Data Areas, Event and Alarm Messages and Acknowledgement	13-5
13.5	User Data Areas, Screen Numbers	13-10
13.6	User Data Area, Date/Time	13-11
13.7	User Data Area, Date/Time PLC	13-12
13.8	User Data Area, Coordination	13-13
13.9	User Data Areas, Trend Request and Trend Transfer	13-14
13.10	User Data Area, LED Assignment	13-16
13.11	Recipes	13-18
13.11.1	Asynchronous data transfer	13-19
13.11.2	Synchronous data transfer	13-20
13.11.3	Data mailbox for synchronized data transfer	13-20
13.11.4	Synchronization process	13-21
13.11.5	PLC jobs with recipes	13-25

Part VII Connection to OMRON PLCs

14	Communication Management for OMRON PLCs	14-1
14.1	Basic Methods of Functioning	14-3
14.2	Configuration in ProTool	14-4
14.3	Data Types	14-5
14.4	Optimization	14-6
15	User Data Areas for OMRON PLCs	15-1
15.1	User Data Areas Available	15-1
15.2	User Data Area, User Version	15-4
15.3	User Data Area, Job Mailbox	15-4
15.4	User Data Areas, Event and Alarm Messages and Acknowledgement	15-5
15.5	User Data Areas, Screen Numbers	15-10
15.6	User Data Area, Date/Time	15-11
15.7	User Data Area, Date/Time PLC	15-12

15.8	User Data Area, Coordination	15-13
15.9	User Data Areas, Trend Request and Trend Transfer	15-14
15.10	User Data Area, LED Assignment	15-16
15.11	Recipes	15-18
15.11.1	Asynchronous data transfer	15-19
15.11.2	Synchronous data transfer	15-20
15.11.3	Data mailbox for synchronized data transfer	15-20
15.11.4	Synchronization process	15-21
15.11.5	PLC jobs with recipes	15-25

Part VIII Connection to Schneider Automation PLCs (Modicon)

16	Communication Management for Modicon PLCs	16-1
16.1	Basic Methods of Functioning	16-3
16.2	Configuration in ProTool	16-4
16.3	Data Types	16-5
16.4	Optimization	16-6
17	User Data Areas for Modicon PLCs	17-1
17.1	User Data Areas Available	17-1
17.2	User Data Area, User Version	17-4
17.3	User Data Area, Job Mailbox	17-4
17.4	User Data Areas, Event and Alarm Messages and Acknowledgement ..	17-5
17.5	User Data Areas, Screen Numbers	17-10
17.6	User Data Area, Date/Time	17-11
17.7	User Data Area, Date/Time PLC	17-12
17.8	User Data Area, Coordination	17-13
17.9	User Data Areas, Trend Request and Trend Transfer	17-14
17.10	User Data Area, LED Assignment	17-16
17.11	Recipes	17-18
17.11.1	Asynchronous data transfer	17-19
17.11.2	Synchronous data transfer	17-20
17.11.3	Data mailbox for synchronized data transfer	17-20
17.11.4	Synchronization process	17-21
17.11.5	PLC jobs with recipes	17-25

Part IX Connection to Schneider Automation PLCs (Telemecanique)		
18	Communication Management for Telemecanique PLCs	18-1
18.1	Basic Methods of Functioning	18-4
18.2	Configuration in ProTool	18-5
18.3	Data Types	18-6
18.4	Optimization	18-7
19	User Data Areas for Telemecanique PLCs	19-1
19.1	User Data Areas Available	19-1
19.2	User Data Area, User Version	19-4
19.3	User Data Area, Job Mailbox	19-4
19.4	User Data Areas, Event and Alarm Messages and Acknowledgement	19-5
19.5	User Data Area, Screen Number	19-10
19.6	User Data Area, Date/Time	19-11
19.7	User Data Area, Date/Time PLC	19-12
19.8	User Data Area, Coordination	19-13
19.9	User Data Areas, Trend Request and Trend Transfer	19-14
19.10	User Data Area, LED Assignment	19-16
19.11	Recipes	19-18
19.11.1	Asynchronous data transfer	19-19
19.11.2	Synchronous data transfer	19-20
19.11.3	Data mailbox for synchronized data transfer	19-20
19.11.4	Synchronization process	19-21
19.11.5	PLC jobs with recipes	19-25
Part X Appendix		
20	System Messages	A-1
21	PLC Jobs	B-1
22	Interface Area Assignment	C-1
23	SIMATIC HMI Documentation	D-1
	Abbreviations	Abbrev-1
	Index	Index-1

Part I

Introduction

Introduction

1

Introduction

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

- **SIMATIC500/505**
 - 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 and 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 via OPC

Network Connection with OPC

2

Settings for DCOM

3

Network Connection with OPC

This chapter describes the connection of the server and client with the OPC to form a network.

General Information

Windows-based systems, such as Panel PCs, are used for realistic machine and process representations and can communicate with office applications via Ethernet with TCP/IP and OPC.

This means that visualization and data processing on site are possible as is the calling in of system-wide data and the archiving of process data. Universal information flows ensure a clear view of the status of all processes.

What is OPC?

OPC stands for **OLE for Process Control** and is a standard open systems interface. It is based on OLE/COM and DCOM technology and enables simple, standardized data exchange between automation/PLC applications, field devices and office applications.

Data can be exchanged between devices and applications from different providers via a common interface:

- **OPC simplifies** the connection of automation components from different manufacturers to PC applications such as visualization systems and office applications.
- **OPC standardizes** communication to the extent that any OPC server and applications can work together without problems occurring.

Note

Leading industrial automation companies have joined together to form the **OPC Foundation**.

Further information on the OPC Foundation is provided in the Internet under the following address: <http://www.opcfoundation.org>.

Conditions

Since data exchange with OPC is performed using the **DCOM (Distributed Component Object Model)**, only operating units with one of the following operating systems can be implemented:

- Windows 2000 Service Pack 2
- Windows NT 4.0 Service Pack 6

OPC must be installed on the runtime system and selected from the communication components.

The OPC server must be located on the same network as the OPC client or be accessible via RAS (Remote Access Service).

For the OPC client channel to be able to start the OPC server automatically and successfully establish the process communication connection, the startup and access permissions of the OPC server must be set accordingly.

Data exchange

To display or evaluate data on the operating unit, it can be retrieved via the OPC interface from any OPC server in the network operating as a client.

The data which is exchanged is in the form of **tags**. They are addressed by their symbolic names assigned in the *Tag* dialog.

Tags can be processed within the entire network, in the following way for example:

- **Trend tags** can be represented in a trend curve display.
- Tags are stored in a **tag archive** and then evaluated.

2.1 Possible Configurations

To enable communication via the OPC channel, ProTool/Pro RT is equipped with an applicable COM interface to establish the exchange of data between PLCs or automation systems.

An operating unit can be used as either an OPC server or OPC client. When used as an OPC Client, the operating unit can be connected to a maximum of 8 OPC servers.

Operating system	OPC server	OPC client
Windows NT 4.0 Service Pack 6	x	x
Windows 2000 Service Pack 2	x	x

Configuration with an operating unit as the OPC client

The following diagram illustrates an example of a configuration with an operating unit as the OPC client:

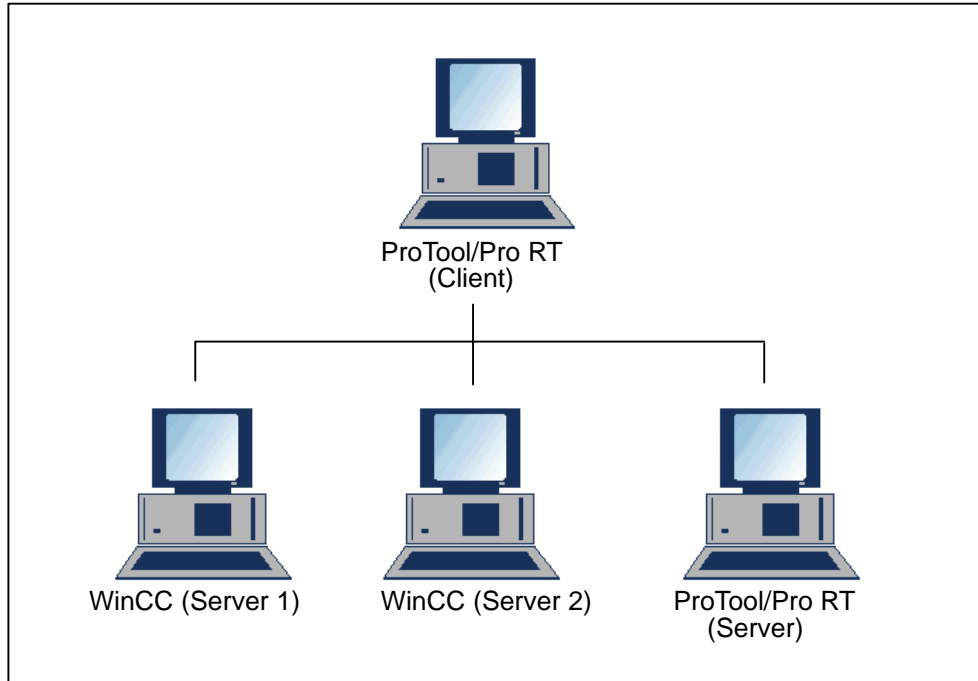


Figure 2-1 Configuration with the operating unit as OPC client

Configuration with an operating unit as the OPC server

The following diagram illustrates an example of a configuration with an operating unit as the OPC server:

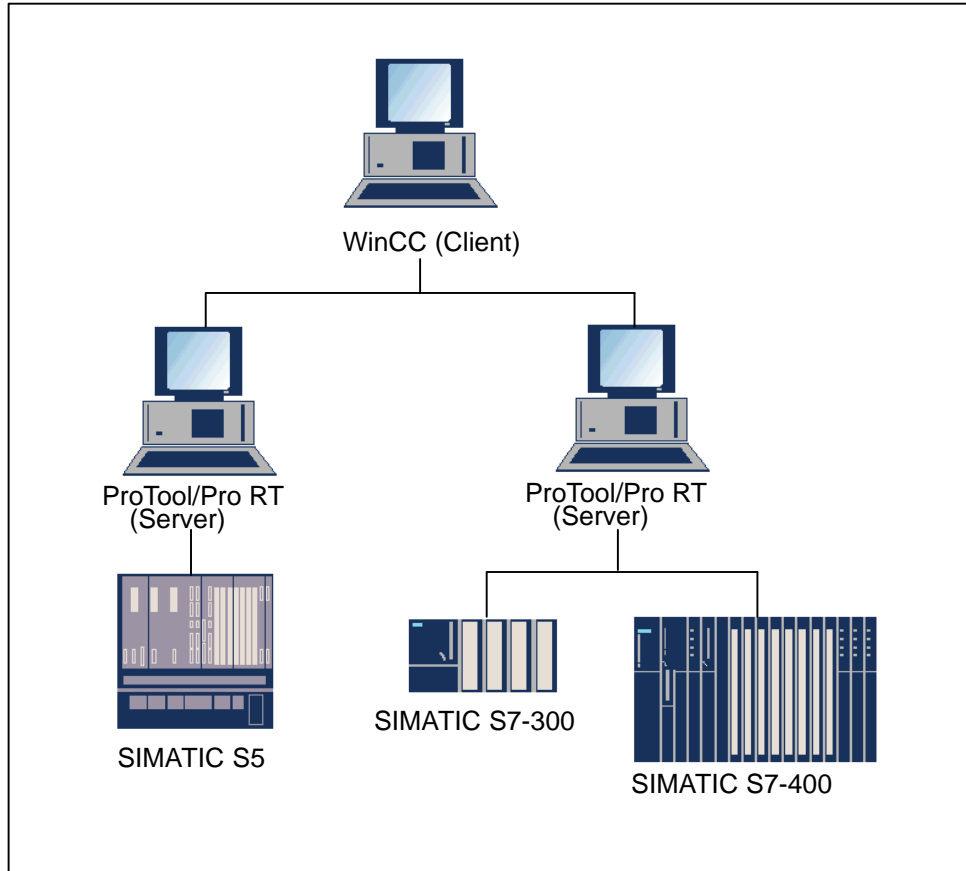


Figure 2-2 Configuration with the operating unit as an OPC server

The software for the OPC server and OPC client is supplied with the configuration software and automatically installed.

Select PLC protocol

When creating a new project, select the driver required from the *Project Assistant – PLC Selection* dialog box.

Set the *OPC* driver.

Define the driver parameters after clicking on the *Parameter...* button.

For subsequent changes to the parameters, select *PLC* in the project window and then *Properties → Parameters...*

Tasks of the tags

The general data exchange between the operating units is performed via process values. To do this, tags must be created in the project of the one operating unit which point to addresses in the project on the other operating unit. The first 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 other operating unit.

2.2 Starting Up the OPC

Connection

The OPC server(s) must be installed in the same Windows-supported network as the OPC client.

Connecting the operating unit to the PLC

The connection of the OPC client and OPC server involves selecting the OPC PLC with the corresponding parameters and setting the start and access permissions of the OPC server DCOM.

2.3 OPC Client Parameters

To establish a connection via the OPC, the following parameters must be defined for the PLC under *Parameters...*:

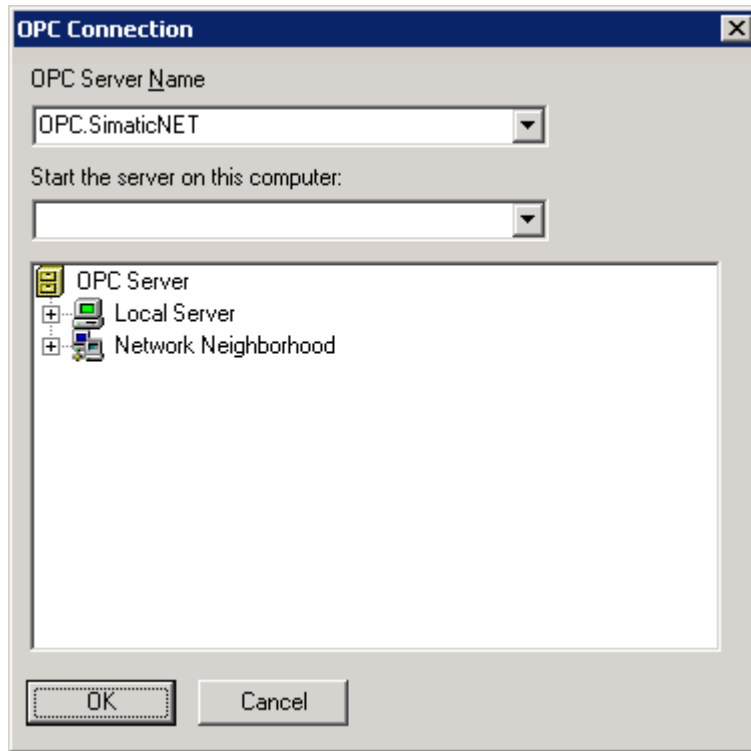


Figure 2-3 OPC Connection

The lower field lists the OPC servers which are available for selection.

In the case of SIMATIC HMI, the current tag value is read in. The current value is not explicitly read from the PLC.

2.4 OPC Client Tag Parameters

For the connection via OPC, set the parameters specified below for the tags of the OPC client in *General*, except for the known parameters *Name*, *Acquisition Cycle* (s), etc.:

Figure 2-4 Tag

PLC

Define the symbolic name of the OPC servers to be connected via OPC.

Type

Define the tag type to be read from the OPC server.

The tag type defined on the OPC client must be identical to the tag type used on the OPC server.

Browse

After selecting the *Browse* button, a window opens up containing selectable items.

Note

Length (words) is specified in ProTool for *Area Pointers*. This concerns the **SHORT** type and not the WORD type.

Item Name

Define the tag name used on the OPC server.

With the SIMATIC HMI (ProTool/Pro, WinCC), the tag name is the symbolic name of the tag.

With SIMATIC NET, the Item Name can be

```
S7 : [CPU416-2DP | S7-OPC-Server | CP_L2_1 : ] DB100 , REAL0 , 1
```

or

```
S7 : [CPU416-2DP | S7-OPC-Server | CP_L2_1 : ] MB0
```

Access path

The access path remains empty

2.5 Server Parameters – OPC

For connection via OPC, select *System* → *Settings* and set the *OPC server* parameter.

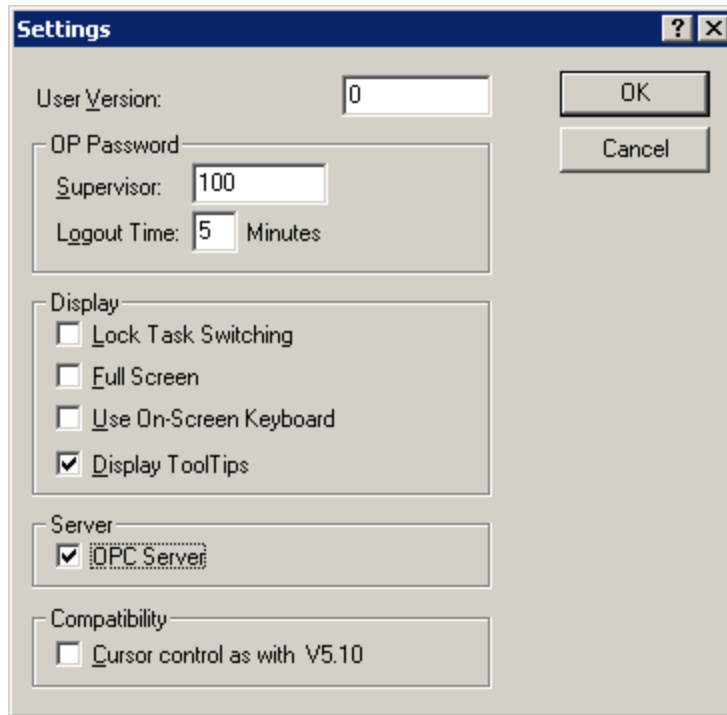


Figure 2-5 OPC Connection

Server

Activate the *OPC Server* check box to connect the OPC server.

Settings for DCOM

This chapter describes the DCOM configuration required for networking with OPC.

Since the DCOM configuration depends on how the network is configured, such as the security aspect, etc., this chapter only provides a **basic** description. Security aspects are **not** taken into consideration in this chapter.

The following settings are recommended. They enable a connection via OPC. However, it is not possible to guarantee that the function of other modules remains unaffected.

Configuring DCOM

The settings for the DCOM configuration are defined using the *DCOM Configuration Properties* program. This can be started via *Start → Run* and entering the program name `dcomcnfg.exe`.

The *Distributed COM Configuration Properties* program appears (refer to Figure 3-1). Select the OPC servers entry on the *Applications* tab control: OPC.SimaticHMI.PTPro. The Properties dialog box is opened after clicking on the *Properties* button.

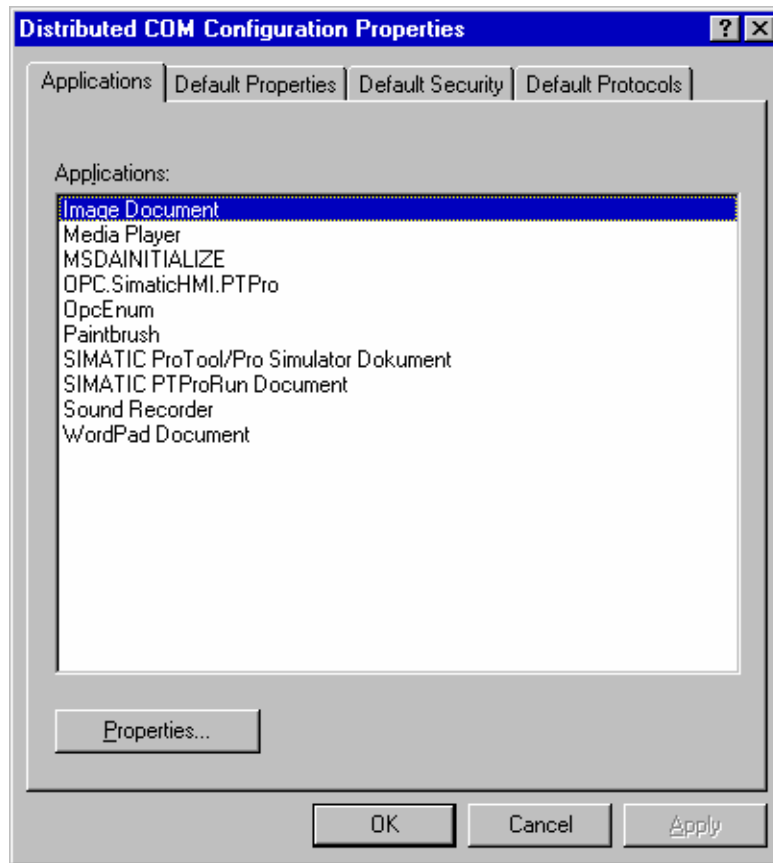


Figure 3-1 DCOM Configuration Properties – Applications

The *OPC.SimaticHMI.PTPro Properties* dialog box appears (refer to Figure 3-2). On the *General* tab control, set *Authentication Level:* (none).

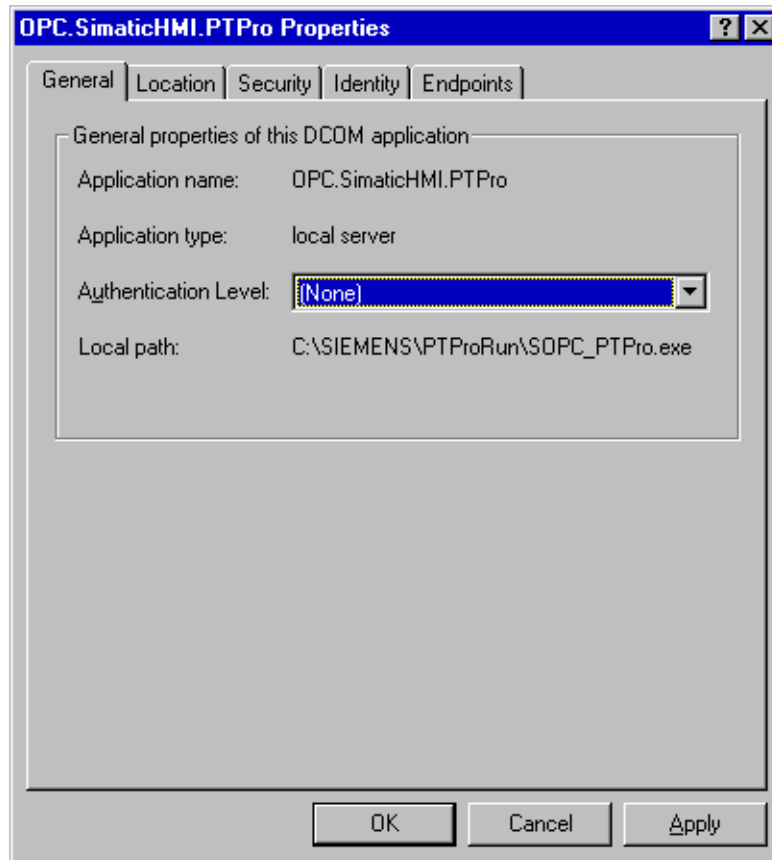


Figure 3-2 OPC.SimaticHMI.PTPro Properties – General

Set *Run application on this computer* in the `Location` tab control (refer to Figure 3-3).

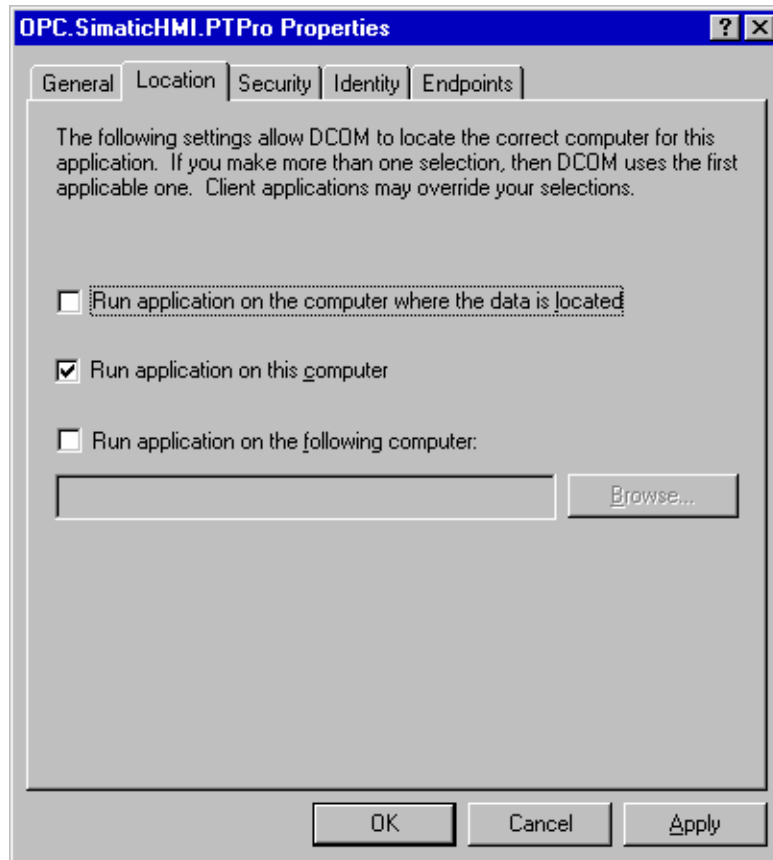


Figure 3-3 OPC.SimaticHMI.PTPro Properties – Standard

On the *Security* tab control (refer to Figure 3-4), define the settings Use default access permissions, Use custom access permissions and Use custom configuration permissions.

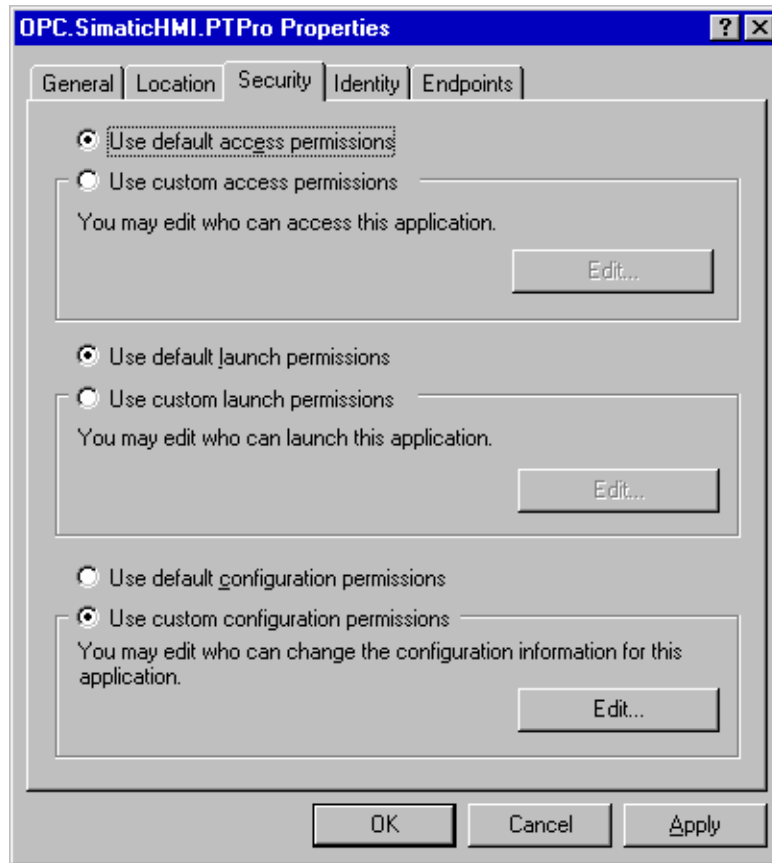


Figure 3-4 OPC.SimaticHMI.PTPro Properties – Security

Set *The interactive user* in the Identity tab control (refer to Figure 3-5).

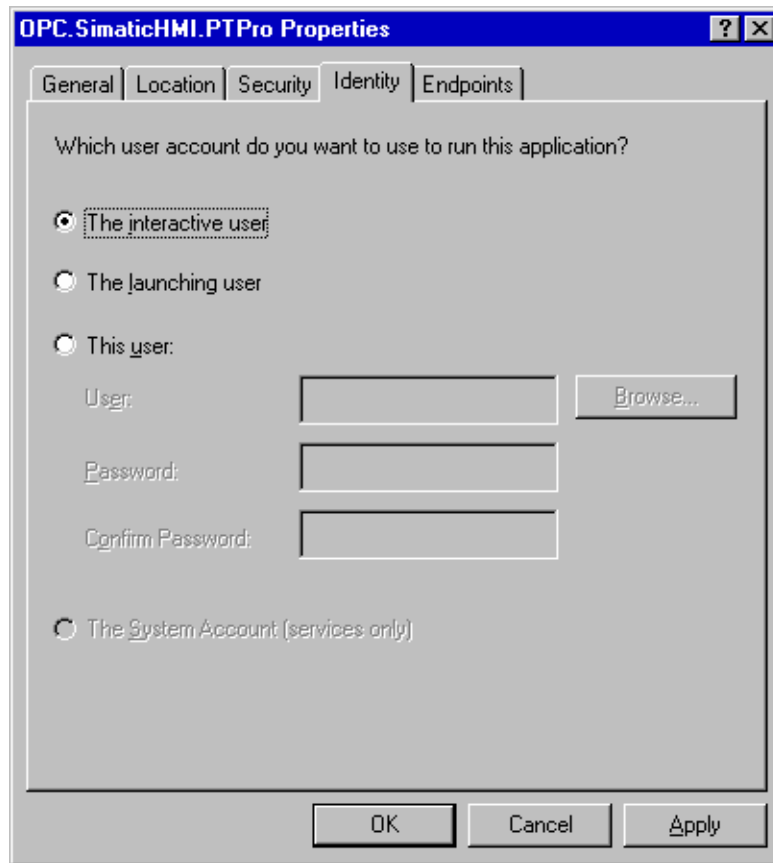


Figure 3-5 OPC.SimaticHMI.PTPro Properties – Identity

Nothing should be changed on the *Endpoints* tab control (refer to Figure 3-6).

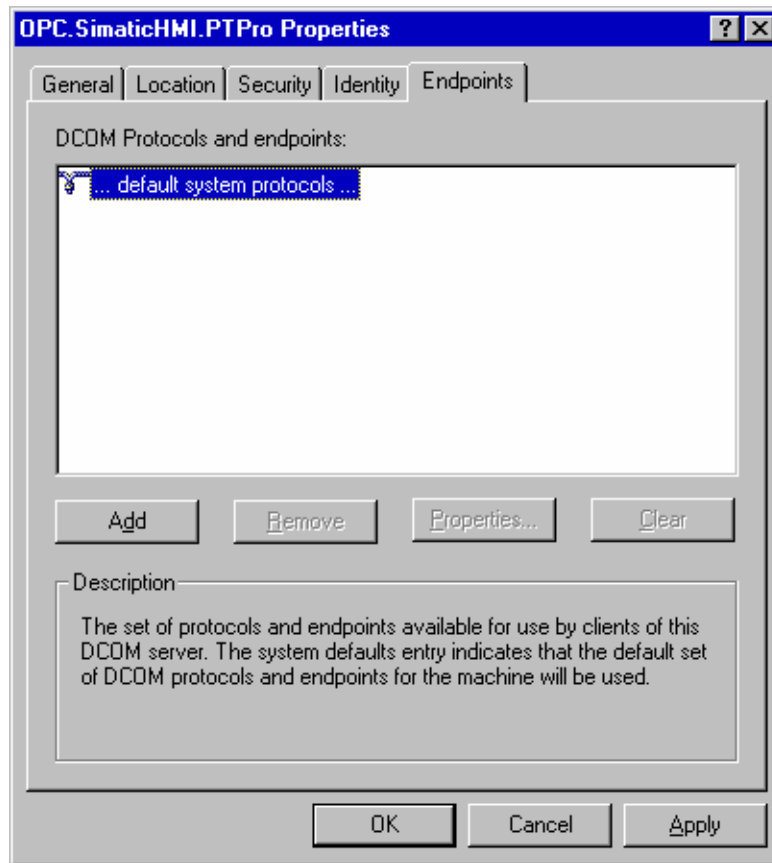


Figure 3-6 OPC.SimaticHMI.PTPro Properties – Endpoints

Use the *OK* button to return to the *DCOM Configuration Properties* dialog box. Use the *Default Properties* tab control (refer to Figure 3-7) to select the *Enable DCOM (Distributed COM) on this computer* and *Enable COM Internet Services on this computer*. Continue to use *Default Authentication Level: (none)* and *Default Impersonation Level: Anonymous*.

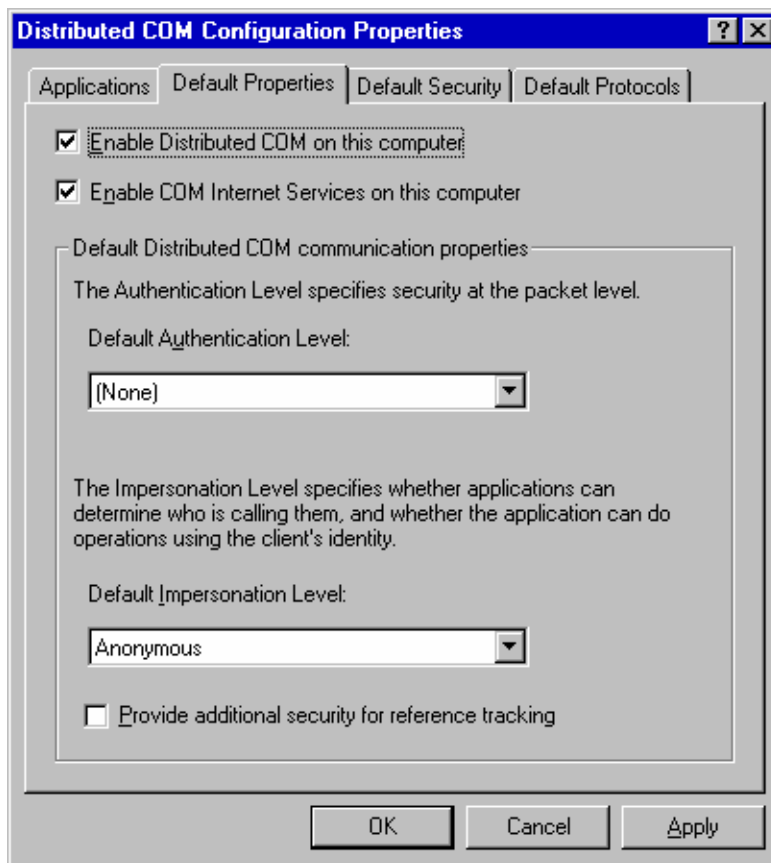


Figure 3-7 DCOM Configuration Properties – Default Properties

Use the *Default Security* tab control (refer to Figure 3-8), to define who should be assigned permissions to access, start or configure the OPC server. To do this, select the *Edit Default* in each case. One further dialog box appears in which to select the type of access for the user and another in which to add more users and groups.



Figure 3-8 DCOM Configuration Properties – Default Security

If this concerns the same user with the same password on all the individual computers, no special rights need to be assigned.

If, however, different users are involved, e.g.

User X and User Y, or

User X + Domain 1 and User X + Domain 2,

the corresponding rights must be defined in *Default Security*.

Part III

Connection to Allen-Bradley via DF1 and DH485

Communication Management for Allen-Bradley via DF1

4

Communication Management for Allen-Bradley via DH485

5

User Data Areas for Allen-Bradley PLCs

6

Communication Management for Allen-Bradley PLCs via DF1

4

This chapter describes the communication between operating unit and Allen-Bradley PLCs from the SLC500, PLC5/20 and MicroLogix series using the DF1 protocol.

General Information

The connection, in the case of these PLCs, is established by the following internal PLC protocols:

- DF1 – point-to-point connection
- DH+ via KF2 module and DF1 – multi-point connection
- DH485 via KF3 module and DF1 – multi-point connection

Operating units

The following operating units can be connected to SLC500, PLC5/20 and MicroLogix PLCs:

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

Installation

The driver necessary for the connection to the SLC500, PLC5/20 and MicroLogix PLCs is contained in the configuration software and is installed automatically.

The connection between the operating unit and the PLC is basically restricted to defining the interface parameters. Special function blocks for connection to the PLC are not required.

Connection

The operating unit must be connected to the DF1 interface of the CPU (RS 232 or RS 422) or to a KF2 or KF3 module (refer to the documentation of the unit to be connected).

Note

The Allen-Bradley company also offers a wide range of communication adapters to integrate “DF1 participants” in DH485, DH and DH+ networks. Connections via the KF2 and KF3 modules are approved for Windows-based systems. Other connections have **not** been tested by Siemens AG and, therefore, **not** been approved for release.

- DF1 protocol

The operating unit must be connected to the DF1 interface on the CPU (RS232) (refer to Figure 4-1). Please refer to Table 4-1 for information concerning the connection cables to be used.

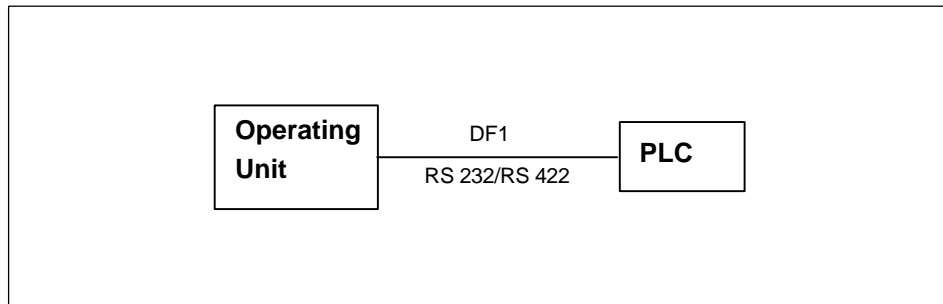


Figure 4-1 Connecting the operating unit to the PLC

- DH+ protocol

The operating unit must be connected to the RS232 interface of the KF2 module, and the KF2 module to the DH+ interface of the CPU (refer to Figure 4-2). Please refer to Table 4-1 for information concerning the connection cables to be used.

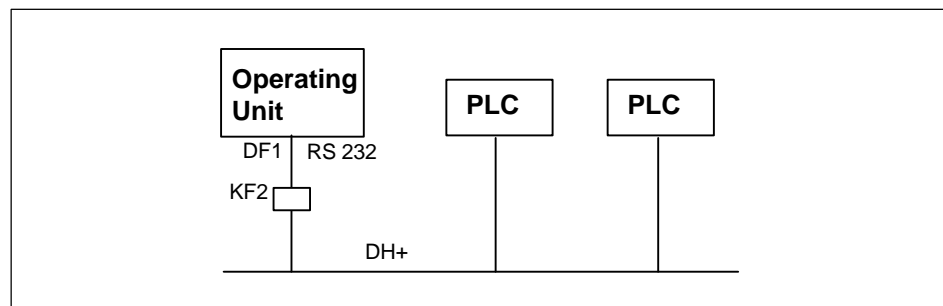


Figure 4-2 Connecting the operating unit to the PLC

- DH485 protocol

Only valid for Allen-Bradley SLC 50x.

The operating unit must be connected to the RS232 interface of the KF3 module and the KF3 module connected via an AIC or NET-AIC to the DH485 interface of the CPU (refer to Figure 2324-3). Please refer to Table 4-1 for information concerning the connection cables to be used.

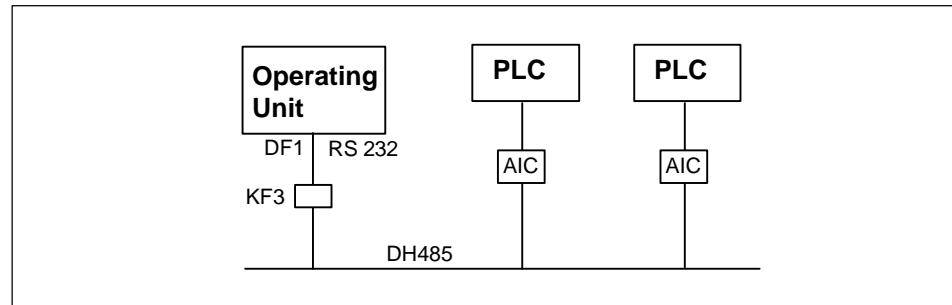


Figure 4-3 Connecting the operating unit to the PLC

Note

When using a PC or OP37/Pro the FIFO of the interface via which communication should take place must be switched off.

Windows 95:

Select the COM ports required using *Control Panel* → *System* → *Device Manager* → *Connections (COM and LPT)* and then select *Properties* → *Connection Settings* → *More...* to deactivate the option *Use FIFO Buffer*.

Windows NT:

Select the COM ports required using *Control Panel* → *Connections (COM and LPT)* *Connections (COM and LPT) Settings* → *More...* to deactivate the option *FIFO activated*.

The following connection cables are available for connection of the operating unit to the PLC:

Table 4-1 Applicable connection cables (refer to Appendix, Part C Interface Assignment)

Interface	SLC500/ MicroLogix	MicroLogix	PLC5/20	
	RS 232, 9-pin	Mini-DIN	RS 232, 25-pin	RS 422, 25-pin
RS 232, 9-pin	Allen-Bradley standard cable 1747 CP3	Allen-Bradley standard cable 1761-CBL PM02	Allen-Bradley standard cable 1784 CP10	–
RS 232, 15-pin	6XV1440-2K ___	Point-to-point cable 1	6XV1440-2L ___	–
RS 422, 9-pin	–	–	–	6XV1440-2V ___

'_' Length code (refer to Catalog ST 80)

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

4.1 Basic Methods of Functioning

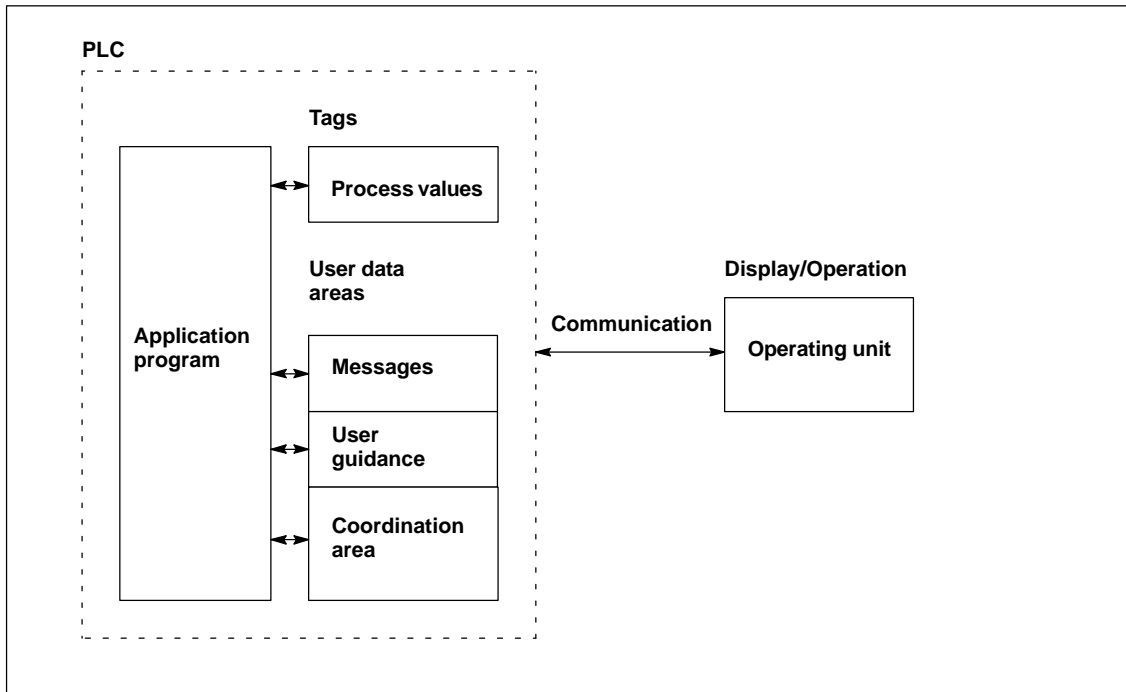


Figure 4-4 Communication structure

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 6.

4.2 Configuration in ProTool

When creating a new project, select the protocol required from the *Project Wizard* → *PLC Selection* dialog box.

Define one of the following protocols:

- Allen-Bradley DF1 SLC500 for the SLC500 and MicroLogix PLCs,
- Allen-Bradley DF1 PLC5/20 for the PLC5/20 PLC,

Select the *Parameter . . .* button to define the protocol parameters.

Note

The settings on the operating unit must match with those on the PLC.

When starting up, ProTool must not be integrated in STEP 7; deactivate the menu item *Integration in STEP 7*.

Define the following parameters for the PLC:

Table 4-2 PLC parameters

Parameters	Explanation
Interface	The operating unit interface to which the PLC is connected must be set here. <ul style="list-style-type: none"> – Panel PC: COM 1 or COM 2 – Standard PC: COM 1 to COM 4 – MP 370: IF1A, IF2 or IF1B – MP 270, MP 270B: IF1A, IF2 or IF1B – TP 270, OP 270: IF1A, IF2 or IF1B – TP 170B, OP 170B: IF1A, IF2 or IF1B – TP 170A: IF1A or IF1B
Target address	Select the PLC address or, in the case of a point-to-point DF1 connection of the PLC, the address 0.
CPU type	Only valid for Allen-Bradley DF1 SLC500: Set the CPU type of that used in the PLC: SLC500, SLC501, SLC502, SLC503, SLC504, SLC505 or MicroLogix
Error code	Set BCC or CRC.
Interface type	Set RS232 or RS422 according to the interface.
Data bits	Set 7 or 8.
Parity	Set NONE, EVEN or UNEVEN.
Stop bits	Set 1 or 2.
Baud rate	Define the transmission rate between the operating unit and PLC here. System setting: 9600 bit/s.

Note

Configure the driver DF1 FULL-DUPLEX as follows: NO HANDSHAKING for Control Line and AUTO-DETECT for Embedded Responses.

For subsequent changes to the parameters, select PLC in the project window and then *Properties* → *Parameter*

4.3 Data Types

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

Table 4-3 Data types

Data type	Addressed by	Format
ASCII ¹	A	ASCII
Binary	B	BIT, UNSIGNED INT
Counter	C	BIT, SIGNED INT, UNSIGNED INT
BCD (PLC5 only)	D	BIT, SIGNED INT, UNSIGNED INT, BCD4, BCD8
Float ¹	F	REAL
Digital Input	I	BIT, UNSIGNED INT
Data Register (Integer)	N	BIT, SIGNED INT, UNSIGNED INT, SIGNED LONG, UNSIGNED LONG, REAL
Digital Output	O	BIT, UNSIGNED INT
Control	R	BIT, UNSIGNED INT
Status	S	BIT, UNSIGNED INT
Timer	T	BIT, SIGNED INT, UNSIGNED INT

¹ Valid for PLCs in the SLC503, SLC504, SLC505 and PLC5/20 series.

Representation in ProTool

In ProTool the data format UNSIGNED INT is abbreviated as UIN, UNSIGNED LONG as ULONG, SIGNED INT as INT and SIGNED LONG as LONG.

Note

Input/output modules with 8 or 16 ports occupy a complete word in the PLC. An input/output module with 24 or 32 ports occupies two words. If non-available bits are assigned in the operating unit, the unit issues an error message.

For this reason, ensure that only those bits are assigned which are assigned to a port when configuring input/output modules with 8 or 24 ports.

4.4 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 effective update time is improved by setting one single large area rather than several smaller 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: Approx. 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 by the operating unit, 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.

Communication Management for Allen-Bradley PLCs via DH485

5

This chapter describes the communication between the operating unit and Allen-Bradley PLC types SLC500, SLC501, SLC502, SLC503, SLC504 and SLC505 (subsequently referred to as SLCs) and MicroLogix using the DH485 protocol.

General Information

The connection, in the case of these PLCs, is established by the following internal PLC protocols:

- DH485 – multi-point connection

Operating units

The following operating units can be connected to SLC PLCs and MicroLogix:

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

Installation

The driver necessary for the connection to the SLC and MicroLogix PLCs is contained in the configuration software and is installed automatically.

The connection between the operating unit and the PLC is basically restricted to defining the interface parameters. Special function blocks for connection to the PLC are not required.

Connection

Note

The Allen-Bradley company also offers a wide range of communication adapters to integrate “DF1 participants” in DH485, DH and DH+ networks. Other connections have **not** been tested by Siemens AG and, therefore, **not** been approved for release.

The CPU must be connected directly to the operating unit or the AIC or AIC+ module, and the module connected to the RS 485 interface of the operating unit (multi-point connection).

The SLC PLCs are equipped with an RS 232 or RS 485 interface and are connected to the bus via the AIC or AIC+ accordingly. The MicroLogix PLCs only have an RS 232 interface and can only be connected via the AIC+.

- Point-to-point connection via RS 232

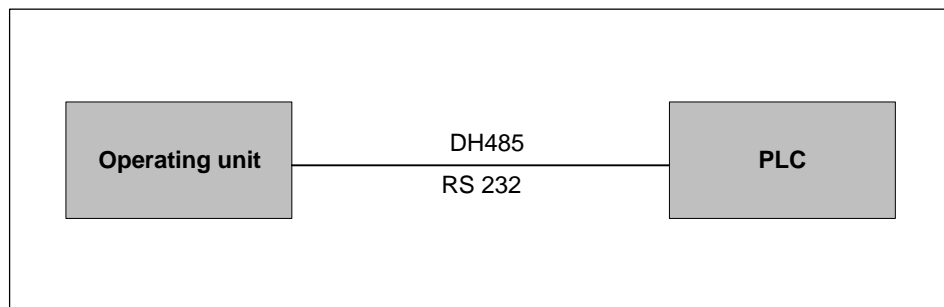


Figure 5-1 Connecting the operating unit via a point-to-point connection

- Multi-point connection via RS 485

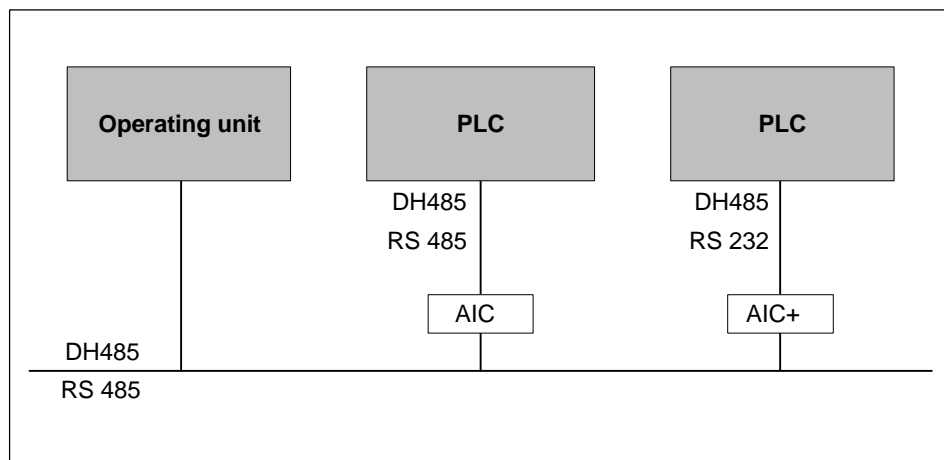


Figure 5-2 Connecting the operating unit via a multi-point connection

The following connection cables are available for connection of the operating unit to the PLC:

Table 5-1 Applicable connection cables (refer to Appendix, Part C Interface Assignment)

Interface	SLC, MicroLogix RS 232, 9-pin	MicroLogix RS 232, Mini-DIN	Bus connection RS 485, 6-pin
RS 232, 9-pin	Allen-Bradley standard cable 1747 CP3	Allen-Bradley standard cable 1761-CBL PM02	–
RS 232, 15-pin	6XV1440-2K _ _ _	Point-to-point cable 1	–
RS 485, 9-pin	–	–	Multi-point cable

'_' Length code (refer to Catalog ST 80)

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

5.1 Basic Methods of Functioning

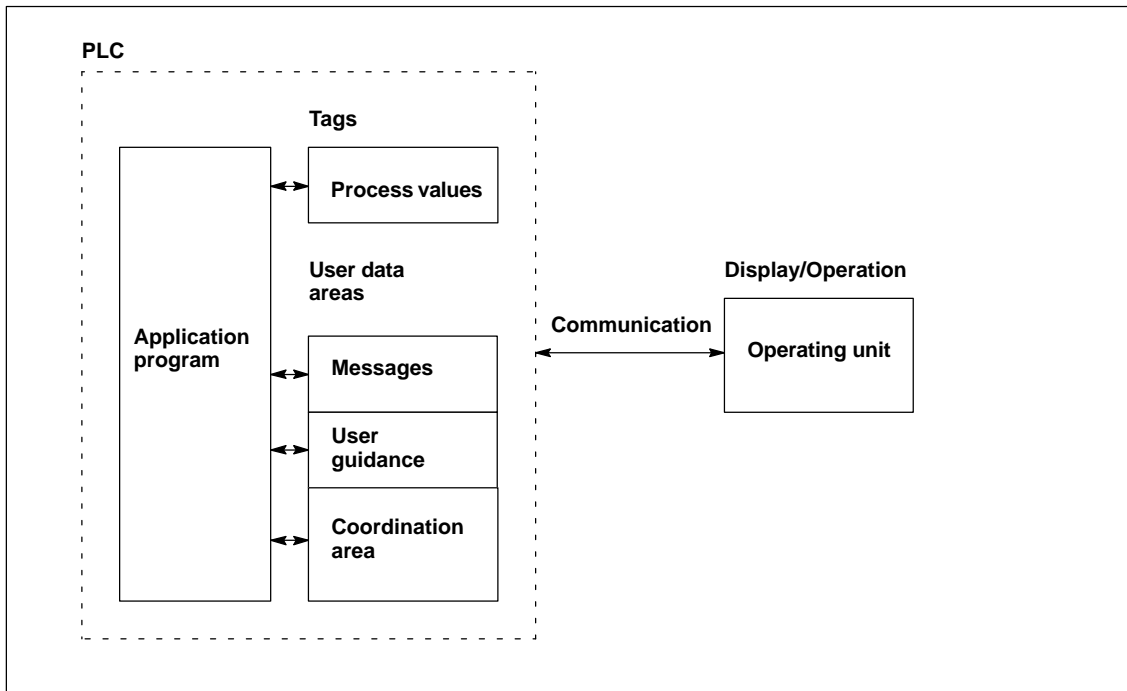


Figure 5-3 Communication structure

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 6.

5.2 Configuration in ProTool

When creating a new project, select the protocol required from the *Project Wizard* → *PLC Selection* dialog box.

Set the protocol:

- Allen-Bradley DH485 for the SLC and MicroLogix PLCs

Note

The settings on the operating unit must match with those on the PLC.

When starting up, ProTool must not be integrated in STEP 7; deactivate the menu item *Integration in STEP 7*.

Select the *Parameter . . .* button to define the protocol parameters. Define the following parameters for the PLC:

Table 5-2 PLC parameters

Parameters	Explanation
OP address	Set the OP address here. The addresses 1-31 are available for selection.
Target address	Set the address of the PLC to be communicated with. The addresses 1-31 are available for selection.
Max. bus address	Set the maximum bus address to be taken into account for token transfer. The addresses 2-31 are available for selection.
Interface	The operating unit interface to which the PLC is connected must be set here. <ul style="list-style-type: none"> - Panel PC: COM 1 or COM 2 - Standard PC: COM 1 to COM 4 - MP 370: IF1A, IF2 or IF1B - MP 270, MP 270B: IF1A, IF2 or IF1B - TP 270, OP 270: IF1A, IF2 or IF1B - TP 170B, OP 170B: IF1A, IF2 or IF1B - TP 170A: IF1A or IF1B
CPU type	Define a controller type. Select SLC50x for SLC503, SLC504 or SLC505.
Interface type	Set RS232 or RS422 according to the PLC.
Data bits	Set 8 or 7 – default: 8
Parity	Set NONE, EVEN or UNEVEN – default: even
Stop bits	Set 1 or 2.
Baud rate	Define the transmission rate between the operating unit and PLC here. System setting: 9600 bit/s.

For subsequent changes to the parameters, select PLC in the project window and then *Properties* → *Parameter . . .*

5.3 Data Types

When configuring tags and area pointers, the data types listed in Table 5-3 are available for use.

Table 5-3 Data types

Data type	Addressed by	Format
ASCII ¹	A	ASCII
Binary	B	BIT, UNSIGNED INT
Counter	C	BIT, SIGNED INT, UNSIGNED INT
Float ¹	F	REAL
Digital Input	I	BIT, UNSIGNED INT
Data Register (Integer)	N	BIT, SIGNED INT, UNSIGNED INT, SIGNED LONG, UNSIGNED LONG, REAL
Digital Output	O	BIT, UNSIGNED INT
Control	R	BIT, UNSIGNED INT
Status	S	BIT, UNSIGNED INT
Timer	T	BIT, SIGNED INT, UNSIGNED INT

¹ Valid for SLC 503, SLC 504 and SLC 505

Representation in ProTool

In ProTool the data format UNSIGNED INT is abbreviated as UIN, UNSIGNED LONG as ULONG, SIGNED INT as INT and SIGNED LONG as LONG.

Note

Input/output modules with 8 or 16 ports occupy a complete word in the PLC. An input/output module with 24 or 32 ports occupies two words. If non-available bits are assigned in the operating unit, the unit issues an error message.

For this reason, ensure that only those bits are assigned which are assigned to a port when configuring input/output modules with 8 or 24 ports.

5.4 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 effective update time is improved by setting one single large area rather than several smaller 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: Approx. 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 by the operating unit, 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.

Network configuration

The network participants (operating unit and PLC) are basically considered equal in the case of the DH485 protocol. The owner of a so called “token” has the current bus control until the token is transferred to the participant with the node one number higher. For optimum bus configuration, ensure the following:

- The bus participants should be assigned consecutive numbers starting with one, without any gaps where possible, so that there are no interruptions in the token transfer.
- The “Max. bus address” parameter should be exactly 1 higher than the highest bus node address used.

User Data Areas for Allen-Bradley PLCs

6

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.

6.1 User Data Areas Available

Definition

The user data areas can be set up in the PLC as output, input, status, binary and N files.

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 6-1 and 6-2 provide an overview of the functional range of the individual operating units.

Table 6-1 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 6-2 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 6-3 illustrates the way in which the PLC and operating unit access the individual user data areas – Read (R) or Write (W).

Table 6-3 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	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.

6.2 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*

6.3 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		
n+0	0	Job no.
n+1	Parameter 1	
n+2	Parameter 2	
n+3	Parameter 3	

Figure 6-1 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.

6.4 User Data Areas, 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 6-4 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 6-4 Division of message areas

Operating unit	Event message area, Alarm message area OP acknowledgement area, PLC acknowledgement area			
	Number of data areas, maximum	Words in data area, maximum	Words, total	Messages, total
Panel PC	8	125	250	4000
Standard PC	8	125	250	4000
MP 370	8	125	250	4000
MP 270, MP 270B	8	125	250	4000
TP 270, OP 270	8	125	250	4000
TP 170B, OP 170B	8	125	125	2000
TP 170A ¹	8	63	63	1000

¹ Only event messages possible.

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:

N 7 Element 8 Length 5 (in words)

Figure 6-2 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.

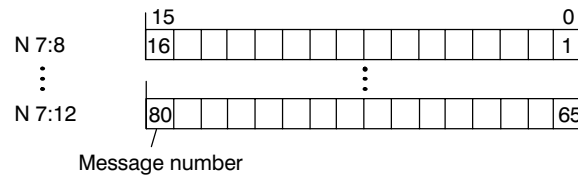


Figure 6-2 Assignment of message bit and message number

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

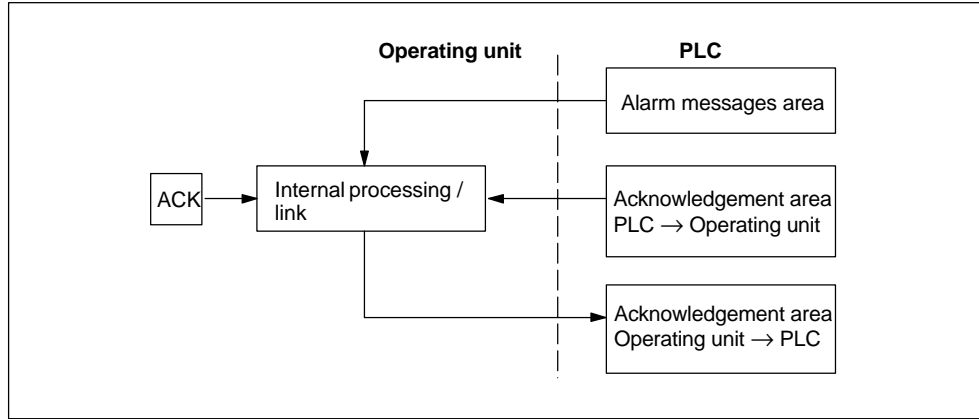


Figure 6-3 Alarm message and acknowledgement areas

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:

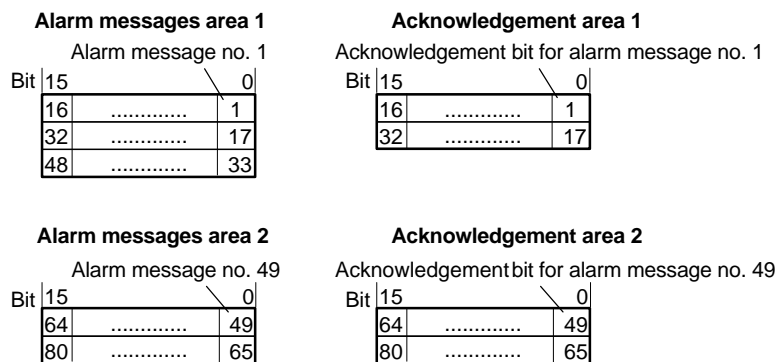


Figure 6-4 Assignment of acknowledgement bit and message number

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 6-5 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.

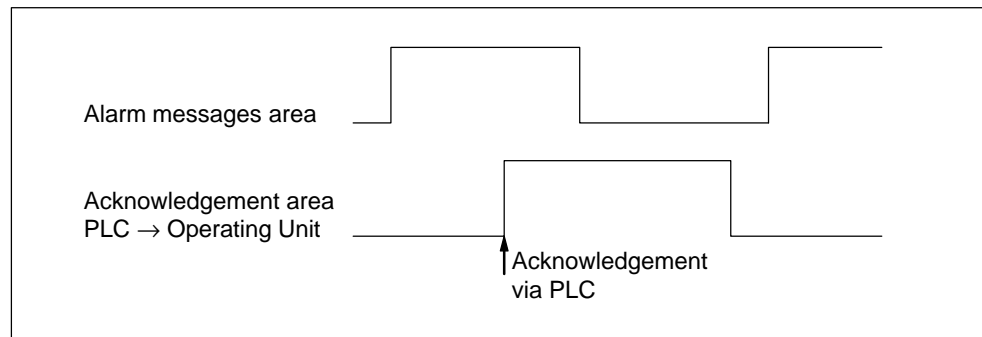


Figure 6-5 Signal diagram for acknowledgement area PLC → Operating Unit

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 6-6 illustrates the signal diagram.

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

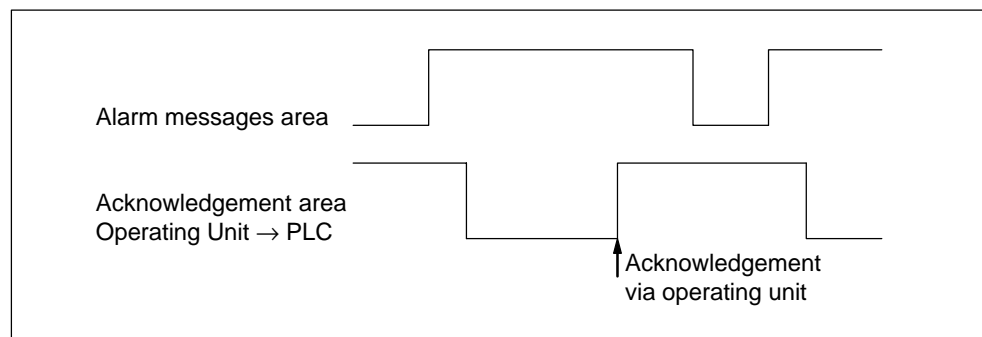


Figure 6-6 Signal diagram for acknowledgement area Operating Unit → PLC

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 6-7 illustrates such a case.

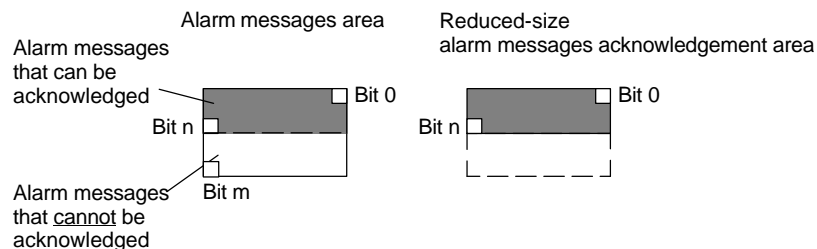


Figure 6-7 Reduced-size acknowledgement area

Note

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

6.5 User Data Area, Screen Number

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.

	15	8	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

6.6 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 6-8 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)		
n+2	Reserved				
n+3	Reserved		Weekday (1-7, 1=Sun)		Date
n+4	Day (1-31)		Month (1-12)		
n+5	Year (80-99/0-29)		Reserved		

Figure 6-8 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.

6.7 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 6-9 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.

6.8 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

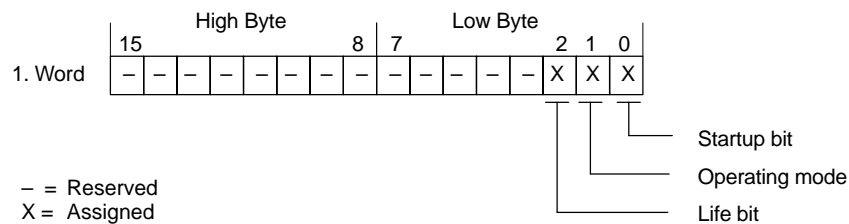


Figure 6-10 Significance of the bits in the coordination area

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.

6.9 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 (refer to Table 6-5).

Table 6-5 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

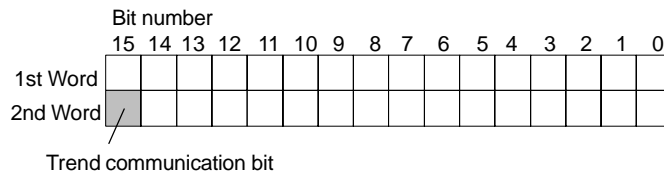
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

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 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.

6.10 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 6-6 Partitioning of the LED assignment 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:

Table 6-7 LED states

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

6.11 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 6-19)
- Synchronized transfer using the data mailbox (Page 6-20)

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 6-21)
- By PLC jobs (Page 6-22)
- By activating configured functions (Page 6-23)

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.

6.11.1 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.

6.11.2 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*.

6.11.3 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:

Decimal	Value		Explanation
	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

6.11.4 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	<ul style="list-style-type: none"> 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". <ul style="list-style-type: none"> 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 6-25.

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 6-25.

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	<ul style="list-style-type: none"> 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”.	
	<ul style="list-style-type: none"> 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.

6.11.5 PLC jobs with 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 – 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 – 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	—	

Part IV

Connection to GE Fanuc Automation PLCs

Communication Management for
GE Fanuc PLCs

7

User Data Areas for
GE Fanuc PLCs

8

Communication Management for GE Fanuc PLCs

7

This chapter describes the communication between operating unit and GE Fanuc Automation PLCs from the 90-30, 90-70 and 90-Micro series.

General information

The GE Fanuc Automation PLCs consist of the 90-70, 90-30 and 90 Micro series. In the subsequent section, these series are referred to under the general term GE Fanuc PLC 90.

The connection, in the case of these PLCs, is established by the following internal PLC protocol:

- SNP/SNPX – multi-point connection

Operating units

The following operating units can be connected to a GE Fanuc PLC 90 controller:

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

Installation

The driver necessary for the connection to the GE Fanuc PLC 90 controllers is contained in the configuration software and is installed automatically.

The connection between the operating unit and the PLC is basically restricted to defining the interface parameters. Special function blocks for connection to the PLC are not required.

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Connection

The connection between the operating unit and GE Fanuc PLC 90 controllers is basically restricted to defining the interface parameters and bus address. Special function blocks for connection to the PLC are not required.

The operating unit must be connected to the appropriate PLC interface (refer to the documentation supplied with the PLC).

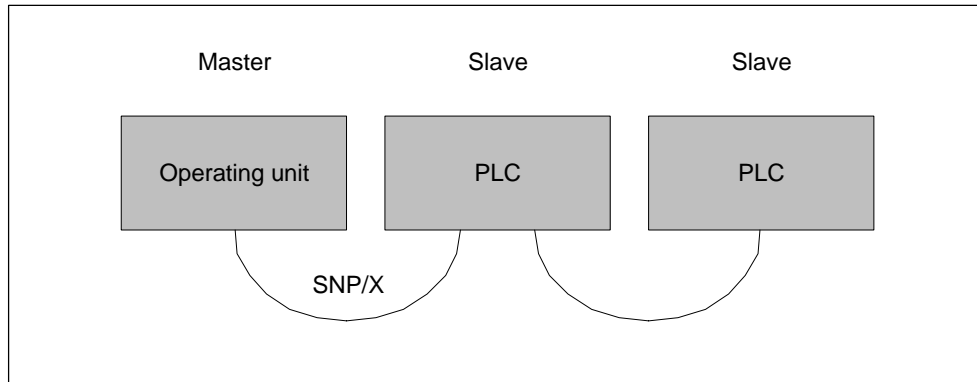


Figure 7-1 Connection between the operating unit and PLC

The following connection cables are available for connection of the operating unit to the PLC:

Table 7-1 Applicable connection cables (refer to Appendix, Part C Interface Assignment)

Interface	9-pin	6-pin	15-pin	8-pin
RS 232, 9-pin	For Adapter 2	Western connector 2	–	RJ 45_2
RS 232, 15-pin	For Adapter 1	Western connector 1	–	RJ 45_1
RS 232, with cable to adapter	–	–	Multi-point cable 2	–
RS 422, 9-pin	–	–	Multi-point cable 1	–

'_' Length code (refer to Catalog ST 80)

Caution

Only valid for MP 270.

After disconnecting and then reconnecting a plug, it is possible that no connection is re-established to the operating unit. The connection is only established after the operating unit has been restarted. This condition only occurs in the case of the MP 270 and a direct connection via the RS 422 (IF1B).

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

7.1 Basic Methods of Functioning

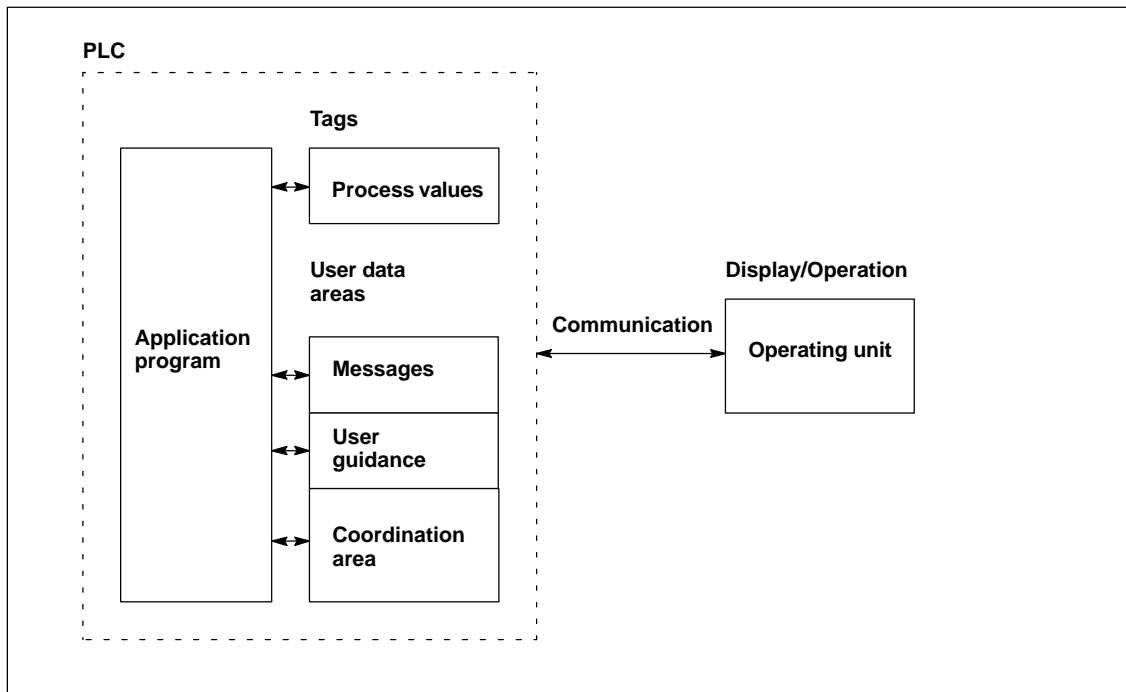


Figure 7-2 Communication structure

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 8.

7.2 Configuration in ProTool

When creating a new project, select the protocol required from the *Project Wizard* → *PLC Selection* dialog box.

Set the protocol:

- SNP/SNPX

Note

The settings on the operating unit must match with those on the PLC.

When starting up, ProTool must not be integrated in STEP 7; deactivate the menu item *Integration in STEP 7*.

Select the *Parameter . . .* button to define the protocol parameters. Define the following parameters for the PLC:

Table 7-2 PLC parameters

Parameters	Explanation
Bus address	Set the PLC bus address here. 7 ASCII characters are permitted: 0–9, _ (underscore) and A–Z (capital letters).
CPU type	Set the CPU type of that used in the PLC. If the CPU type cannot be selected, select the CPU type <i>Free</i> .
Interface	The operating unit interface to which the PLC is connected must be set here. <ul style="list-style-type: none"> – PanelPC COM 1 or COM 2 – Standard PC COM 1 to COM 4 – MP 370 IF1A, IF2 or IF1B – MP 270, MP 270B IF1A, IF2 or IF1B – TP 270, OP 270 IF1A, IF2 or IF1B – TP 170B, OP170B IF1A, IF2 or IF1B – TP 170A IF1A or IF1B
LongBreak	Set the time (in ms) to establish the connection to the individual PLCs.
Interface type	Set RS232 or RS422 according to the PLC.
Data bits	Set 8 here.
Parity	Set NONE , EVEN or UNEVEN.
Stop bits	Set 1 or 2 here.
Baud rate	Define the transmission rate between the operating unit and PLC here. System setting: 9600 bit/s.

LongBreak

It is recommended to retain the default setting of 50 ms. If connection problems should occur despite identical interface parameters in the PLC and operating unit, increase this value step by step.

Note

An increase in the LongBreak automatically causes an increase in the update time.

For subsequent changes to the parameters, select PLC in the project window and then *Properties* → *Parameter*

7.3 Data Types

When configuring tags and area pointers, the data types listed in Table 7-3 are available for use.

Table 7-3 Data types

Data type	Addressed by	Format
Analog IN	AI	Word, UInt, Int, DWord, DInt, Real BCD-4, BCD-8
Analog OUT	AQ	Word, UInt, Int, DWord, DInt BCD-4, BCD-8
Binary	M, T or G	Bit, Byte, Word, UInt, Int, DWord, DInt BCD-4, BCD-8
Digital Input	I	Bit, Word
Digital Output	Q	Bit, Word
Data Register (Integer)	R	Word, UInt, Int, DWord, DInt BCD-4, BCD-8
Status	S, SA, SB, SC	Bit, Word
Program Registers (90-70 CPU only)	P	Word, UInt, Int, DWord, DInt BCD-4, BCD-8

Note

Valid for the Program Register data type:

The password for access to *Program Register* (addressing: P) is "P_TASK". This password cannot be changed by the user because it is defined in the driver.

The password is contained in the protocol for access to *Program Register*. Therefore, the LM-90 project, to which access is required, must have the name P_TASK.

Representation in ProTool

In ProTool the data format UNSIGNED INT is abbreviated as UIN, UNSIGNED LONG as ULONG, SIGNED INT as INT and SIGNED LONG as LONG.

7.4 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 effective update time is improved by setting one single large area rather than several smaller 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: Approx. 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 by the operating unit, 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 GE Fanuc PLCs

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.

8.1 User Data Areas Available

Definition

The user data areas can be set up in various data areas in the PLC (Data Register (R), Binary (M)).

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 8-1 and 8-2 provide an overview of the functional range of the individual operating units.

Table 8-1 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 8-2 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 8-3 illustrates the way in which the PLC and operating unit access the individual user data areas – Read (R) or Write (W).

Table 8-3 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	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.

8.2 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*

8.3 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	Right byte
n+0	0	Job no.
n+1	Parameter 1	
n+2	Parameter 2	
n+3	Parameter 3	

Figure 8-1 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. Afterwards, the unit 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.

8.4 User Data Areas, 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 8-4 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 8-4 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, maximum	Words, total	Messages, total
Panel PC	8	125	250	4000
Standard PC	8	125	250	4000
MP 370	8	125	250	4000
MP 270, MP 270B	8	125	250	4000
TP 270, OP 270	8	125	250	4000
TP 170B, OP 170B	8	125	125	2000
TP 170A ¹	8	63	63	1000

¹ Only event messages possible.

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:

R43 Address 43 Length 5 (in words)

Figure 8-2 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.

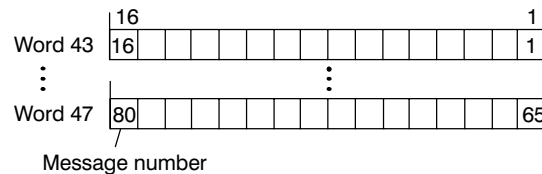


Figure 8-2 Assignment of message bit and message number

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 8-3 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 8-5 and 8-6.

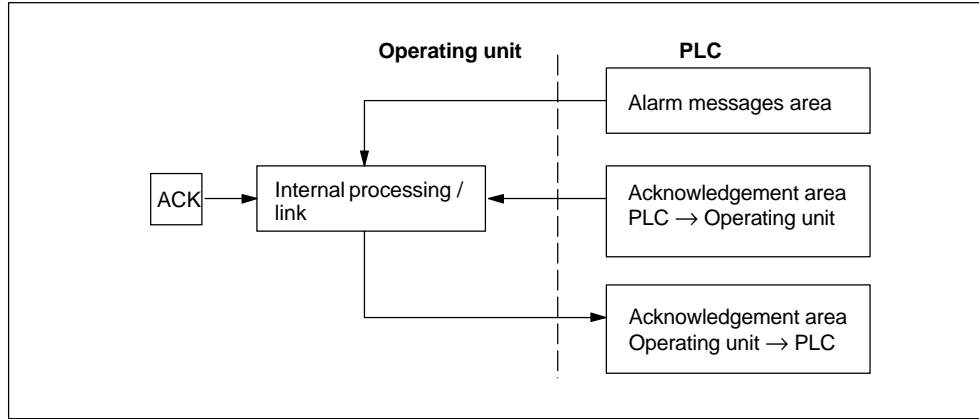


Figure 8-3 Alarm message and acknowledgement areas

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:

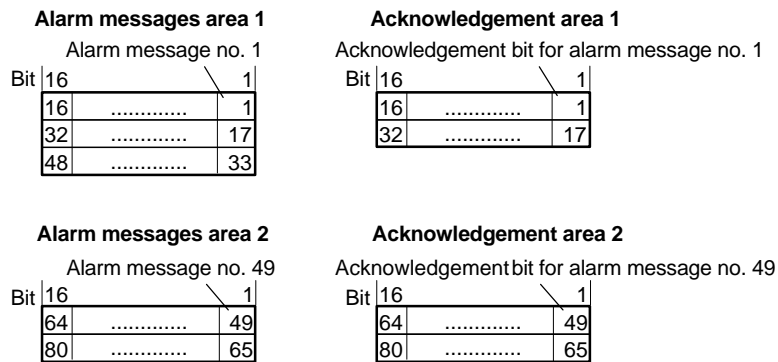


Figure 8-4 Assignment of acknowledgement bit and message number

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 8-5 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.

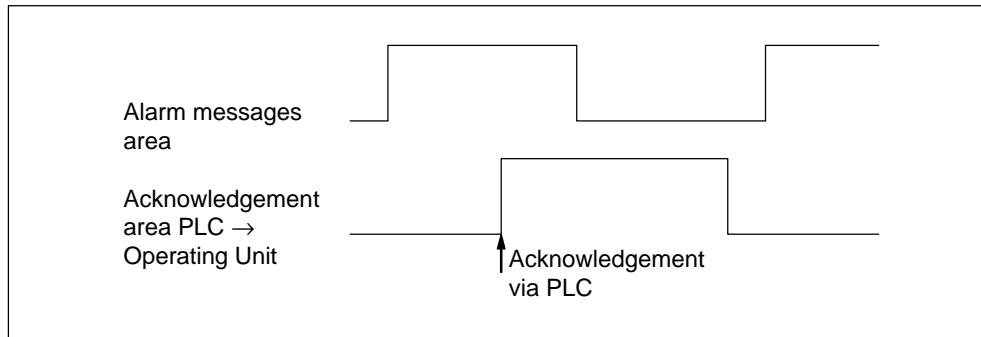


Figure 8-5 Signal diagram for acknowledgement area PLC → Operating Unit

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 8-6 illustrates the signal diagram.

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

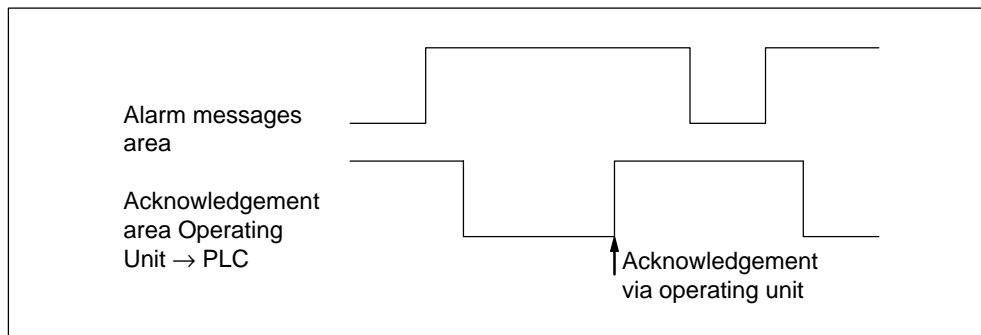


Figure 8-6 Signal diagram for acknowledgement area Operating Unit → PLC

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 8-7 illustrates such a case.

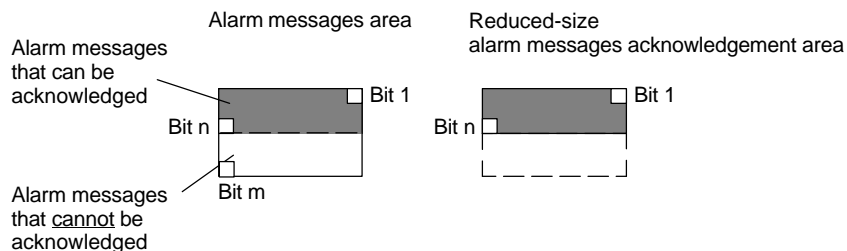


Figure 8-7 Reduced-size acknowledgement area

Note

Place important alarm messages in the alarm messages area starting at Bit 1 in ascending order.

8.5 User Data Areas, 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 words.

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

	16	9	8	1
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

8.6 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 8-8 illustrates the structure of the data area. All data is in BCD format.

	Left byte		Right byte		
DW	16	9	8	1	
n+0	Reserved		Hour (0–23)		Time
n+1	Minute (0–59)		Second (0–59)		
n+2	Reserved				
n+3	Reserved		Weekday (1–7, 1=Sun)		Date
n+4	Day (1–31)		Month (1–12)		
n+5	Year (80–99/0–29)		Reserved		

Figure 8-8 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.

8.7 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)

	Left byte		Right byte	
DW	16	9	8	1
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 8-9 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.

8.8 User Data Area, Coordination

The coordination user data area is two 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

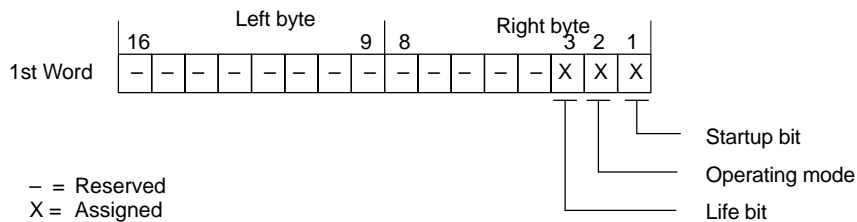


Figure 8-10 Significance of the bits in the coordination area

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.

8.9 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 (refer to Table 8-5).

Table 8-5 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

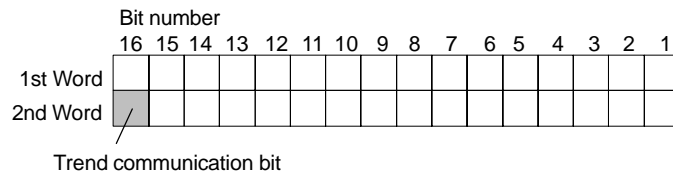
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

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.

8.10 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 8-6 Partitioning of the LED assignment 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:

Table 8-7 LED states

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

8.11 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 8-19)
- Synchronized transfer using the data mailbox (Page 8-20)

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 8-21)
- By PLC jobs (Page 8-22)
- By activating configured functions (Page 8-23)

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.

8.11.1 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.

8.11.2 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*.

8.11.3 Data mailbox for synchronized data transfer

Structure

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

	16	1
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:

Decimal	Value		Explanation
	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

8.11.4 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	<ul style="list-style-type: none"> 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". <ul style="list-style-type: none"> 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 8-25.

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 8-25.

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	<ul style="list-style-type: none"> 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”.	
	<ul style="list-style-type: none"> 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.

8.11.5 PLC jobs with 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 – 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 – 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	—	

Teil V **Connection to
LG Industrial Systems/
IMO PLCs**

Communication Management
for LG Industrial Systems/IMO

9

User Data Areas for LG Industrial
Systems/IMO

10

Communication Management for LG Industrial Systems/IMO PLCs

9

This chapter describes the communication between operating unit and LG Industrial Systems (Lucky Goldstar) PLCs from the GLOFA-GM (GM4, GM6 and GM7) series and IMO PLCs from the G4, G6 and G7M series.

General Information

Communication from one or more LG Industrial Systems/IMO PLCs is realized via a Cnet communication module with RS 232/RS 485/RS 422 physics to the operating unit.

The connection, in the case of these PLCs, is established by the following internal PLC protocol:

- Dedicated communication

Operating units

The following operating units can be connected to one of the PLCs mentioned above:

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

Note

The operating unit can only be implemented as a master.

A licensed runtime version must be installed on the Panel PC and standard PC.

Installation

The driver necessary for the connection to the PLCs mentioned is contained in the configuration software and is installed automatically.

The connection between the operating unit and the PLC is basically restricted to defining the interface parameters. Special function blocks for connection to the PLC are not required.

Connection

The operating unit must be connected to the Cnet module, e.g. G4L-CUEA or G6L-CUEC, via the RS 232, RS 422 or RS 485 interface. In the case of the RS 232 interface, only zero modem mode is supported.

The "Dedicated Protocol" available also provides a direct connection possibility to the GM6 CPU-B without ComputerLinkModule (Cnet) G6L, but this GM6-CPU communication, however, does **not** support any symbolic tags *Named*.

The following connection cables are available for connection of the operating unit to the PLC:

Table 9-1 Applicable connection cables (refer to Appendix, Part C Interface Assignment)

Interface	Point-to-point cable	Multi-point cable
RS 232, 9-pin	Point-to-point cable 1	–
RS 232, 15-pin	Point-to-point cable 4	–
RS 422, 9-pin	Point-to-point cable 2	Multi-point cable 2
RS 485, 9-pin	Point-to-point cable 3	Multi-point cable 1

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

Setting the operating mode switch on the Cnet module

The Operating Mode Switch must be set to *Dedicated* (e.g. in the case of G4L-CUEA, to Position "3").

9.1 Basic Methods of Functioning

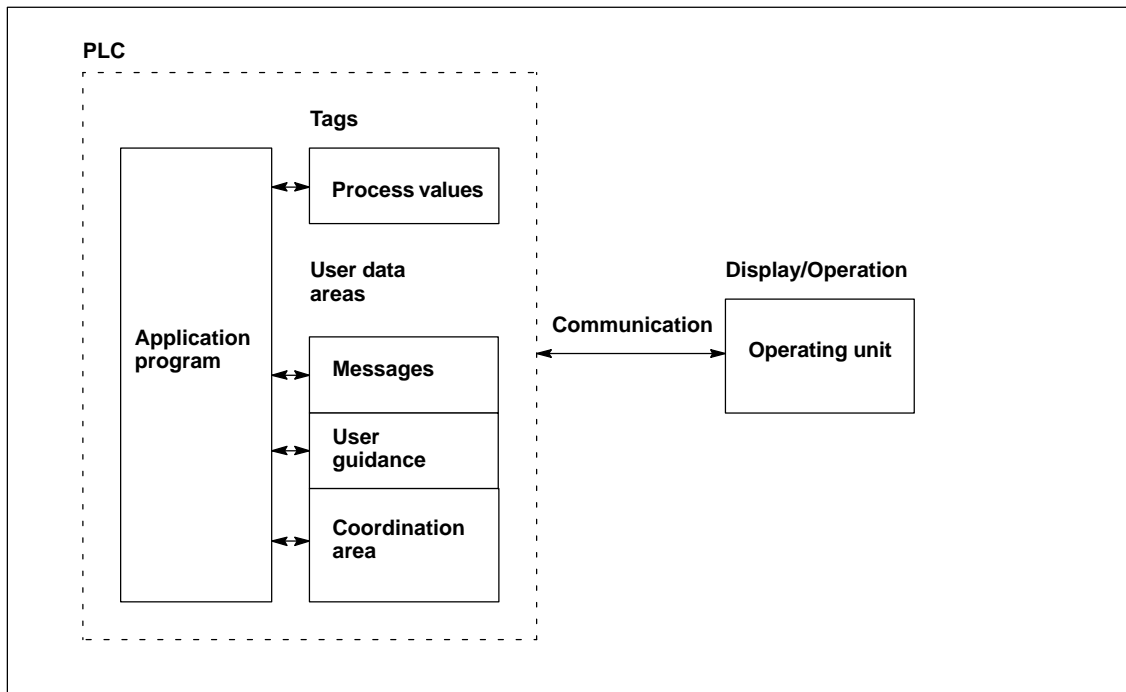


Figure 9-1 Communication structure

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 10.

9.2 Configuration in ProTool

When creating a new project, select the protocol required from the *Project Wizard* → *PLC Selection* dialog box.

Note

The settings on the operating unit must comply with those on the PLC.

By using the Cnet Frame Editor (CnetEdit.exe) program, it is possible to check and define the control parameters for the Cnet module. These settings only take effect on the Cnet module when power is switched on again. The parameters for GM6 CPU-B and GM7 are set using GMWIN.

Note

The settings on the operating unit must match with those on the PLC.

When starting up, ProTool must not be integrated in STEP 7; deactivate the menu item *Integration in STEP 7*.

Select the *Parameter . . .* button in order to set the protocol parameters and station address of the Cnet module. Define the following parameters for the PLC:

Table 9-2 PLC parameters

Parameters	Explanation
Interface	The operating unit interface to which the PLC is connected must be set here. Note for Panels and Multi Panels If the IF1B interface is used, the RS 422 receive data signal and the RTS signal must be switched by using the 4 DIL switches on the rear side of the Multi Panels. Further information is available in the operating unit equipment manual.
Station	This is used to set the Cnet module station address of the PLC. Values between 0 and 31 are permissible.
Interface type	Set RS232, RS422 or RS485 here.
Data bits	Set 7 or 8.
Parity	Set NONE, EVEN and or UNEVEN.
Stop bits	Set 1 or 2.
Baud rate	Define the transmission rate between the operating unit and PLC here. System setting: 38400 bit/s.

For subsequent changes to the parameters, select PLC in the project window and then *Properties* → *Parameters . . .*

9.3 Data types

When configuring tags and area pointers, the data types listed in Table 9-3 are available for use.

Table 9-3 Data types

Data type	Name	Addressed by	Format
Internal Memory	%M	0 to max. 64 kbyte	BOOL, BYTE, WORD, DOUBLE WORD
Output	%Q	Base (0–63) Slot (0–7) Card (0–63)	BOOL, BYTE, WORD, DOUBLE WORD
Input	%I	Base (0–63) Slot (0–7) Card (0–63)	BOOL, BYTE, WORD, DOUBLE WORD
Symbolic tag	Named	Max. 16 byte longer string consisting of A–Z, 0–9, “_”	BOOL, BYTE, WORD, DOUBLE WORD, SINT, INT, DINT, USINT, UINT, UDINT, TIME, STRING

Representation in ProTool

The condition for this is that these data areas have also been set up with GMWIN for the CPU.

In the case of *symbolic tags*, the name entered must be exactly the same as that used in the PLC. In order to have write access to a *symbolic tag* it must be registered as READ_WRITE in the “access variable area” of the PLC under GMWIN; READ_ONLY is only sufficient for output fields.

Note

The symbolic tags `Named` cannot be used for communication with GM7 (via the Cnet module) and direct to GM6 CPU-B.

Note

Only `MW%` can be used for area pointers.

The following options are available for entering the address for internal memory `%M` in BOOL format:

- `MX` `Bit`
- `MB` `Bit-in-byte`
- `MW` `Bit-in-word`
- `fD` `Bit-in-Dword`

STRINGS of up to 4 ASCII characters can be read by the Lucky Goldstar communication software and **not** written.

9.4 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 effective update time is improved by setting one single large area rather than several smaller 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: Approx. 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 by the operating unit, 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 LG Industrial Systems/IMO PLCs

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

The user data areas can be set up in various data areas in the PLC (Internal Memory (M)).

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*.

Functional 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
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
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*

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.

Word	Left byte (LB)	Right byte (RB)
n+0	0	Job no.
n+1	Parameter 1	
n+2	Parameter 2	
n+3	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. Afterwards, the unit 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 OP acknowledgement area, PLC acknowledgement area			
	Number of data areas, maximum	Words in data area, maximum	Words, total	Messages, total
Panel PC	8	125	250	4000
Standard PC	8	125	250	4000
MP 370	8	125	250	4000
MP 270, MP 270B	8	125	250	4000
TP 270, OP 270	8	125	250	4000
TP 170B, OP 170B	8	125	125	2000
TP 170A ¹	8	63	63	1000

¹ Only event messages possible.

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:

M43 Length 5 (in words)

Figure 10-2 illustrates the assignment of all 80 (5 x16) message numbers to the individual bit numbers in the PLC event message area. The assignment is performed automatically on the operating unit.

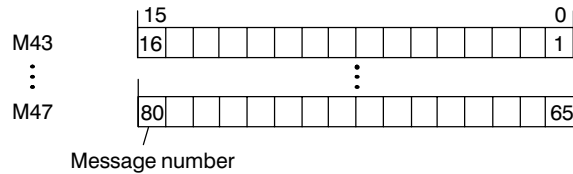


Figure 10-2 Assignment of message bit and message number

User Data Area, 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.

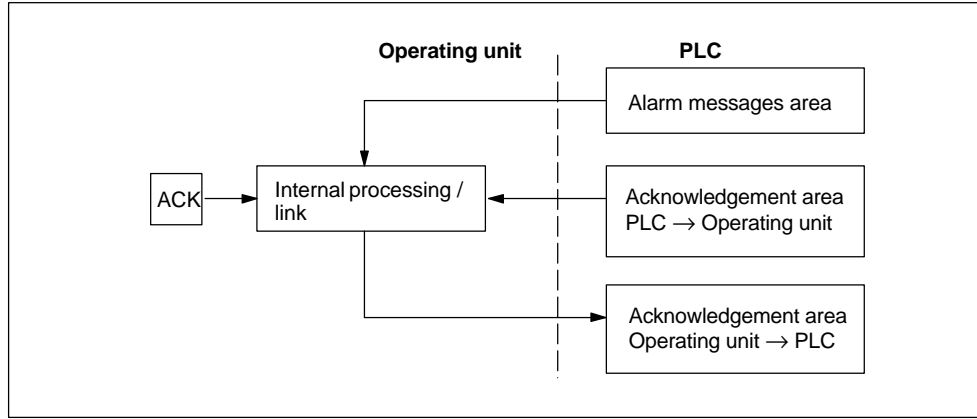


Figure 10-3 Alarm message and acknowledgement areas

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:

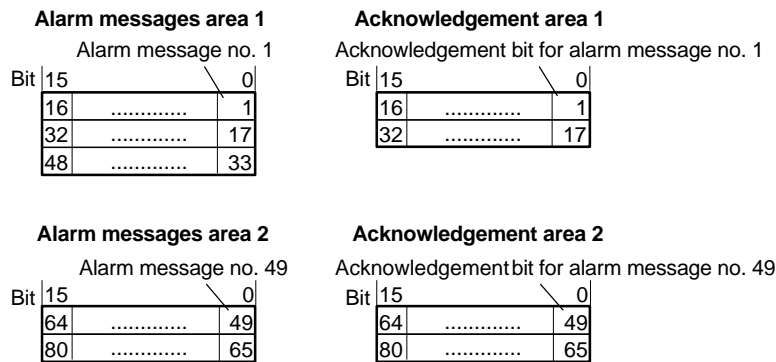


Figure 10-4 Assignment of acknowledgement bit and message number

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 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.

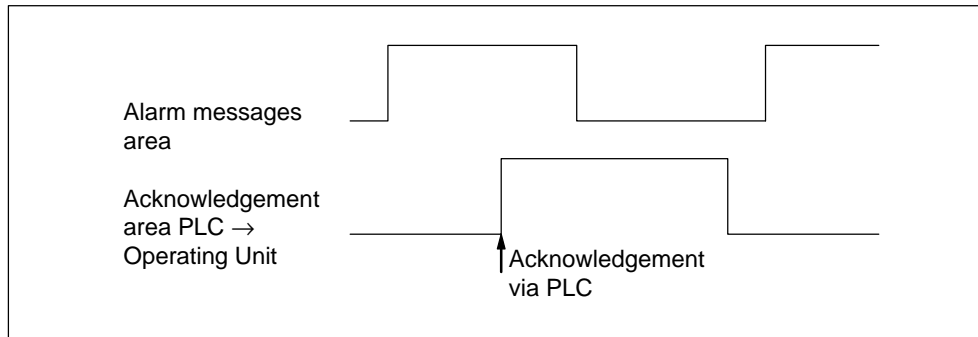


Figure 10-5 Signal diagram for acknowledgement area PLC → Operating Unit

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.

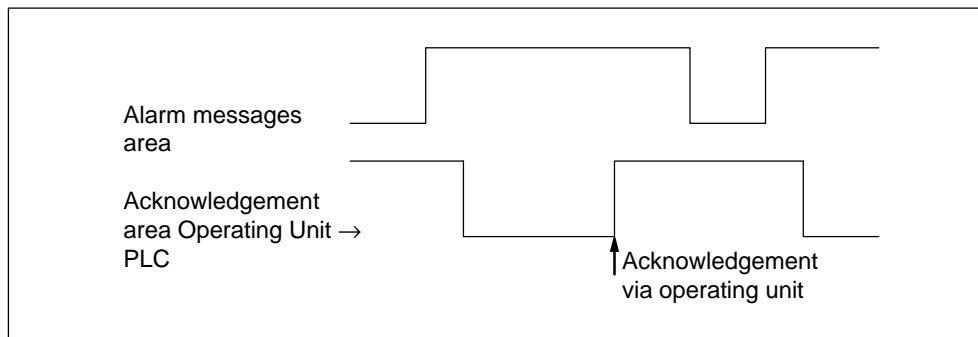


Figure 10-6 Signal diagram for acknowledgement area Operating Unit → PLC

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.

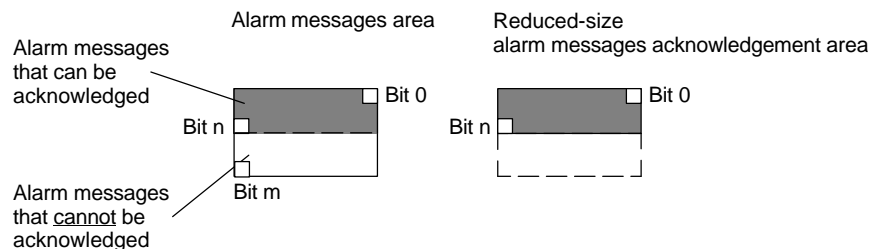


Figure 10-7 Reduced-size acknowledgement area

Note

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

10.5 User Data Area, Screen Number

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 words.

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

	15	8	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

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 10-8 illustrates the structure of the data area. All data is in BCD format.

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

Figure 10-8 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.

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)

	Left byte		Right byte	
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 10-9 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.

10.8 User Data Area, Coordination

The coordination user data area is two 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

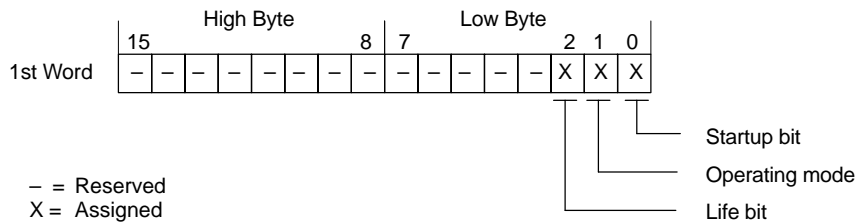


Figure 10-10 Significance of the bits in the coordination area

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.

10.9 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 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 (refer to 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

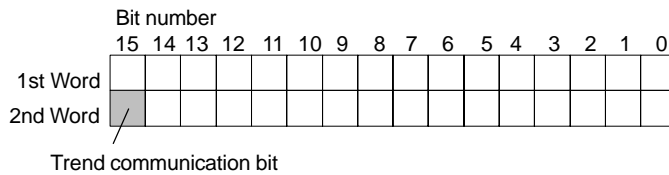
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

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 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 the LED assignment 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:

Table 10-7 LED states

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.

Operating modes

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

- Asynchronous transfer (Page 10-19)
- Synchronized transfer using the data mailbox (Page 10-20)

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 10-21)
- By PLC jobs (Page 10-22)
- By activating configured functions (Page 10-23)

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.

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 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.

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 Guide*.

10.11.3 Data mailbox for synchronous 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:

Decimal	Value		Explanation
	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	<ul style="list-style-type: none"> 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". <ul style="list-style-type: none"> 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 10-25.

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 10-25.

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	<ul style="list-style-type: none"> 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”.	
	<ul style="list-style-type: none"> 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-related 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 with 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 – 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 – 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	—	

Part VI

Connection to Mitsubishi Electric PLCs

Communication Management for
Mitsubishi Electric via PU

11

Communication Management for
Mitsubishi Electric via Protocol 4

12

User Data Area for
Mitsubishi Electric PLCs

13

Communication Management for Mitsubishi PLCs via PU Protocol

11

This chapter describes the communication between operating unit and Mitsubishi Electric PLCs from the MELSEC FX and MELSEC FX0 series.

General Information

The connection, in the case of these PLCs, is established by the following protocol:

- Programming unit protocol (PU protocol) – point-to-point connection

The driver necessary for the connection to the MELSEC FX and MELSEC FX0 PLCs is contained in the configuration software and is installed automatically.

Operating units

The following operating units can be connected to a Mitsubishi PLC:

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

Connection

The operating unit must be connected to the programming interface of the CPU (RS 422) (refer to PLC documentation).

The connection between the operating unit and Mitsubishi Electric PLC is basically restricted to defining the interface parameters and bus address. Special function blocks for connection to the PLC are not required.

The following connection cables are available for connection of the operating unit to the PLC:

Table 11-1 Applicable connection cables (refer to Appendix, Part C Interface Assignment)

Interface	FX series, Sub-D, 25-pin	FX0, Mini DIN, 8-pin
RS 232, 9-pin	Mitsubishi SC-08 ¹	Mitsubishi SC-07 ¹
RS 232, 15-pin	Adapter 6XV1440-2UE32 Mitsubishi SC-081 ¹	Adapter 6XV1440-2UE32 Mitsubishi SC-071 ¹
RS 422, 9-pin	6XV1440-2R_ _ _	6XV1440-2P_ _ _
RS 422, 25-pin	–	6XV1440-2Q_ _ _

' _ ' Length code (refer to Catalog ST 80)

¹ Since Mitsubishi PLCs normally communicate via RS 422, the Mitsubishi programming cable SC-07 or SC-08 with integrated RS 422/RS 232 adaptation is required for the OP address.

Note

Only valid for RS 232:

Limited cable length of approx. 3 m.

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

Connection type

The point-to-point connection from an operating unit to a Mitsubishi FX CPU via the PU protocol (protocol for access to the program and memory elements of the FX series PC CPU, Version V121 and later) has undergone system tests by Siemens AG and been approved.

11.1 Basic Methods of Functioning

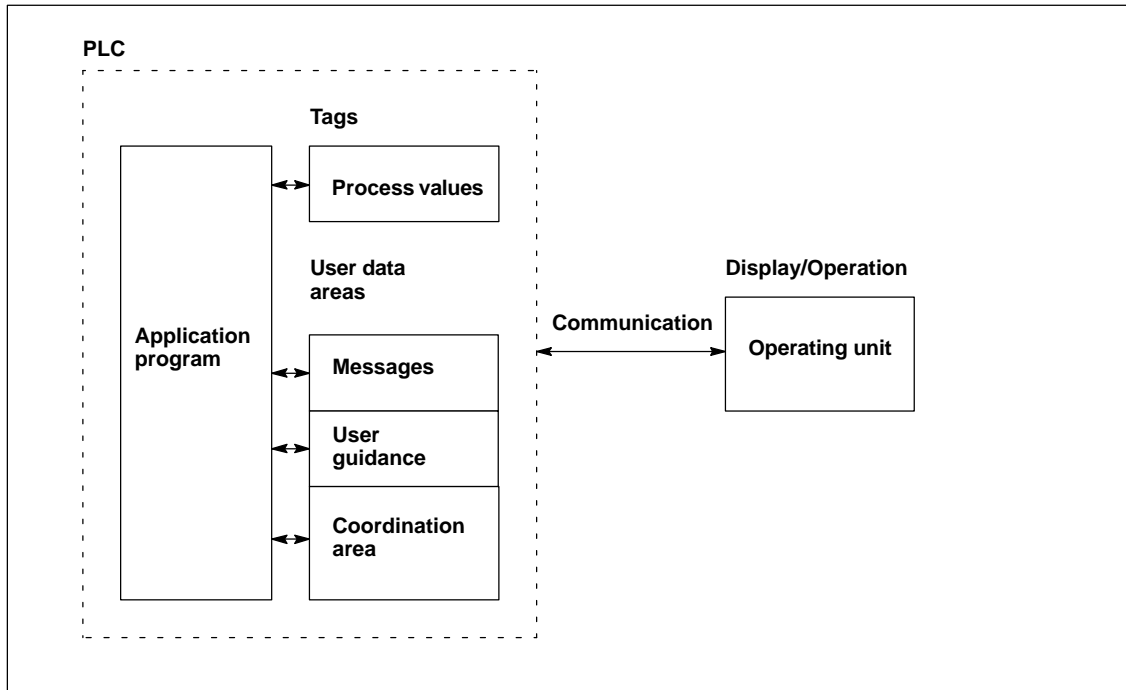


Figure 11-1 Communication structure

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 13.

11.2 Configuration in ProTool

When creating a new project, select the protocol required from the *Project Wizard* → *PLC Selection* dialog box.

Select the *Parameter ...* button to define the protocol parameters. Set the protocol:

- MITSUBISHI FX for the Mitsubishi PLC

Then define the following parameters after clicking on the *Parameter* button.

Note

The settings on the operating unit must match with those on the PLC.

When starting up, ProTool must not be integrated in STEP 7; deactivate the menu item *Integration in STEP 7*.

Define the following parameters for the PLC:

Table 11-2 PLC parameters

Parameters	Explanation
Interface	The operating unit interface to which the Mitsubishi PLC is connected must be set here.
CPU type	Define the PLC to which the operating unit is connected. Use the <i>FX Series</i> setting.
Interface type	Set RS232 or RS422. If the operating unit is a PC, only RS232 can be used.
Data bits	Set 7 or 8.
Parity	Set NONE, EVEN or UNEVEN.
Stop bits	Set 1 or 2.
Baud rate	Define the transmission rate between the operating unit and PLC here. The communication can be set to a baud rate of 19200, 9600, 4800, 2400, 1200, 600 or 300 baud.

For subsequent changes to the parameters, select PLC in the project window and then *Properties* → *Parameter ...*.

11.3 Data Types

When configuring tags and area pointers, the data types listed in Table 11-3 are available for use.

Table 11-3 Data types

Data type	Addressed by	Format
Input	X	Bit 4-bit block 8-bit block 12-bit block 16-bit block 20-bit block 24-bit block 28-bit block 32-bit block
Output	Y	Bit 4-bit block 8-bit block 12-bit block 16-bit block 20-bit block 24-bit block 28-bit block 32-bit block
Flag	F	Bit 4-bit block 8-bit block 12-bit block 16-bit block 20-bit block 24-bit block 28-bit block 32-bit block
Time element, actual value	T	Word
16-bit counter, actual value	C – 16-bit	Word
32-bit counter, actual value	C – 32-bit	DOUBLE
Data register	D	Bit Word, Double, String, IEEE float

11.4 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 effective update time is improved by setting one single large area rather than several smaller 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: Approx. 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 by the operating unit, 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.

Communication Management for Mitsubishi PLCs via Protocol 4

12

This chapter describes the communication between operating unit and Mitsubishi Melsec PLCs from the FX, A, AnS, Q and QnAS series.

General Information

The communication of Mitsubishi Melsec PLCs from the FX, A, AnS, Q and QnAS series is realized by the interface modules via an operating unit interface with RS 232 or RS 422 physics via Protocol 4.

Only those physical connections are enabled on operating units which are available as standard equipment for the units – this particularly applies to a standard PC on which only the RS 232 interface is enabled. A multi-point connection with up to 4 PLCs is possible via an RS 422 interface (Panel PCs and Multipanels) or an RS 232/RS 422 converter.

The connection, in the case of these PLCs, is established by the following protocol:

- Protocol 4 – point-to-point/multi-point connection

Operating units

The following operating units can be connected to a Mitsubishi PLC:

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

Note

The operating unit can only be implemented as a master.

Installation

The driver necessary for the connection to the FX, A, AnS, Q and QnAS PLCs is contained in the configuration software and is installed automatically.

The connection between the operating unit and the PLC is basically restricted to defining the interface parameters. Special function blocks for connection to the PLC are not required.

Connection

The operating unit can be connected to one or more PLCs from the Melsec-FX series via the multifunctional serial interface with an RS 232 or RS 422 communication module (e.g. FX2N-232-BD) or to PLCs from the A (AnN, AnA, AnU, AnS) Q and QnA (QnAS) series via interface modules, e.g. A1SJ71UC24-R2/R4 (AnS(H)), A1SJ71QC24 (QnAS), AJ71UC24 (A/AnU) or AJ71QC24N (Q/QnA) via RS 232 or RS 422.

The following connection cables are available for connection of the operating unit to the PLC:

Table 12-1 Applicable connection cables (refer to Appendix, Part C Interface Assignment)

Interface	Point-to-point cable	Multi-point cable
RS 232, 9/9-pin	Point-to-point cable 1	Multi-point cable 1 via converter
RS 232, 9/25-pin	Point-to-point cable 2	–
RS 232, 15/9-pin	Point-to-point cable 3	–
RS 232, 15/25-pin	Point-to-point cable 4	–
RS 422, 9-pin	Point-to-point cable 5	Multi-point cable 2

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

12.1 Basic Methods of Functioning

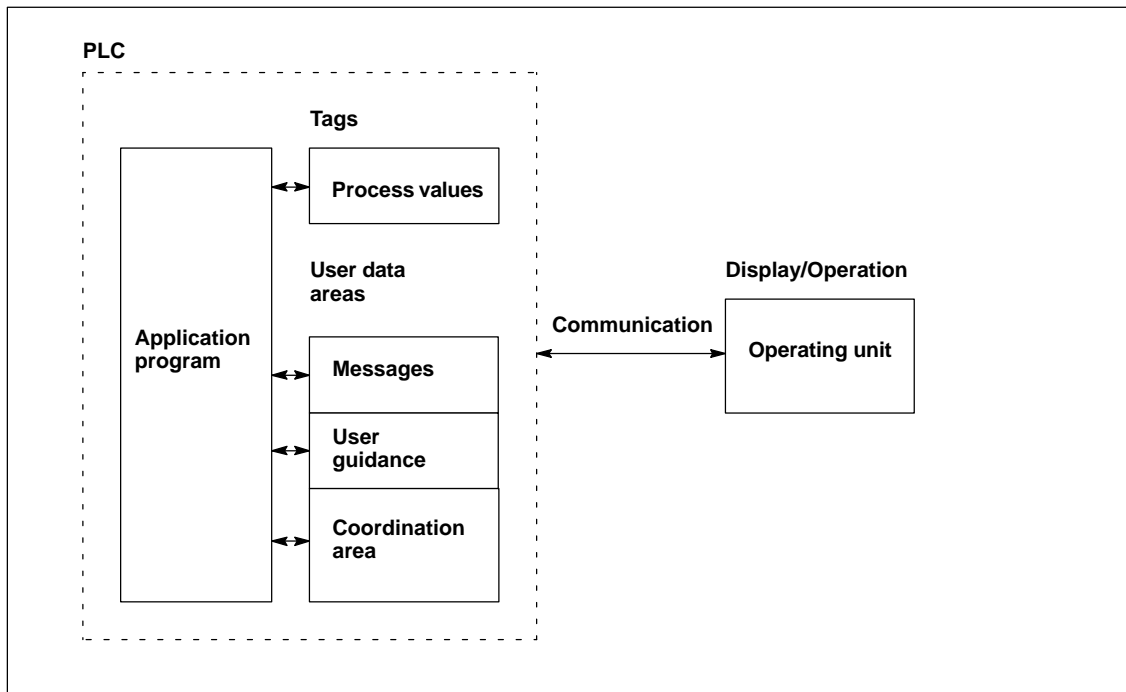


Figure 12-1 Communication structure

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 13.

Note

Area pointers can only be configured in user data area D.

If, a PLC from another series is included when configuring a PLC, not all tags can be transferred.

The inputs and outputs (X/Y) are converted from hexadecimal to octal for the FX series, and vice versa, in the case of the A/Q series. If the address is greater than the permissible address range of the target PLC (X/Y > 777, Timer/Counter > 999 or D > 9999), the address is allocated to 0. Non-existent operands, such as W, B, F are assigned to D0.

Protected areas (Write Disable During RUN) can only be read and not written to, according to the CPU type. Special relays/registers may be write protected or only for system use. Writing data in these special address areas (> 8191) may lead to malfunction of the CPU.

The data types STRING and REAL do not recognize all CPUs.

The CPUs in the various series have differing limits with regard to their address range, so refer to the Mitsubishi documentation for the relevant information.

12.2 Configuration in ProTool

When creating a new project, select the protocol required from the *Project Wizard* → *PLC Selection* dialog box.

Set the protocol:

- Mitsubishi Protocol 4

Note

The settings on the operating unit must match with those on the PLC.

When starting up, ProTool must not be integrated in STEP 7; deactivate the menu item *Integration in STEP 7*.

Select the *Parameter . . .* button to define the protocol parameters.

The parameters must be set via D8120 and D8121 in the FX series PLCs.

The parameters are set via switches on the interface modules of the A, Q, AnS, QnAS PLCs. In the case of module A1SJ71UC24-R2, the station number is always 0. The computer link, dedicated protocol, Protocol format 4 must be selected.

Define the following parameters for the PLC:

Table 12-2 PLC parameters

Parameters	Explanation
Interface	The operating unit interface to which the Mitsubishi PLC is connected must be set here.
CPU type	<p>Define the PLC type to which the operating unit is connected. The following entries are possible:</p> <ul style="list-style-type: none"> • FX0N/FX1S • FX/FX2C/FX1N/FX2N/FX2NC • A/AnS/AnN • AnA/AnU/Q/QnA/QnAS <p>The PLC type must be selected in order that:</p> <ul style="list-style-type: none"> • the maximum telegram length of the PLC is not exceeded during runtime, • protocol differences between FX/A/AnS/AnN CPUs (5-character addressing) and larger CPUs (7-character addressing) are realized and • the addressing for X and Y (hexadecimal or octal) can be adapted. <p>Instead of checking the address range of the operands according to the PLC, they are selected in the largest size possible for the protocol. The user is therefore not restricted when the memory areas of the PLCs supported are triggered.</p>
Station	Define the station number 0–15 of the PLC here.
Checksum	Select between <i>yes</i> and <i>no</i> here.
Interfaces type	Set RS232 or RS422. If the operating unit is a PC, only RS232 can be used.
Data bits	Set 7 or 8.
Parity	Set NONE, EVEN or UNEVEN.
Stop bits	Set 1 or 2.
Baud rate	Define the transmission rate between the operating unit and PLC here. The communication can be set to a baud rate of 19200 or 9600 baud.

For subsequent changes to the parameters, select the PLC in the project window and then *Properties* → *Parameters*

12.3 Data Types

When configuring tags and area pointers, the data types listed in Table 12-3 are available for use.

Table 12-3 Data types

Data type	Addressed by	Format
Output	Y	BOOL, 4-bit block 8-bit block 12-bit block 16-bit block 20-bit block 24-bit block 28-bit block 32-bit block
Input	X	BOOL, 4-bit block 8-bit block 12-bit block 16-bit block 20-bit block 24-bit block 28-bit block 32-bit block
Flag	F	BOOL, 4-bit block 8-bit block 12-bit block 16-bit block 20-bit block 24-bit block 28-bit block 32-bit block
Link marker	B	BOOL, 4-bit block 8-bit block 12-bit block 16-bit block 20-bit block 24-bit block 28-bit block 32-bit block
Timer	T	Word
Counter	C	Word, DWord
Data register	D	BOOL, Word, DWord, Int, DInt, Real, String

Table 12-3 Data types, continued

Data type	Addressed by	Format
Link register	W	Word, DWord, Int, DInt, Real
Fault marker	F	BOOL, 4-bit block 8-bit block 12-bit block 16-bit block 20-bit block 24-bit block 28-bit block 32-bit block

12.4 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 effective update time is improved by setting one single large area rather than several smaller 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: Approx. 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 by the operating unit, 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 Mitsubishi PLCs

13

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.

13.1 User Data Areas Available

Definition

The user data areas can be set up in various data areas in the PLC (data register (D)).

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 13-1 and 13-2 provide an overview of the functional range of the individual operating units.

Table 13-1 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 13-2 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 13-3 illustrates the way in which the PLC and operating unit access the individual user data areas – Read (R) or Write (W).

Table 13-3 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 area	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.

13.2 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*

13.3 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+1	Parameter 1	
n+2	Parameter 2	
n+3	Parameter 3	

Figure 13-1 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. Afterwards, the unit 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.

13.4 User Data Areas, 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 13-4 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 13-4 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, maximum	Words, total	Messages, total
Panel PC	8	125	250	4000
Standard PC	8	125	250	4000
MP 370	8	125	250	4000
MP 270, MP 270B	8	125	250	4000
TP 270, OP 270	8	125	250	4000
TP 170B, OP 170B	8	125	125	2000
TP 170A ¹	8	63	63	1000

¹ Only event messages possible.

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:

D 43 Length 5 (in words)

Figure 13-2 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.

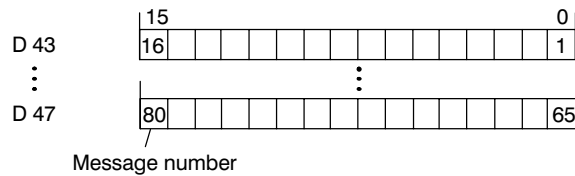


Figure 13-2 Assignment of message bit and message number

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 13-3 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 13-5 and 13-6.

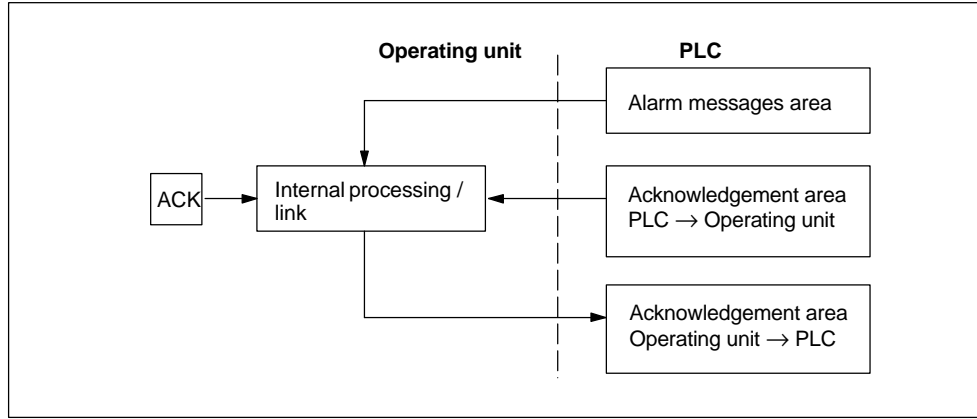


Figure 13-3 Alarm message and acknowledgement areas

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:

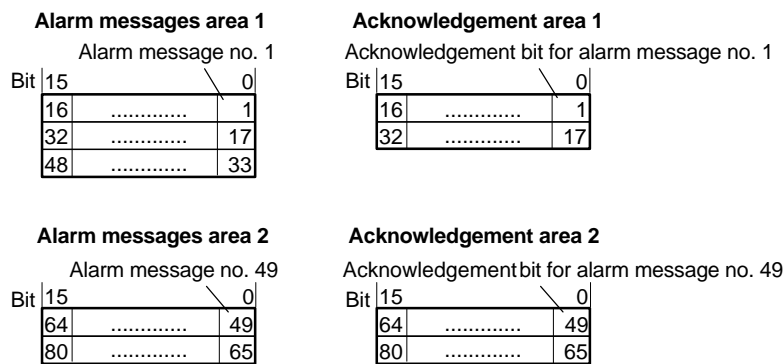


Figure 13-4 Assignment of acknowledgement bit and message number

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 13-5 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.

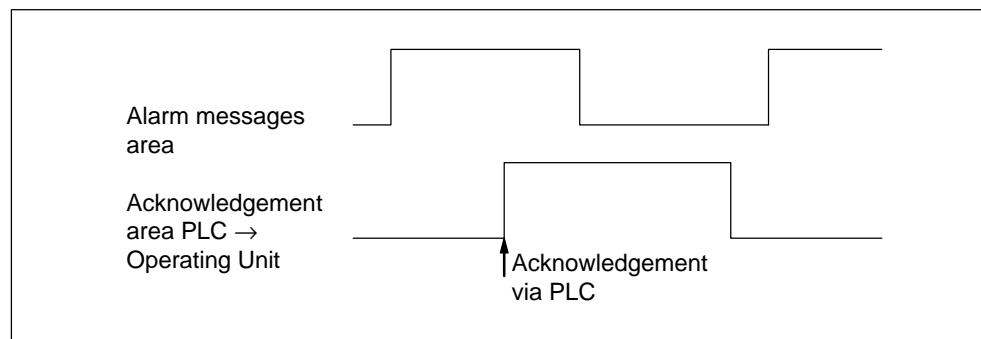


Figure 13-5 Signal diagram for acknowledgement area PLC → Operating Unit

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 13-6 illustrates the signal diagram.

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

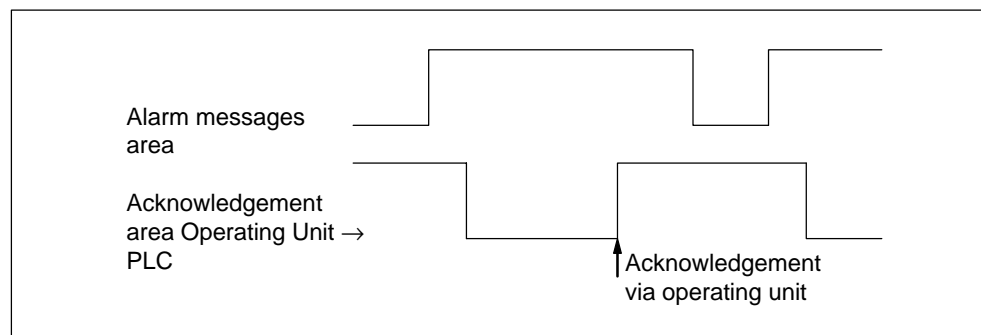


Figure 13-6 Signal diagram for acknowledgement area Operating Unit → PLC

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 13-7 illustrates such a case.

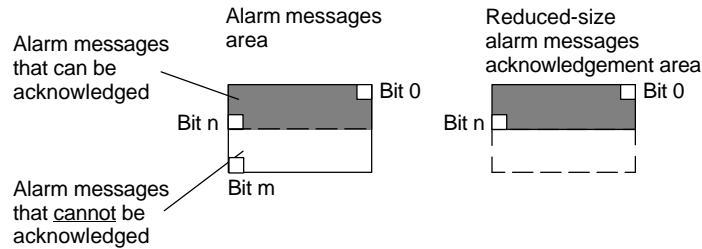


Figure 13-7 Reduced-size acknowledgement area

Note

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

13.5 User Data Areas, 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 words.

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

	15	8	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

13.6 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 13-8 illustrates the structure of the data area. All data is in BCD format.

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

Figure 13-8 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.

13.7 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)

	Left byte		Right byte	
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 13-9 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.

13.8 User Data Area, Coordination

The coordination user data area is two 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

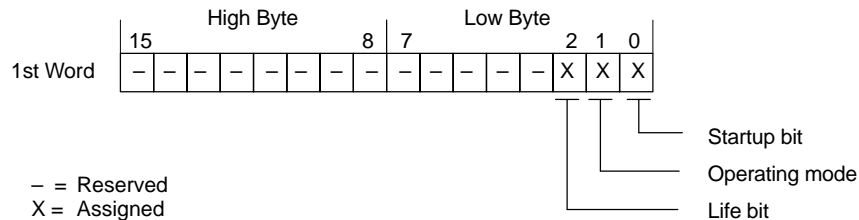


Figure 13-10 Significance of the bits in the coordination area

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.

13.9 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 (refer to Table 13-5).

Table 13-5 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

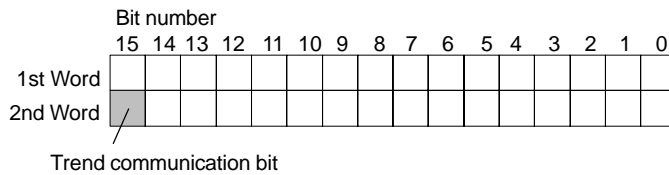
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

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.

13.10 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 13-6 Partitioning of the LED assignment 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:

Table 13-7 LED states

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

13.11 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 13-19)
- Synchronized transfer using the data mailbox (Page 13-20)

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 13-21)
- By PLC jobs (Page 13-22)
- By activating configured functions (Page 13-23)

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.

13.11.1 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.

13.11.2 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*.

13.11.3 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:

Decimal	Value		Explanation
	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

13.11.4 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	<ul style="list-style-type: none"> 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". <ul style="list-style-type: none"> 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 13-25.

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 13-25.

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	<ul style="list-style-type: none"> 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”. <ul style="list-style-type: none"> 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.

13.11.5 PLC jobs with 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 – 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 – 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	—	

Part VII

Connection to OMRON PLCs

Communication Management for
OMRON PLCs

14

User Data Areas for
OMRON PLCs

15

Communication Management for OMRON PLCs

14

This chapter describes the communication between operating unit and OMRON PLCs from the SYSMAC C, SYSMAC CV, SYSMAC CS1, SYSMAC alpha and CP series.

General Information

The connection, in the case of these PLCs, is established by the following internal PLC protocol:

- SYSMAC Way (Hostlink/Multilink protocol)

Only those connections are enabled which are present on the operating unit as standard equipment. In the case of standard PCs in particular, only the RS 232 interface is enabled. A multi-point connection to up to 4 PLCs is possible using a RS 232/RS 422 converter.

Operating units

The following operating units can be connected to SYSMAC and CP PLCs:

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

Note

The operating unit can only be implemented as a master.

Installation

The connection between the operating unit and the PLC is basically restricted to defining the interface parameters. Special function blocks for connection to the PLC are not required.

The driver necessary for the connection to the SYSMAC and CP PLCs is contained in the configuration software and is installed automatically.

Connection

The connection of the operating unit is dependent on the protocol selected.

The following connection cables are available for connection of the operating unit to the PLC:

Table 14-1 Applicable connection cables (for interface assignment, refer to Appendix, Part C)

Interface	RS 232 9-pin	RS 232 Periphery port	RS 422 9-pin	RS 422 Terminals
RS 232, 9-pin	–	Manufacturer's programming cable	–	–
RS 232, 15-pin	6XC1440-2X __	–	–	–
RS 232 via converter	–	–	–	Multi-point cable 1
RS 422, 9-pin	–	–	RS 422, 9-pin	Multi-point cable 2

'_' Length code (refer to Catalog ST 80)

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

Connection type

The connection of an operating unit (Panel PC, standard PC) to an OMRON PLC from the OMRON SYSMAC C series (not CQM-CPU11/21), SYSMAC CV, SYSMAC CS1 and SYSMAC alpha via the Hostlink/Multilink protocol and RS 232 has been tested by Siemens AG and approved.

A multi-point connection to up to 4 OMRON LCs in an RS 422 four-wire multidrop combination can be realized via a communication adapter.

14.1 Basic Methods of Functioning

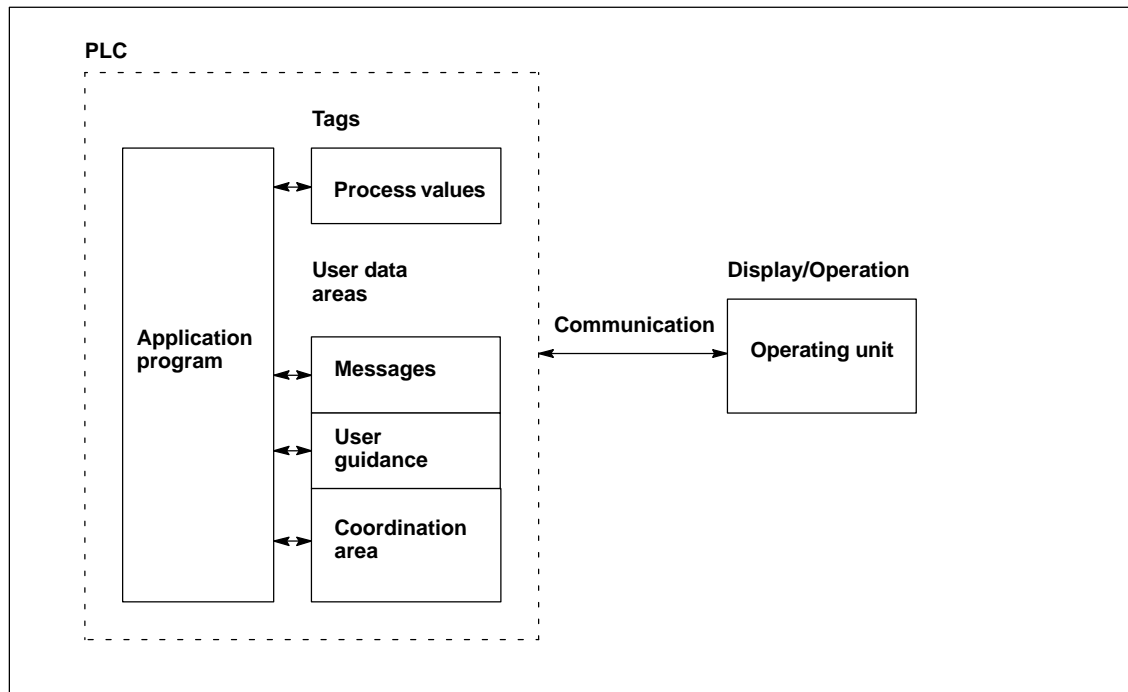


Figure 14-1 Communication structure

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 15.

14.2 Configuration in ProTool

When creating a new project, select the protocol required from the *Project Wizard* → *PLC Selection* dialog box.

Set the protocol:

- SYSMAC Way

Note

The settings on the operating unit must match with those on the PLC.

When starting up, ProTool must not be integrated in STEP 7; deactivate the menu item *Integration in STEP 7*.

Select the *Parameter . . .* button to define the protocol parameters. Define the following parameters for the PLC:

Table 14-2 PLC parameters

Parameters	Explanation
Interface	The operating unit interface to which the PLC is connected must be set here. – PanelPC COM 1 or COM 2 – Standard PC COM 1 to COM 4 – MP 370 IF1A, IF2 or IF1B – MP 270, MP 270B IF1A, IF2 or IF1B – TP 270, OP 270 IF1A, IF2 or IF1B – TP 170B, OP170B IF1A, IF2 or IF1B – TP 170A IF1A or IF1B
Station	Define the station number of the PLC connected.
Interface type	Set RS232 or RS422.
Data bits	Set 7 or 8.
Parity	Set NONE, EVEN or UNEVEN.
Stop bits	Set 1 or 2.
Baud rate	Define the transmission rate between the operating unit and PLC here. The communication can be set to a baud rate of 19200, 9600, 2400, 4800 or 1200 baud.

For subsequent changes to the parameters, select PLC in the project window and then *Properties* → *Parameters . . .*

14.3 Data Types

When configuring tags and area pointers, the data types listed in Table 14-3 are available for use.

Table 14-3 Data types

Data type	Addressed by	Format
Status	CPU status	BIN
Input/Output words	I/O	BIN, DEC, +/-DEC
ID marker word	HR	BIN, DEC, +/-DEC, LDC, +/-LDC, IEEE, ASCII
Auxiliary marker word	AR	BIN, DEC, +/-DEC, LDC, +/-LDC, ASCII
Interface marker word	LR	BIN, DEC, +/-DEC, LDC, +/-LDC, ASCII
Data marker word	DM	BIN, DEC, +/-DEC, LDC, +/-LDC, IEEE, ASCII
Timer/Counter status	T/C BIN	BIN
Timer/Counter actual values	T/C VAL	DEC, +/-DEC
the type of PLC	CPU type	Byte

Note

Reliable reading from and writing to all data areas the OMRON PLCs is only possible in operating modes STOP or MONITOR.

Either the IR/SR or CIO area is named with the I/O according to the PLC series. The data types LR, HR and AR are not recognized by all PLC series.

Addressing from the CV and CS PLC series

In the case of PLCs from the CV and CS series, the timers 0–2047 are addressed with T/C 0-2047. The counters 0-2047 must be addressed with an offset of 2048 in ProTool (T/C 2048-4095 corresponds to the counters 0–2047).

Counters and timers with addresses > 2047 cannot be addressed via Hostlink.

Example:

In order to address the counter C20, $T/C\ 20 + 2048 = T/C\ 2068$ must be addressed muss in ProTool.

14.4 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 effective update time is improved by setting one single large area rather than several smaller 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: Approx. 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 by the operating unit, 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 OMRON PLCs

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.

15.1 User Data Areas Available

Definition

The user data areas can be set up in the data area D of 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 15-1 and 15-2 provide an overview of the functional range of the individual operating units.

Table 15-1 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 15-2 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 15-3 illustrates the way in which the PLC and operating unit access the individual user data areas – Read (R) or Write (W).

Table 15-3 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 area	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.

15.2 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*

15.3 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+1	Parameter 1	
n+2	Parameter 2	
n+3	Parameter 3	

Figure 15-1 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.

15.4 User Data Areas, 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 15-4 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 15-4 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, maximum	Words, total	Messages, total
Panel PC	8	125	250	4000
Standard PC	8	125	250	4000
MP 370	8	125	250	4000
MP 270, MP 270B	8	125	250	4000
TP 270, OP 270	8	125	250	4000
TP 170B, OP 170B	8	125	125	2000
TP 170A ¹	8	63	63	1000

¹ Only event messages possible.

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:

Data register D 60 Length 5 (in words)

Figure 15-2 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.

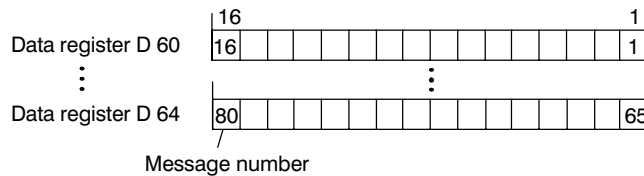


Figure 15-2 Assignment of message bit and message number

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 15-3 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 15-5 and 15-6.

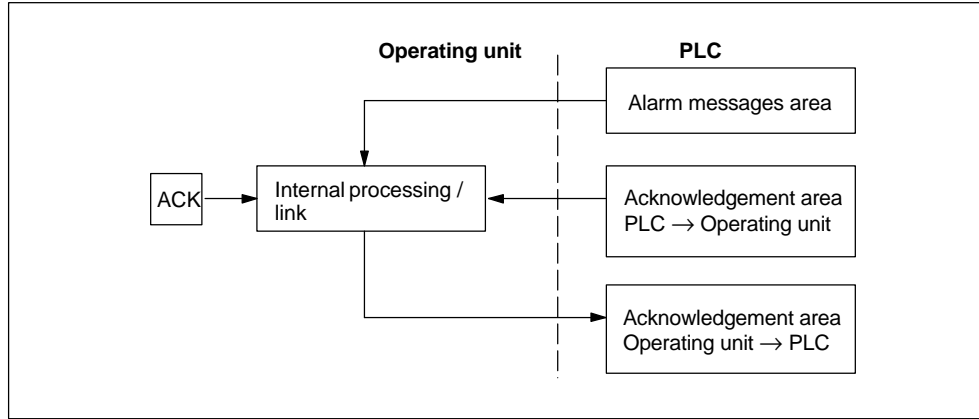


Figure 15-3 Alarm message and acknowledgement areas

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:

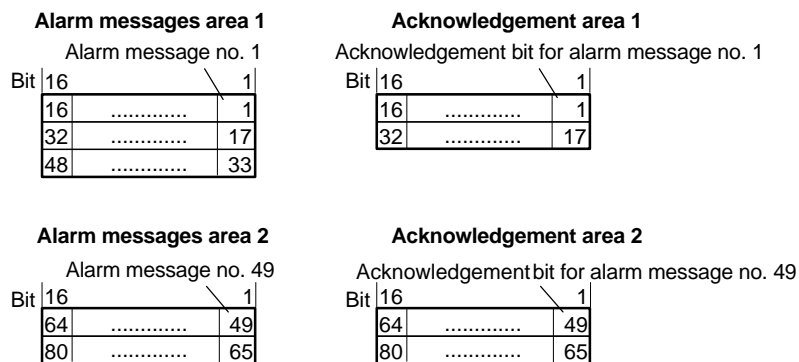


Figure 15-4 Assignment of acknowledgement bit and message number

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 15-5 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.

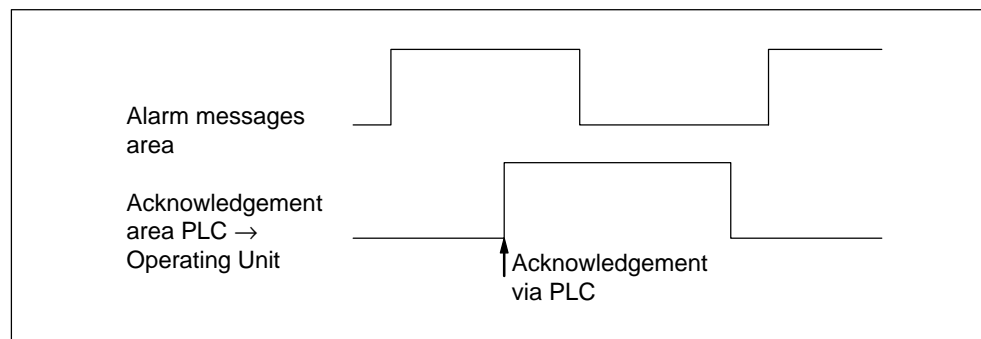


Figure 15-5 Signal diagram for acknowledgement area PLC → Operating Unit

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 15-6 illustrates the signal diagram.

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

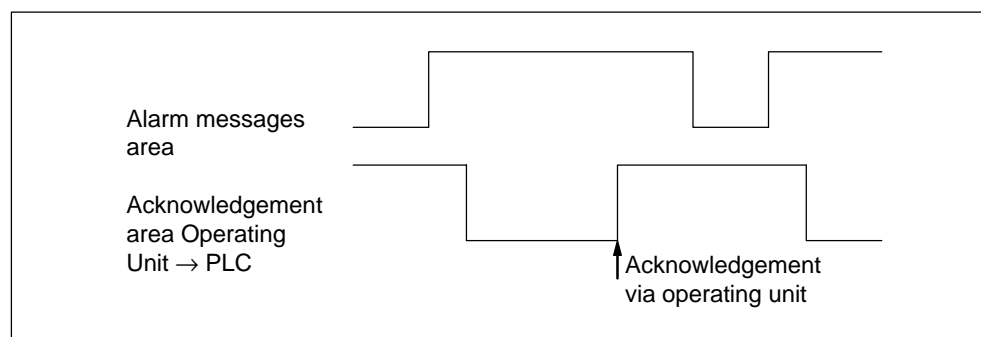


Figure 15-6 Signal diagram for acknowledgement area Operating Unit → PLC

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 15-7 illustrates such a case.

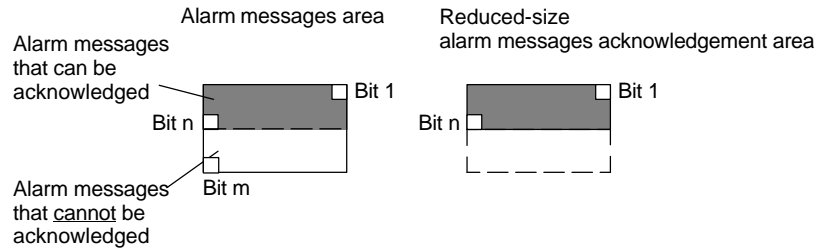


Figure 15-7 Reduced-size acknowledgement area

Note

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

15.5 User Data Areas, 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.

	16	9	8	1
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

15.6 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 15-8 illustrates the structure of the data area. All data is in BCD format.

	DL	DR	
DW	16	9	8
n+0	Reserved	Hour (0–23)	Time
n+1	Minute (0–59)	Second (0–59)	
n+2	Reserved		
n+3	Reserved	Weekday (1–7, 1=Sun)	Date
n+4	Day (1–31)	Month (1–12)	
n+5	Year (80–99/0–29)	Reserved	

Figure 15-8 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.

15.7 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	16	9	8	1
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 15-9 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.

15.8 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

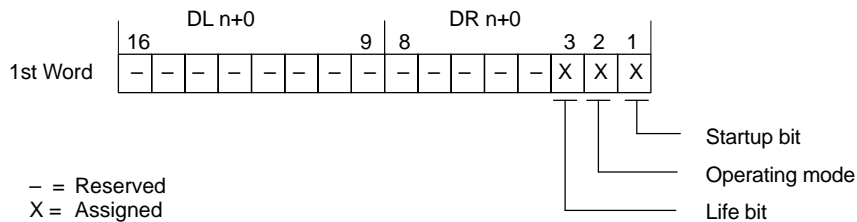


Figure 15-10 Significance of the bits in the coordination area

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.

15.9 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 (refer to Table 15-5).

Table 15-5 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

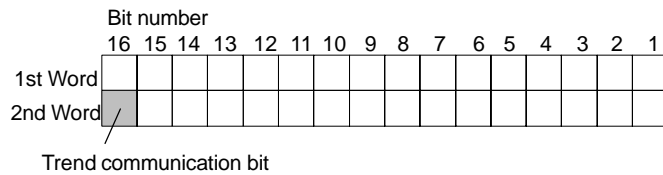
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

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.

15.10 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 15-6 Partitioning of the LED assignment 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:

Table 15-7 LED states

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

15.11 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 15-19)
- Synchronized transfer using the data mailbox (Page 15-20)

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 15-21)
- By PLC jobs (Page 15-22)
- By activating configured functions (Page 15-23)

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.

15.11.1 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.

15.11.2 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*.

15.11.3 Data mailbox for synchronized data transfer

Structure

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

	16	1
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:

Decimal	Value		Explanation
	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

15.11.4 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	<ul style="list-style-type: none"> 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". <ul style="list-style-type: none"> 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 15-25.

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 15-25.

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	<ul style="list-style-type: none"> 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”. <ul style="list-style-type: none"> 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.

15.11.5 PLC jobs with 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 – 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 – 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	—	

Part VIII **Connection to
Schneider
Automation PLCs
(Modicon)**

Communication Management for
Modicon PLCs

16

User Data Areas for
Modicon PLCs

17

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Communication Management for Modicon PLCs

16

This chapter describes the communication between operating unit and Schneider Automation (Modicon) PLCs from the Modicon 984, TSX Quantum and TSX Compact series.

General Information

The connection, in the case of these PLCs, is established by the following internal PLC protocol:

- MODBUS – point-to-point connection

Operating units

The following operating unit can be connected to a Modicon 984, TSX Quantum and TSX Compact PLC:

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

Installation

The driver necessary for the connection to the Modicon 984, TSX Quantum and TSX Compact PLCs is contained in the configuration software and is installed automatically.

The connection between the operating unit and PLC is basically restricted to defining the interface parameters and bus address. Special function blocks for connection to the PLC are not required.

Connection

The operating unit must be connected to the programming interface of the CPU (RS 232) (refer to PLC documentation).

The following connection cables are available for connection of the operating unit to the PLC:

Table 16-1 Applicable connection cables (for interface assignment, refer to Appendix, Part C)

Interface	Direct via Modbus-SS (RS 232)	Via MB Bridge (RS 232)	Via Modem J878 (RS 232)	TXS Compact point-to-point connection
RS 232, 9-pin	Point-to-point cable 1	Point-to-point cable 2	–	Point-to-point cable 2
RS 232, 15-pin	6XV1440-1K ___	6XV1440-1K ___	6XV1440-1L ___	–
RS 232, 15-pin	6XV1440-1K ___	6XV1440-1K ___	–	Point-to-point cable 3

'_' Length code (refer to Catalog ST 80)

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

Connection type

The standard connection from the operating unit to the PLC is the "direct" connection to the Modbus interface with RS 232 physics, available on all CPUs (max. cable length 15 m).

In addition, the following has been tested with the system and approved:

- Multipoint connection from one operating unit (Modbus/Master) with up to 4 PLCs.

The operating unit must be connected to a Modbus Plus Bridge or a Modicon 984 CPU or Modicon TSX Quantum CPU which has been configured as a Modbus Plus Bridge.

- The other PLCs must be connected to the first PLC via the MODBUSPlus connection of the first PLC and can be accessed under their address via the bridge functionality of the first PLC.

Note

It is not possible to integrate the operating unit in a Modbus network because the operating unit is the Modbus/Master.

- The integration of the operating unit in a MODBUS Plus network via Modicon MODBUS Plus Bridge type BM85-000 (logical point-to-point communication of the operating unit with a Modicon 984 or TSX Quantum).
- The integration of the operating unit in a MODBUS Plus Netzwerk network via the bridge function of the Modicon 984 or TSX Quantum (logical point-to-point communication of the operating unit with a PLC).

Note

The connection of the operating unit to PLCs from other manufacturers which provide a MODBUS interface has not been system tested by Siemens AG and is, thus, not approved.

16.1 Basic Methods of Functioning

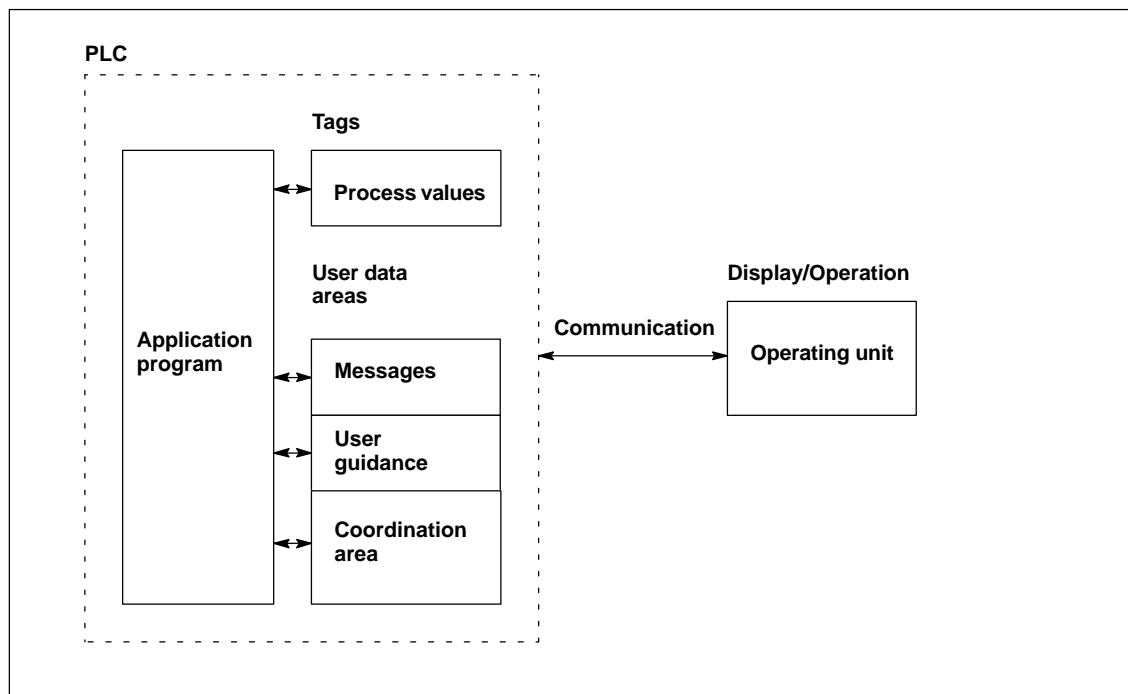


Figure 16-1 Communication structure

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.

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 17.

16.2 Configuration in ProTool

When creating a new project, select the protocol required from the *Project Wizard* → *PLC Selection* dialog box.

Set the protocol:

- Modicon Modbus for Modicon PLC

Note

The settings on the operating unit must match with those on the PLC.

When starting up, ProTool must not be integrated in STEP 7; deactivate the menu item *Integration in STEP 7*.

Select the *Parameter . . .* button to define the protocol parameters. Define the following parameters for the PLC:

Table 16-2 PLC parameters

Parameters	Explanation
CPU type	Define the PLC to which the operating unit is connected. Select between the following CPUs: <ul style="list-style-type: none"> – CPU 984 (except CPU 984A, 984B and 984X), – CPU 984-785 and – CPU TSX Quantum.
Slave address	Set the slave address of the PLC here.
Framing	Define the framing used here. Select between the following settings (Remote Terminal Unit): <ul style="list-style-type: none"> – RTU (standard) – RTU (modem) – RTU (compatible)
Interface	The operating unit interface to which the PLC is connected must be set here.
Interface type	Set RS232 here.
Free parameters	Define whether further settings options are required for the interface parameters. Note This setting has not been subjected to a system test. "Free Parameters" is excluded from the terms of guarantee if activated.
Data bits	Set 8 here.
Parity	Select one of the settings NONE, EVEN and ODD.
Stop bits	Set 1 or 2.
Baud rate	Define the transmission rate between the operating unit and PLC here. System setting: 9600 bit/s.

For subsequent changes to the parameters, select PLC in the project window and then *Properties* → *Parameter*

16.3 Data Types

When configuring tags and area pointers, the data types listed in Table 16-3 are available for use.

Table 16-3 Data types

Data type	Addressed by	Format
Coil (Discrete Output)	0x	Bit, 16 Bit Group
Discrete Input	1x	Bit, 16 Bit Group
Input Register	3x	Bit, +/- INT, INT
Holding Register (Output)	4x	Bit, +/- INT, INT +/- DOUBLE, DOUBLE FLOAT, ASCII
Extended Memory ¹	6x	Bit, +/- INT, INT +/- DOUBLE, DOUBLE FLOAT, ASCII

¹ Only available with the TSX-Quantum PLC.

Representation in ProTool

In the case of data formats *signed Int* and *signed Double*, the placeholders +/- INT and +/- DOUBLE are used.

16.4 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 effective update time is improved by setting one single large area rather than several smaller 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 temperature progress of an oven, for example, is much slower than the speed progress of an electric motor.

Guideline value for the acquisition cycle: Approx. 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 by the operating unit, 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 Modicon PLCs

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

Definition

The user data areas can be set up in various data areas in the PLC (Holding Register (4x)).

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 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	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 17-2 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 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
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.

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*

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+1	Parameter 1	
n+2	Parameter 2	
n+3	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. Afterwards, the unit 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 Areas, 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 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, maximum	Words, total	Messages, total
Panel PC	8	125	250	4000
Standard PC	8	125	250	4000
MP 370	8	125	250	4000
MP 270, MP 270B	8	125	250	4000
TP 270, OP 270	8	125	250	4000
TP 170B, OP 170B	8	125	125	2000
TP 170A ¹	8	63	63	1000

¹ Only event messages possible.

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:

40043 Length 5 (in words)

Figure 17-2 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.

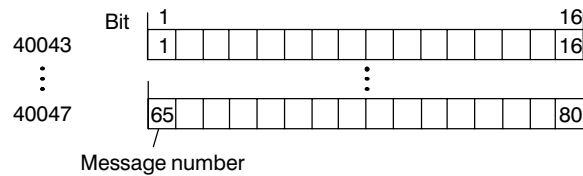


Figure 17-2 Assignment of message bit and message number

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. 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 17-3 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 17-5 and 17-6.

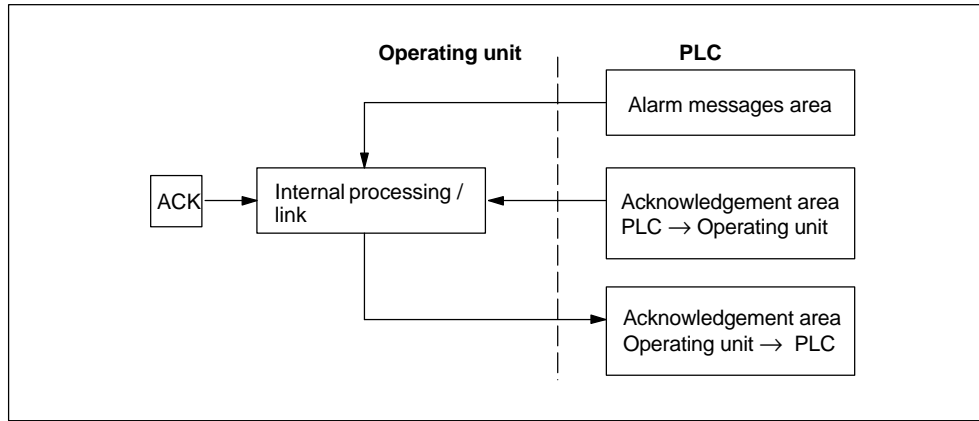


Figure 17-3 Alarm message and acknowledgement areas

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:

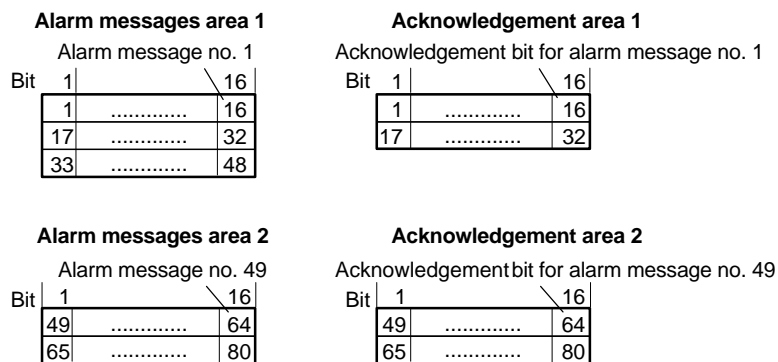


Figure 17-4 Assignment of acknowledgement bit and message number

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 17-5 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.

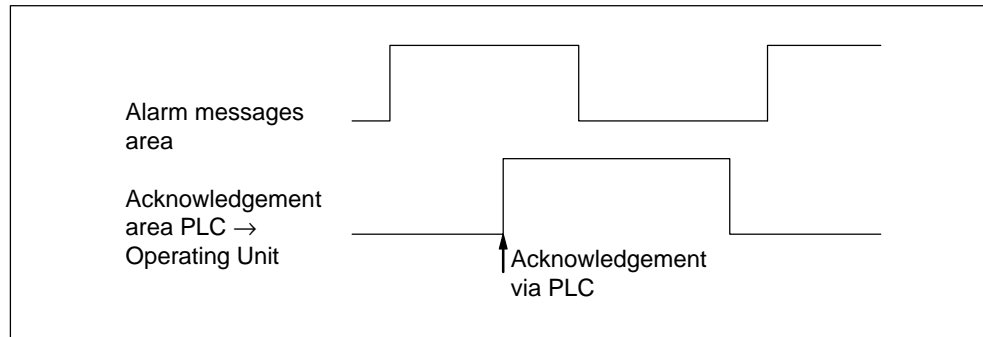


Figure 17-5 Signal diagram for acknowledgement area PLC → Operating Unit

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 17-6 illustrates the signal diagram.

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

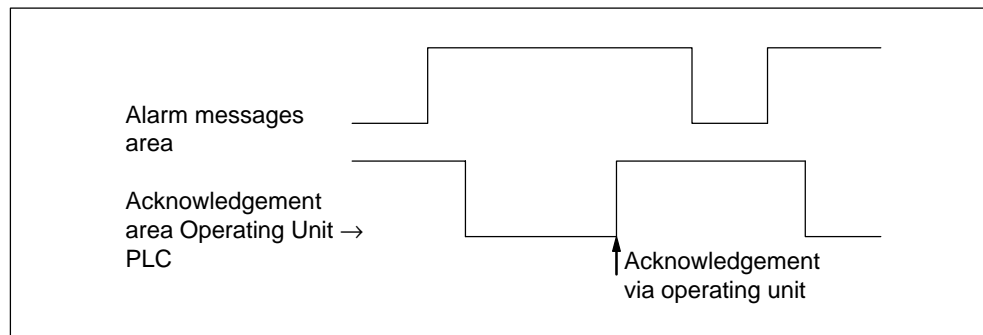


Figure 17-6 Signal diagram for acknowledgement area Operating Unit → PLC

Acknowledgement area 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 17-7 illustrates such a case.

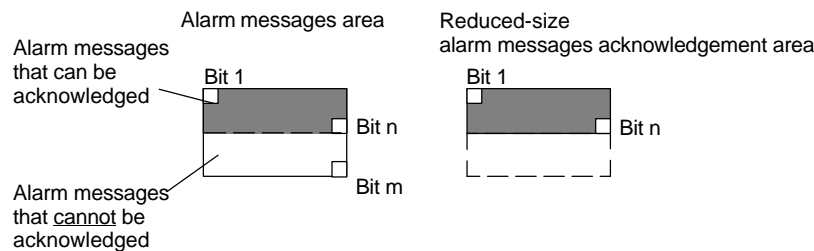


Figure 17-7 Reduced-size acknowledgement area

Note

Place important alarm messages in the alarm messages area starting at Bit 1 in ascending order.

17.5 User Data Areas, 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 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

17.6 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 17-8 illustrates the structure of the data area. All data is in BCD format.

	Left byte		Right byte		
DW	1	8	9	16	
n+0	Reserved		Hour (0–23)		Time
n+1	Minute (0–59)		Second (0–59)		
n+2	Reserved				
n+3	Reserved		Weekday (1–7, 1=Sun)		Date
n+4	Day (1–31)		Month (1–12)		
n+5	Year (80–99/0–29)		Reserved		

Figure 17-8 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.

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)

	Left byte		Right byte	
DW	1	8	9	16
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 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.

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 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

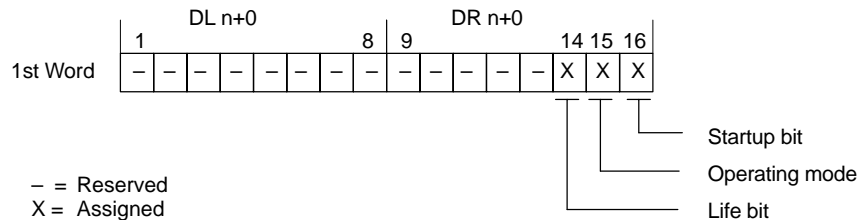


Figure 17-10 Significance of the bits in the coordination area

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.

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 (refer to 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

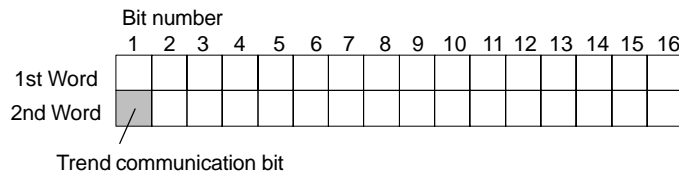
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

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 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 LED assignment 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:

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 17-19)
- Synchronized transfer using the data mailbox (Page 17-20)

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 17-21)
- By PLC jobs (Page 17-22)
- By activating configured functions (Page 17-23)

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.

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:

	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:

Decimal	Value		Explanation
	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	<ul style="list-style-type: none"> 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". <ul style="list-style-type: none"> 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 17-25.

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 17-25.

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	<ul style="list-style-type: none"> 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”.	
	<ul style="list-style-type: none"> 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.

17.11.5 PLC jobs with 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 – 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 – 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	—	

Part IX

Connection to Schneider Automation PLCs (Telemecanique)

Communication Management for
Telemecanique PLCs

18

User Data Areas for
Telemecanique PLCs

19

Communication Management for Telemecanique PLCs

18

This chapter describes the communication between operating unit and Telemecanique PLCs from the TSX 7, TSX 17, TSX 47, Micro and Premium series.

General Information

In the case of the Telemecanique TSX series, the connection is made via the following internal PLC protocols:

- Uni-Telway protocol Multi-point connection

Operating units

The following operating unit can be connected to the Micro, Premium, TSX 7 and TSX 17 PLCs:

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

Note

The operating unit can only be implemented as a slave.

Installation

The driver necessary for the connection to the Micro, Premium, TSX 7 and TSX 17 PLCs is contained in the configuration software and is installed automatically.

The connection between the operating unit and the PLC is basically restricted to defining the interface parameters. Special function blocks for connection to the PLC are not required.

Connection

Communication between the operating unit (Uni-Telway/Slave) and PLC (Uni-Telway/Master) is performed by using the Telemecanique TSX SCA 62 connection socket.

For connection of the operating unit, an RS 485 interface card configured as follows must be used:

- Rx: always on
- Tx: controlled via RTS

Tests performed by Siemens AG involved the use of interface cards of the type C102, CI 132, CI 132I or Ci 132IS from Moxa Data Communication Solutions.

The operating unit must be connected to the CPU interface via the corresponding TSX SCA.

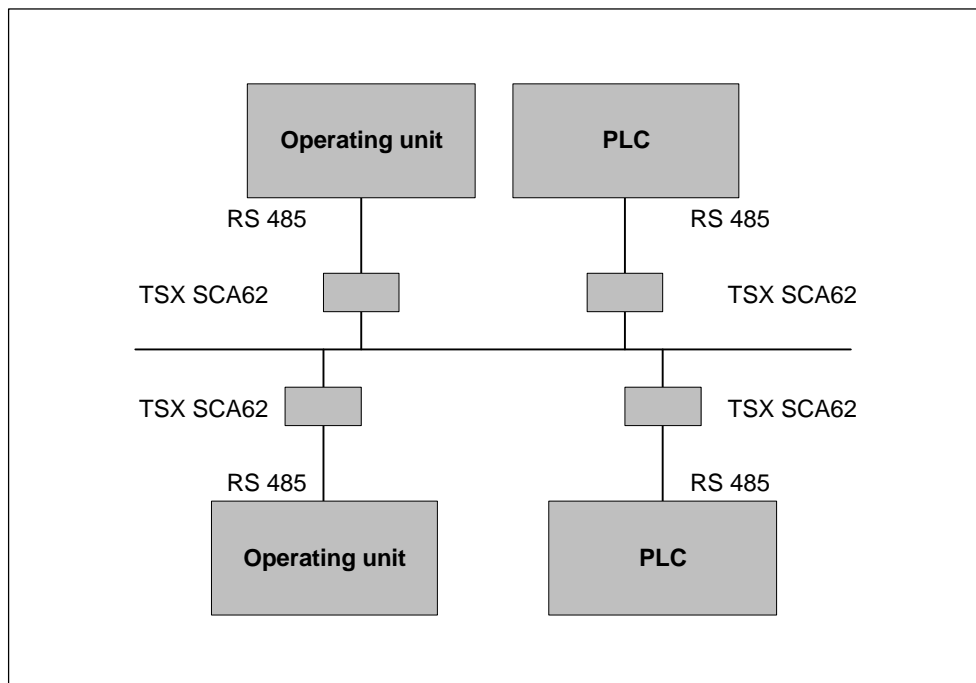


Figure 18-1 Connection of the operating unit to the PLC via the Unit-Telway protocol

Note

When using a Panel PC or standard PC the FIFO of the interface via which communication should take place must be deactivated.

Windows 98 and Windows ME:

Select the COM ports required using *Start → Settings → Control Panel → System → Device Manager → Connections (COM and LPT)* and then select *Properties → Connection Settings → More...* to deactivate the option *Use FIFO Buffer*.

Windows NT:

Select the COM ports required using *Start → Settings → Control Panel → Connections (COM and LPT)* Connections (COM and LPT) select *Settings → More...* to deactivate the option *FIFO activated*.

Windows 2000:

Select the COM ports required using *Start → Settings → Control Panel → System → Administration → Computer Management → System → Device Manager → Connections (COM and LPT)* and then select *Connection Settings → More...* to deactivate the option *Use FIFO Buffer*.

The following connection cables are available for connection of the operating unit to the PLC:

Table 18-1 Applicable connection cables (refer to Appendix, Part C Interface Assignment)

Interface	TTY, 9-pin	RS 485, 15-pin
TTY, 15-pin	6XV1440-1F_ _ _	–
RS 485, 9-pin	–	6XV1440-1E_ _ _
Panel PC, standard PC	–	RS 485 interface card cable

'_' Length code (refer to Catalog ST 80)

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

18.1 Basic Methods of Functioning

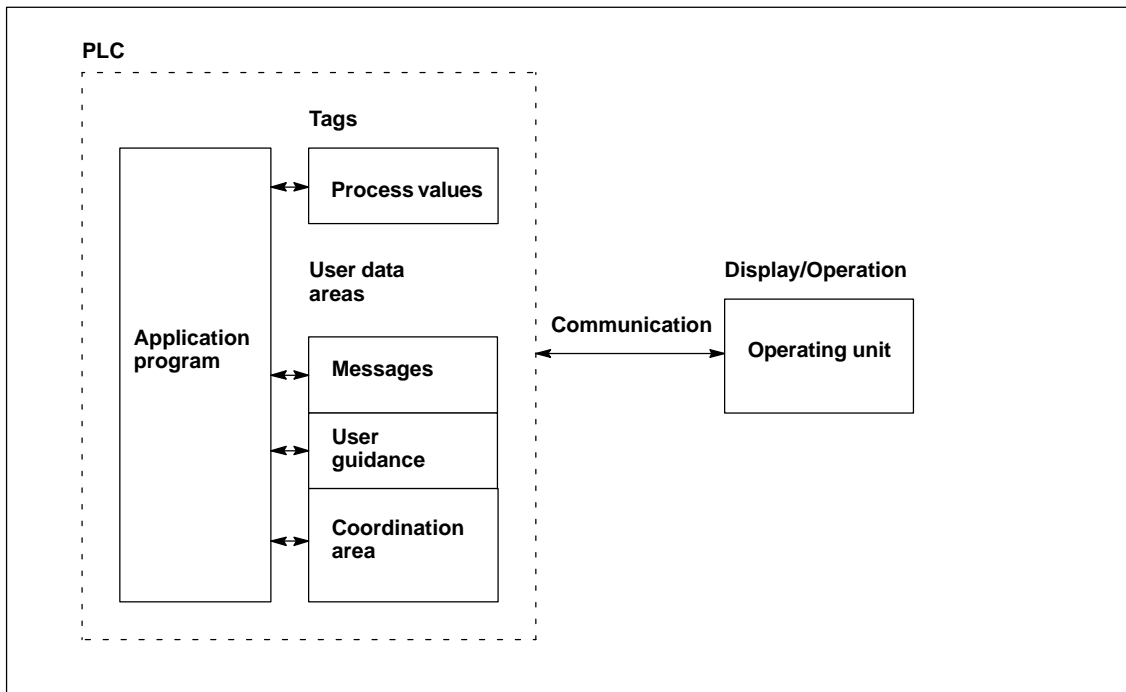


Figure 18-2 Communication structure

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 6.

18.2 Configuration in ProTool

When creating a new project, select the protocol required from the *Project Wizard* → *PLC Selection* dialog box.

Set the protocol:

- "Telemecanique Uni-Telway"

Note

The settings on the operating unit must match with those on the PLC.

When starting up, ProTool must not be integrated in STEP 7; deactivate the menu item *Integration in STEP 7*.

Select the *Parameter . . .* button to define the protocol parameters. Define the following parameters for the PLC:

Table 18-2 PLC parameters

Parameters	Explanation
Bus module / CPU type	Set the processor type, and in the case of Uni-Telway the Telemecanique TSX bus module type too, with which the communication should be performed.
Telway 7	Define whether the PLC is integrated in a superordinated Telway 7 network. In addition, it may be necessary to specify the Telway 7 network or station number.
Gate	Select between <i>System</i> and <i>Intelligent Module</i> . In addition, it may be necessary to define the Uni-Telway station number of the PLC for the <i>Intelligent Module</i> .
Operating unit Uni-Telway station	Specify the station number of the operating unit.
Interface	The operating unit interface to which the Telemecanique PLC is connected must be set here.
Interface type	RS 485 is set in for the Telemecanique Uni-Telway protocol.
Data bits	Set 8 here.
Parity	Set ODD here.
Stop bits	Set 1 here.
Baud rate	Define the transmission rate between the operating unit and PLC here. Communication is possible with a baud rate of 9600 Baud.

For subsequent changes to the parameters, select PLC in the project window and then *Properties* → *Parameters . . .*

18.3 Data Types

When configuring tags and area pointers, the data types listed in Table 18-3 are available for use.

A condition for this is that these data areas have also been set up with PL 7-2, PL 7-3 or PL 7 Junior software for the CPU.

Table 18-3 Data types

Data type	Addressed by	Addressed by (TSX37/57 only)	Format
Input bit	I	%I	BOOL
Output bit	O	%Q	BOOL
Bit	B	%U	BOOL
Word	W	%MW	BOOL, +/- INT, INT, STRING
Double word	DW	%MD	BOOL, +/-LONG, LONG
Float	n. a.	%MF	Float
Constant word	CW	%KW	BOOL, +/- INT, INT, STRING
Constant double word	CDW	%KD	BOOL, +/-LONG, LONG
Constant float	n. a.	%KF	Float
System bit	SY	%S	BOOL
System word	S	%SW	BOOL, +/- INT, INT
Time function	T	%T	+/-INT, INT
Counter	C	%C	+/-INT, INT

Representation in ProTool

In the case of data formats signed Int and signed Long, the placeholder +/- is used.

Note

No write access is possible from the operating unit to the data types Constant word, Constant float and Constant double word.

Note

Only valid for TSX 37 and TSX 57:

The data types `Input bit` and `Output bit` are not supported by these PLCs at present.

18.4 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 effective update time is improved by setting one single large area rather than several smaller 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: Approx. 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 by the operating unit, 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 Telemecanique PLCs **19**

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.

19.1 User Data Areas Available

Definition

The user data areas can be set up in various data areas in the PLC (words (W, %MW)).

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 19-1 and 19-2 provide an overview of the functional range of the individual operating units.

Table 19-1 User data areas available, Part 1

User data area	Standard PC	MP 370	MP 270 MP 270B
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 19-2 User data areas available, Part 2

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

¹ Only possible using operating units with keyboard.

Table 19-3 illustrates the way in which the PLC and operating unit access the individual user data areas – Read (R) or Write (W).

Table 19-3 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 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
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.

19.2 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*

19.3 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	Right byte
n+0	0	Job no.
n+1	Parameter 1	
n+2	Parameter 2	
n+3	Parameter 3	

Figure 19-1 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. Afterwards, the unit 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.

19.4 User Data Areas, 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 19-4 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 19-4 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, maximum	Words, total	Messages, total
Standard PC	8	125	250	4000
MP 370	8	125	250	4000
MP 270, MP 270B	8	125	250	4000
TP 270, OP 270	8	125	250	4000
TP 170B, OP 170B	8	125	125	2000
TP 170A ¹	8	63	63	1000

¹ Only event messages possible.

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:

W 43 Length 5 (in words)

Figure 19-2 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.

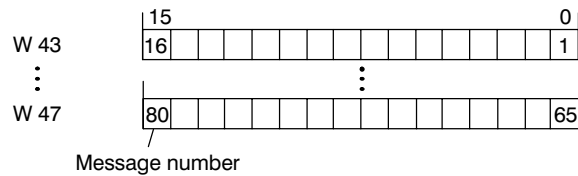


Figure 19-2 Assignment of message bit and message number

User Data Area, 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 19-3 illustrates a schematic diagram of the of the individual alarm message and acknowledgement areas. The acknowledgement sequences are shown in Figures 19-5 and 19-6.

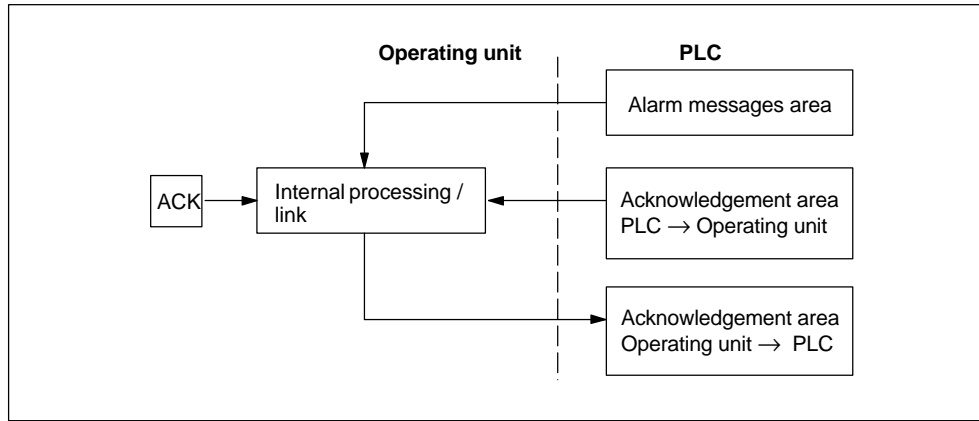


Figure 19-3 Alarm message and acknowledgement areas

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:

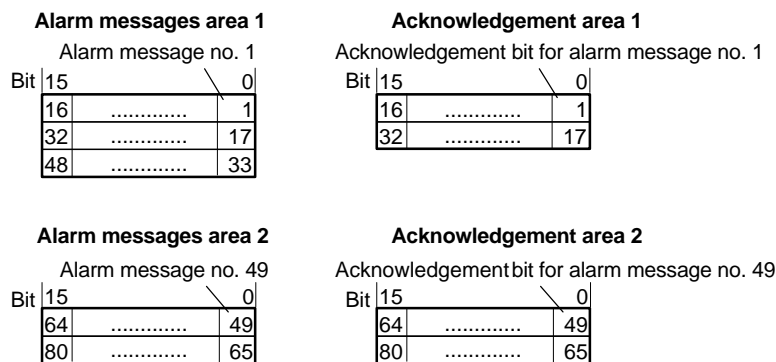


Figure 19-4 Assignment of acknowledgement bit and message number

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 19-5 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.

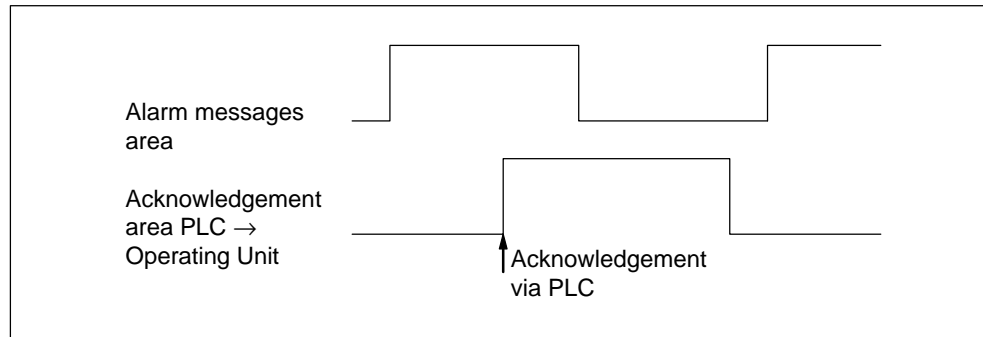


Figure 19-5 Signal diagram for acknowledgement area PLC → Operating Unit

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 19-6 illustrates the signal diagram.

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

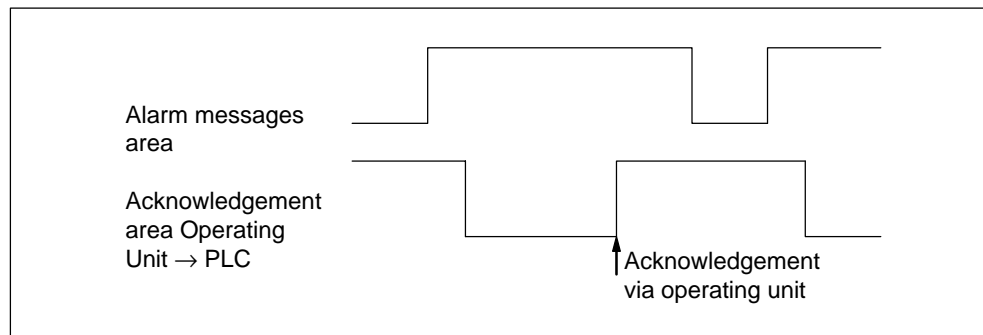


Figure 19-6 Signal diagram for acknowledgement area Operating Unit → PLC

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 19-7 illustrates such a case.

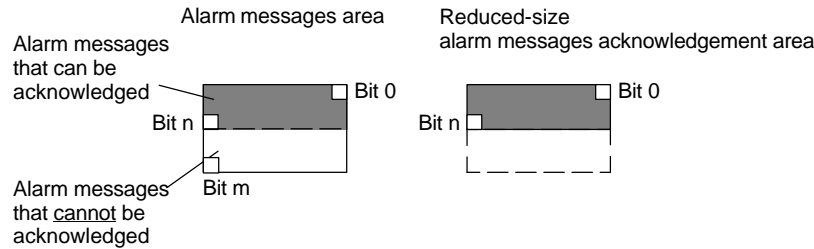


Figure 19-7 Reduced-size acknowledgement area

Note

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

19.5 User Data Area, Screen Number

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 words.

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

	15	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

19.6 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 19-8 illustrates the structure of the data area. All data is in BCD format.

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

Figure 19-8 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.

19.7 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)

DW	Left byte		Right byte	
	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 19-9 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.

19.8 User Data Area, Coordination

The coordination user data area is two 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

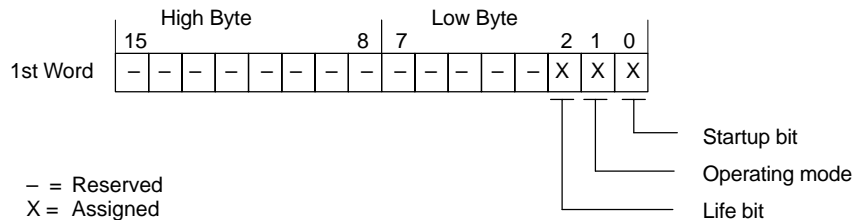


Figure 19-10 Significance of the bits in the coordination area

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.

19.9 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 (refer to Table 19-5).

Table 19-5 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

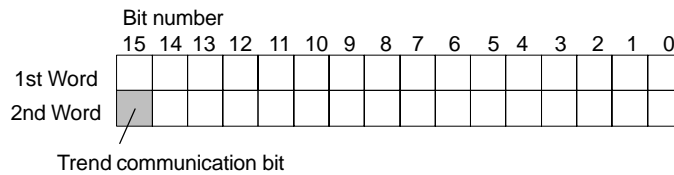
If a screen with one or more trends is opened on the operating unit, the unit sets the corresponding bits in the trend request area. After deselection of the screen, the operating unit resets the corresponding bits in the trend request area.

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 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.

19.10 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 19-6 Partitioning of the LED assignment 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:

Table 19-7 LED states

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

19.11 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 19-19)
- Synchronized transfer using the data mailbox (Page 19-20)

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 19-21)
- By PLC jobs (Page 19-22)
- By activating configured functions (Page 19-23)

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.

19.11.1 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.

19.11.2 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*.

19.11.3 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:

Decimal	Value		Explanation
	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

19.11.4 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	<ul style="list-style-type: none"> 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". <ul style="list-style-type: none"> 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 19-25.

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 19-25.

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	<ul style="list-style-type: none"> • 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”.	
	<ul style="list-style-type: none"> • 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.

19.11.5 PLC jobs with 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 – 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 – 999)	
Word 3	Data record number (1 – 65,535)	
Word 4	—	

Part X

Appendix

System messages

A

PLC Jobs

B

Interface Area Assignment

C

SIMATIC HMI Documentation

D

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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 <i>Import Password List</i> action.	–
70023	Acknowledgement to starting the <i>Export Password List</i> 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 <i>OP Properties</i> dialog and save the RAM file system using the <i>Save Files</i> button in the <i>Persistent Storage</i> 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 <i>S7 PLC name</i> 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 <i>Close archive</i> 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 <i>Open_archive</i> . 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 <i>Close_archive</i> . 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 <i>Start_sequence_archive</i> . No sequence archive is created.	Check the project for the following: <ul style="list-style-type: none"> • the function <i>Start_sequence_archive</i> 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: <ul style="list-style-type: none"> • the function <i>Copy_archive</i> is correctly configured. • the variable parameters are being correctly provided at the operating unit.
80024	The function <i>Copy_archive</i> is configured not to permit copying when the target archive already contains data (Parameter: <i>Write mode</i>). The archive is not copied.	Modify the function <i>Copy_archive</i> 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 <i>\$RT_ERR\$</i> 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 soon 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 <i>offline</i> .	–
110001	The operating mode status has been changed. The operating mode is now <i>online</i> .	–
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 <i>Connect/Disconnect PLC</i> . The operating mode is now <i>offline</i> .	–
110004	The operating status of the PLC specified is changed by the function <i>Connect/Disconnect PLC</i> . The operating mode is now <i>online</i> .	–
110005	An attempt was made to use the function <i>Connect/Disconnect PLC</i> to switch the specified PLC to operating mode <i>online</i> although the entire system is in operating mode <i>Offline</i> . This switch-over is not permissible. The PLC remains in operating mode <i>offline</i> .	Switch the complete system to operating mode <i>online</i> 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: <ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> 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 <i>PLC</i> .
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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 <i>online</i>
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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 <i>Online</i> or re-establish connection to the PLC.
190008	The threshold values configured for the tag have been violated, e.g. by <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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.: <ul style="list-style-type: none"> • A value should be assigned to a counter which is outside the valid, PLC-dependent value range. • A tag of the type <i>Integer</i> should be assigned a value of the type <i>String</i>. 	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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 <i>online</i> 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 <i>Logout</i> .	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	<p>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.</p> <p>The display no longer contains all the messages.</p> <p>However, all the messages are recorded in the message buffer.</p>	–
270002	<p>Messages are displayed from an archive are displayed for which there is no data in the current project.</p> <p>Placeholders are issued for the messages.</p>	Delete older archive files, if necessary.
270003	<p>The service cannot be set up because too many devices was to set up this service.</p> <p>A maximum of four devices can execute this action.</p>	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	<p>No more data is read or written.</p> <p>Possible causes:</p> <ul style="list-style-type: none"> • The cable is defective. • The PLC does not respond, is defective, etc. • Connection is established via the wrong interface. • The system is overloaded. 	<p>Check that the cable is plugged in, the PLC is operational, the correct interface is used.</p> <p>Reboot the system if the system message is displayed continuously.</p>
280002	<p>A connection is used which requires a function module in the PLC.</p> <p>The function block has replied.</p> <p>Communication can now proceed.</p>	–

Number	Effect/Cause	Remedy
280003	<p>A connection is used which requires a function module in the PLC.</p> <p>The function block does not reply.</p>	<p>Check that the cable is plugged in, the PLC is operational, the correct interface is used.</p> <p>Reboot the system if the system message is displayed continuously.</p> <p>The remedy is dependent on the error code:</p> <ol style="list-style-type: none"> 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	<p>The online connection to the PLC has been interrupted. There is no data exchange at present.</p>	<p>Check the PLC parameters in ProTool Pro: baud rate, block length, station address.</p> <p>Check that the cable is plugged in, the PLC is operational, the correct interface is used.</p> <p>Reboot the system if the system message is displayed continuously.</p>
290000	<p>The tag could not be read or written. It is assigned the start value.</p> <p>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.</p>	<p>Check in the configuration that the address has been set up in the PLC.</p>
290001	<p>An attempt has been made to assign a value to a tag which is outside the value range permitted for this type.</p> <p>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.</p>	<p>Observe the value range for the tag type.</p>
290002	<p>It is not possible to convert a value from a source format to a target format.</p> <p>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.</p>	<p>Check the value range or type of the variable.</p>
290003	<p>This message is issued when message number 290000 is triggered more than five times.</p> <p>In this case, no further individual messages are generated.</p>	<p>Check in the configuration that the tag addresses have been set up in the PLC.</p>
290004	<p>This message is issued when message number 290001 is triggered more than five times.</p> <p>In this case, no further individual messages are generated.</p>	<p>Observe the value range for the tag type.</p>

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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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	<p>A data record error with error code %1 has occurred which cannot be described in more detail.</p> <p>The action was canceled.</p> <p>It might be that the data mailbox has not been installed correctly on the PLC.</p>	<p>Check that the data carrier, the data record, the data mailbox and, if necessary, the connection to the PLC.</p> <p>Trigger the action again after waiting a short period.</p> <p>If the error occurs again, please contact the Customer Support. Specify the error code displayed.</p>
290041	<p>A data record or file cannot be saved because the data medium is full.</p>	<p>Delete files no longer required.</p>
290042	<p>An attempt was made to execute several recipe actions simultaneously.</p> <p>The last action was not executed.</p>	<p>Trigger the action again after waiting a short period.</p>
290043	<p>Confirmation request before storing data records.</p>	<p>–</p>
290044	<p>The data store for the recipe has been destroyed and will be deleted.</p>	<p>–</p>
290050	<p>Acknowledgement that the exportation of data records has started.</p>	<p>–</p>
290051	<p>Acknowledgement that the exportation of data records has been completed successfully.</p>	<p>–</p>
290052	<p>Acknowledgement that the exportation of data records has been terminated due to errors.</p>	<p>Ensure that the structure of the data records on the data medium and the current recipe structure on the operating unit are identical.</p>
290053	<p>Acknowledgement that the importation of data records has been started.</p>	<p>–</p>
290054	<p>Acknowledgement that the importation of data records has been completed successfully.</p>	<p>–</p>
290055	<p>Acknowledgement that the importation of data records has been terminated due to errors.</p>	<p>Ensure that the structure of the data records on the data medium and the current recipe structure on the operating unit are identical.</p>
290056	<p>The value in the specified line/column could not be read/written without errors.</p> <p>The action was canceled.</p>	<p>Check the specified line/column.</p>
290057	<p>The tags of the recipe specified have been switched from operating mode “offline” to “online”.</p> <p>Each modification of a tag in this recipe is now immediately transferred to the PLC.</p>	<p>–</p>
290058	<p>The tags of the recipe specified were switched from operating mode “online” to “offline”.</p> <p>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.</p>	<p>–</p>

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	<p>The selected PLC cannot be evaluated for ProAgent.</p> <p>The message display configured with the Evaluate_message_display_fault function could not be found.</p>	<p>Check the parameters of the Evaluate_message_display_fault function.</p>

- 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.

B

PLC Jobs

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	Password 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 PLC³ 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	<p>Retrieve alarm message area and acknowledgement area from the PLC</p> <p>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.</p> <p>Parameter 1 Area pointer no.: 1–8</p> <p>Parameter 2, 3 –</p>	•	•	•
49	<p>Clear event buffer</p> <p>Parameter 1, 2, 3 –</p>	•	•	•
50	<p>Clear alarm buffer</p> <p>Parameter 1, 2, 3 –</p>	•	•	•
51	<p>Select screen</p> <p>Parameter 1 Screen number</p> <p>Parameter 2 –</p> <p>Parameter 3 Field number</p>	•	•	•
69	<p>Read data record from PLC</p> <p>Parameter 1 Recipe number (1 to 999)</p> <p>Parameter 2 Data record number (1–65535)</p> <p>Parameter 3 0: Do not overwrite existing data records 1: Overwrite existing data records</p>	•	•	•
70	<p>Write data record in PLC</p> <p>Parameter 1 Recipe number (1 to 999)</p> <p>Parameter 2 Data record number (1–65535)</p> <p>Parameter 3 –</p>	•	•	•

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 2 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.

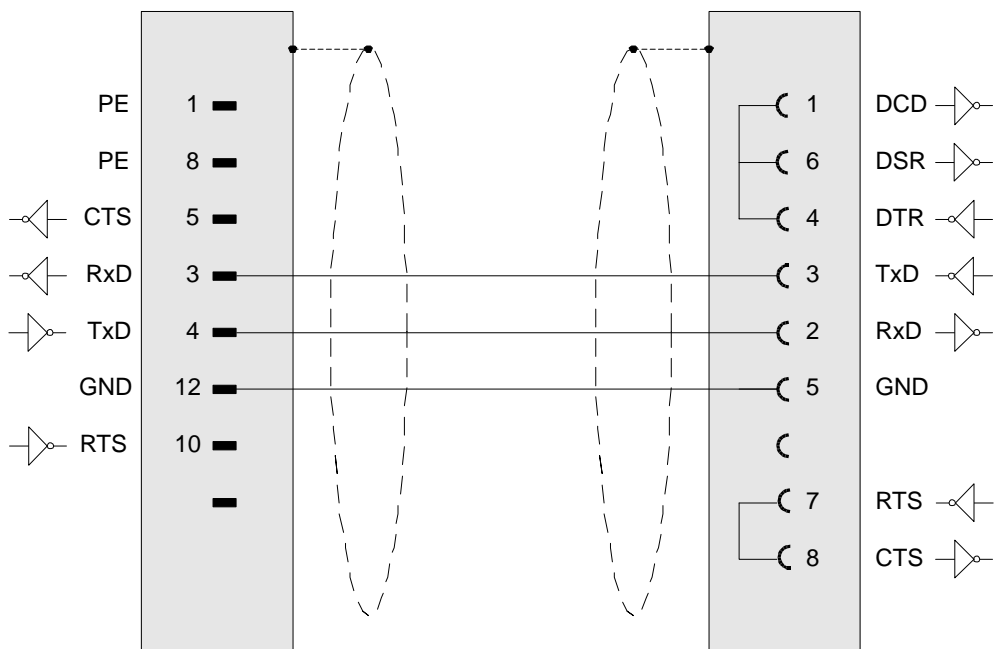
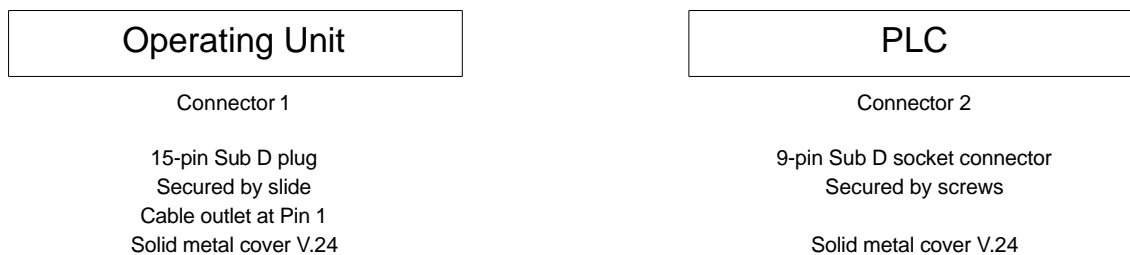
The cables on the following pages are arranged according to PLCs. It defines the interface assignment associated with the respective PLCs:

- Allen Bradley via DF1 and DH 485 see Pages C-2 to C-9
- GE Fanuc Automation see Pages C-10 to C-17
- LG Industrial Systems/IMO (Lucky Goldstar) see Pages C-18 to C-23
- Mitsubishi Electric (PU protocol) see Pages C-24 to C-27
- Mitsubishi Melsec (Protocol 4) see Pages C-28 to C-34
- Omron see Pages C-35 to C-38
- Schneider Automation (Modicon) see Pages C-39 to C-43
- Schneider Automation (Telemecanique) see Pages C-44 to C-46

When selecting the connection cable, please take the “Connection Cables Available” into account, set out in Chapter “Communication with ...” of the respective PLC.

Plug-in Connecting Cable Operating Unit – Allen Bradley SLC500

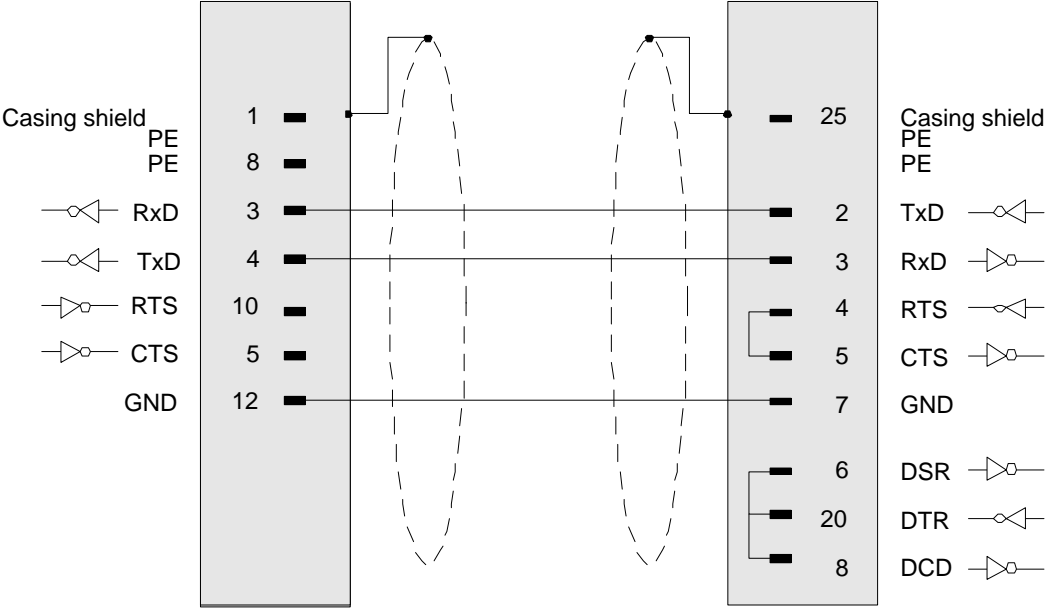
RS 232 Interface
6XV1440-2K _ _ _



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Allen-Bradley PLC5/20

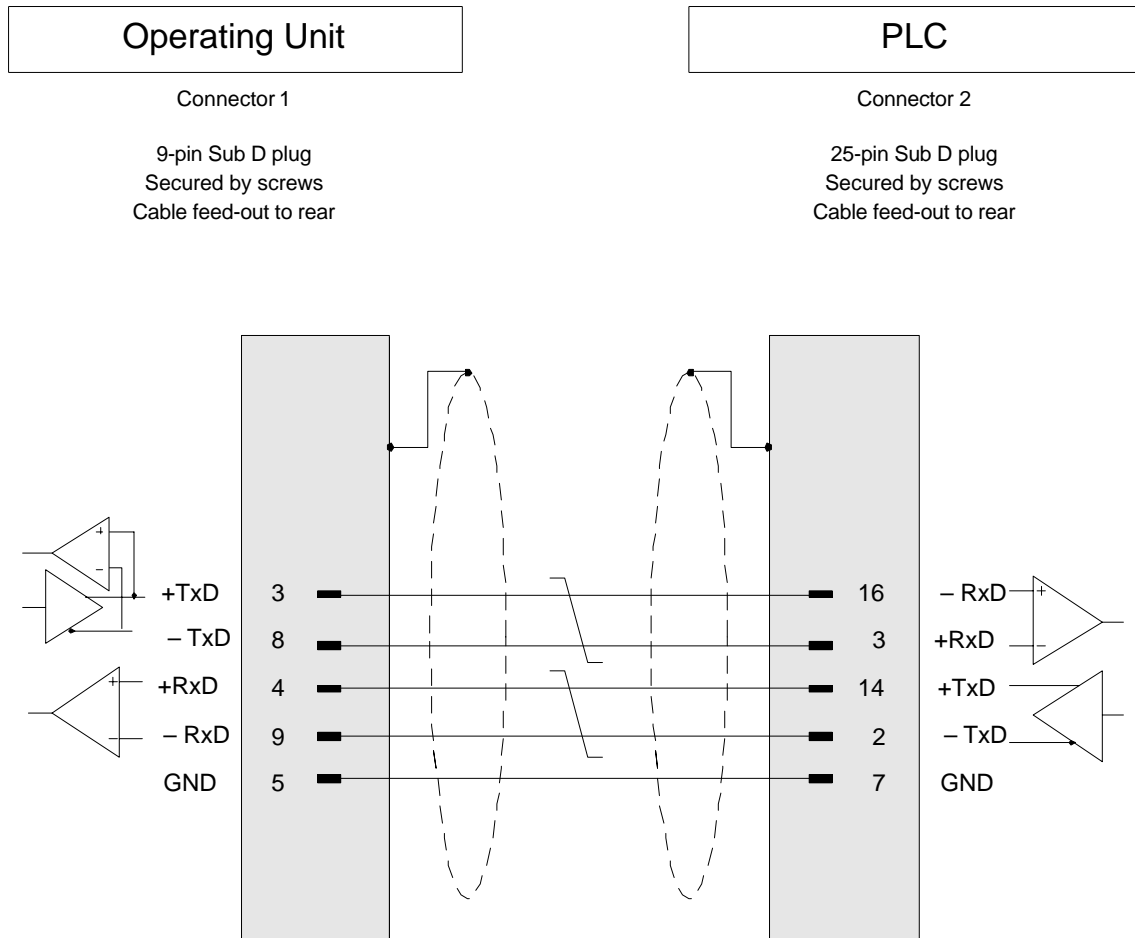
RS 232 Interface
6XV1440-2L _ _ _



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Allen-Bradley PLC5/20

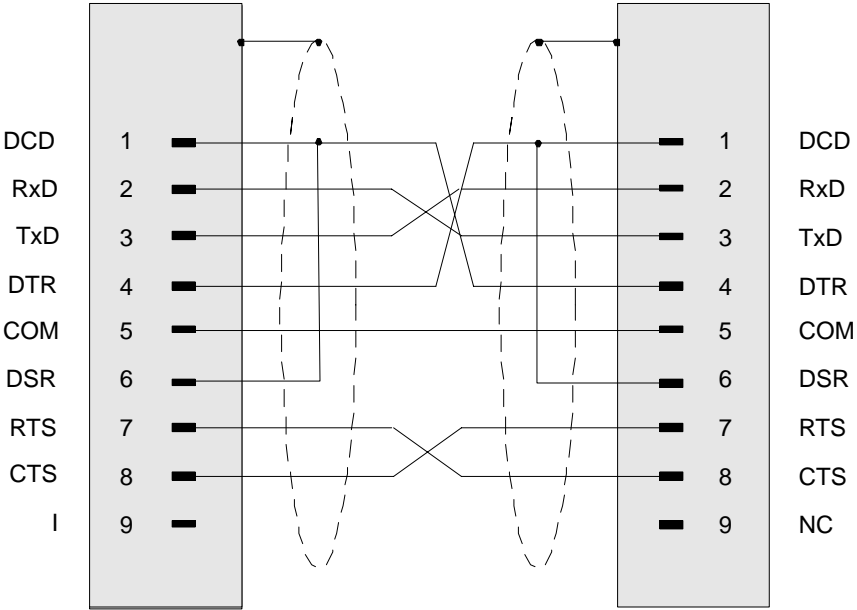
RS 422 Interface
6XV1440-2V _ _ _ _



- Cable: 3 x 2 x 0.14 mm², shielded; max. length: max. 60 m
- Shielding connected at both ends to casing with large contact area, screen contacts connected

Plug-in Connecting Cable Operating Unit – Allen-Bradley SLC500

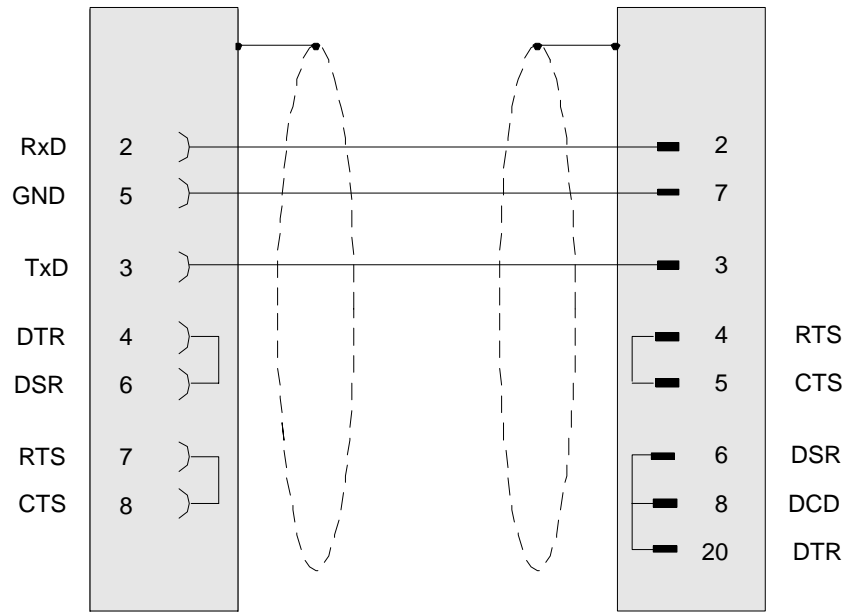
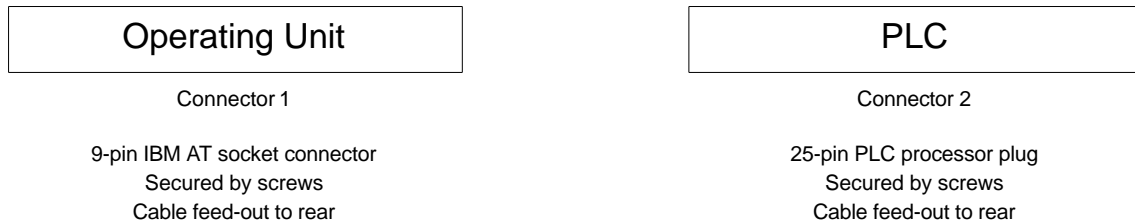
RS 232 Interface
Standard cable 1747 CP3



- Cable: 5 x 0.14 mm², shielded
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Allen-Bradley PLC5/20

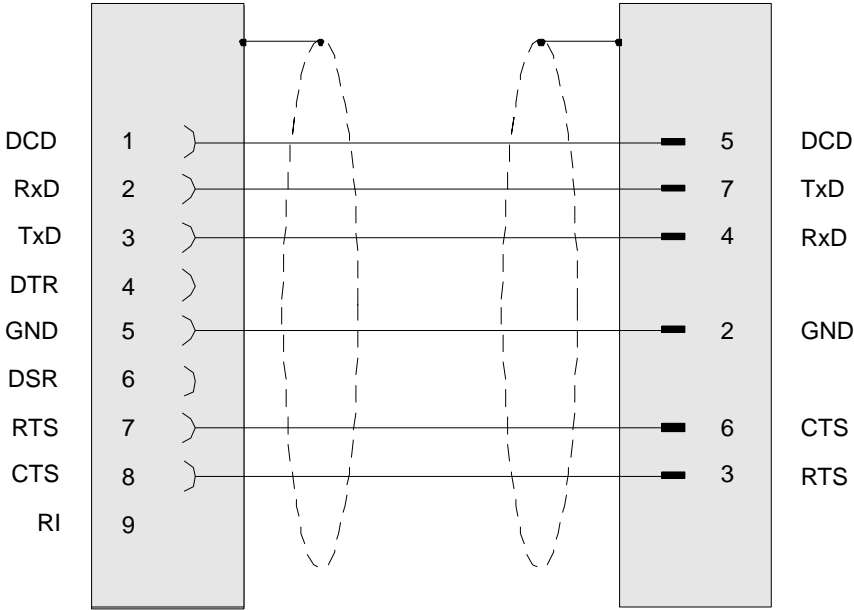
RS 232 Interface
Standard cable 1784 CP10



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Allen-Bradley PLC5/20

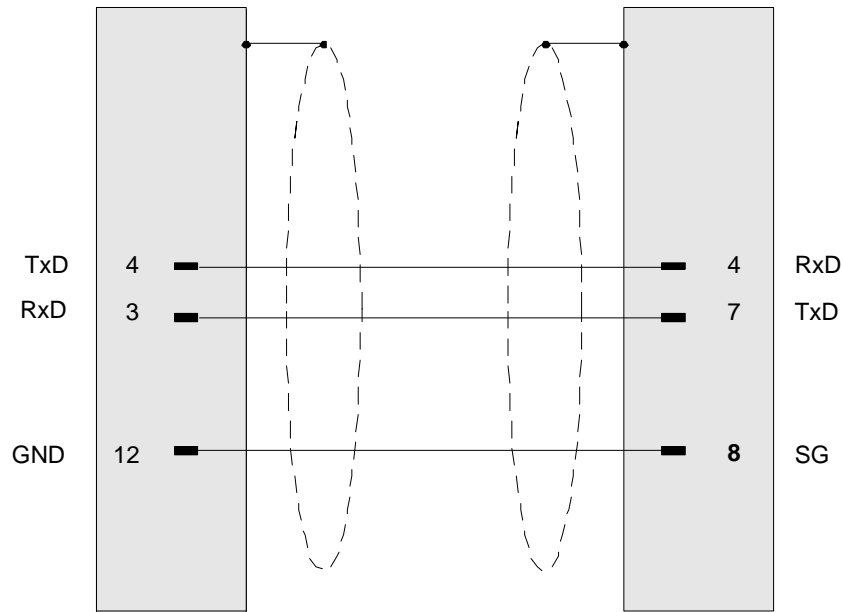
RS 232 Interface
Standard cable 1761-CBL-PM02 (point-to-point cable)



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Allen-Bradley MicroLogix

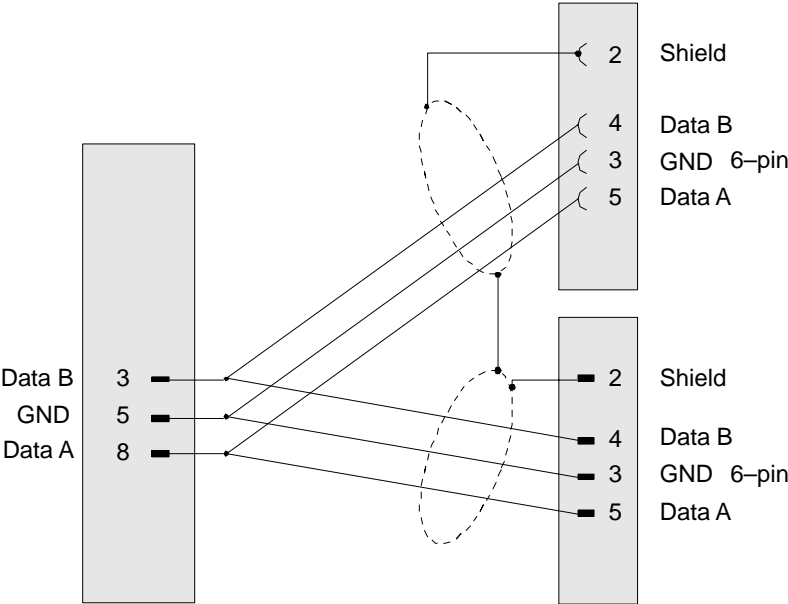
RS 232 Interface



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

**Plug-in Connecting Cable
Operating Unit – Allen-Bradley MicroLogix**

**RS 485 Interface
Multi-point cable 1**



Network connection RS 485: Installation as intermediate link

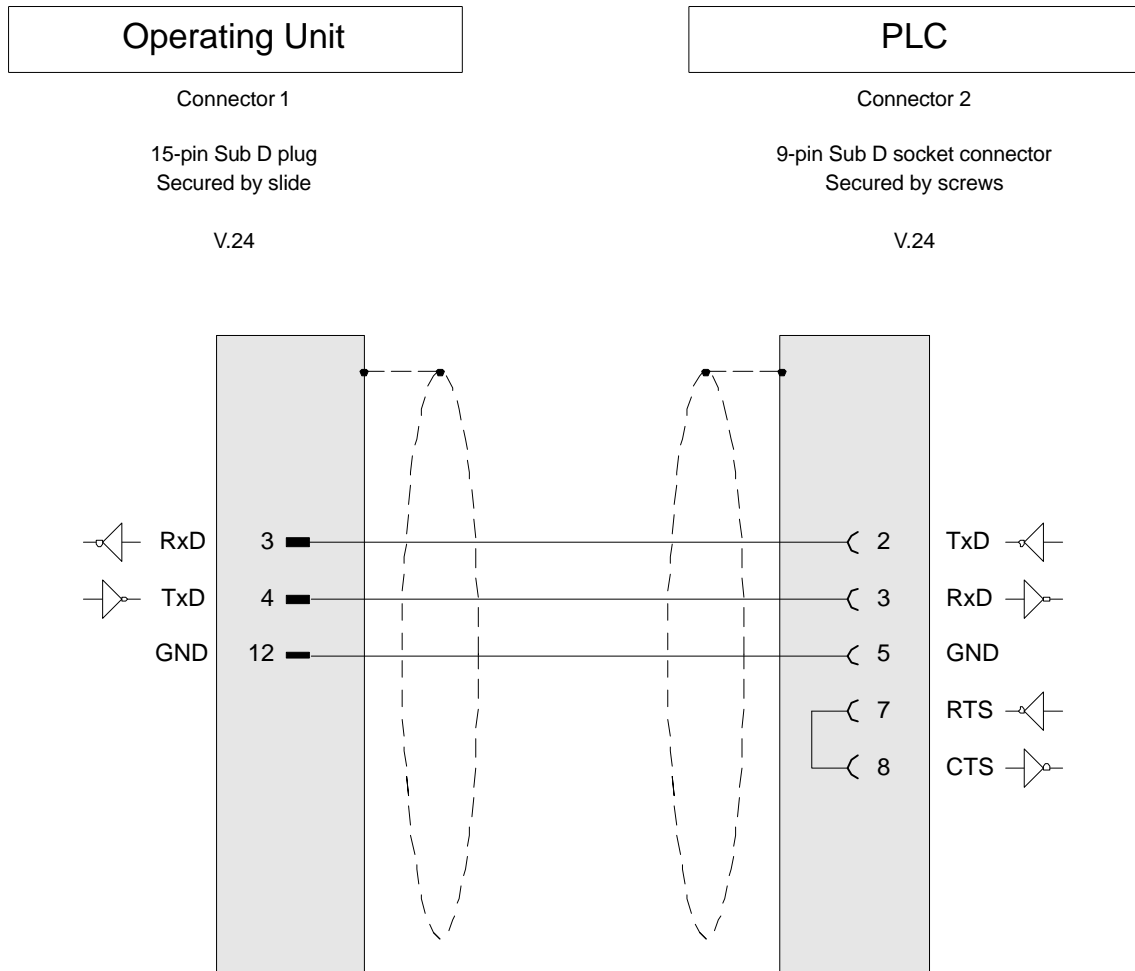
- Both bus ends must be terminated (refer to the documents on installation of the RS 485 network, e.g. Allen-Bradley 1761-6.4).
- If the operating unit is at one end, a 120-Ohm- resistance is necessary between the data lines Data A and Data B.
- Cable length of the entire DH485 network: max. 1220 m.

Note

The cable connection shield must not be connected to the operating unit housing.

Plug-in Connecting Cable Operating Unit – GE Fanuc PLC

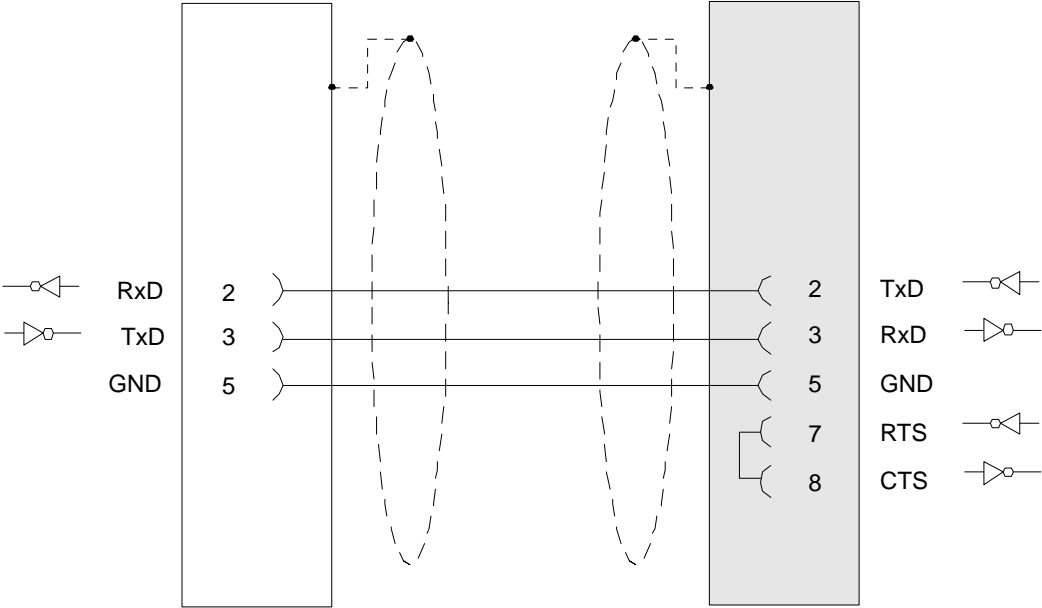
RS 232 Interface Adapter 1 via converter



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – GE Fanuc PLC

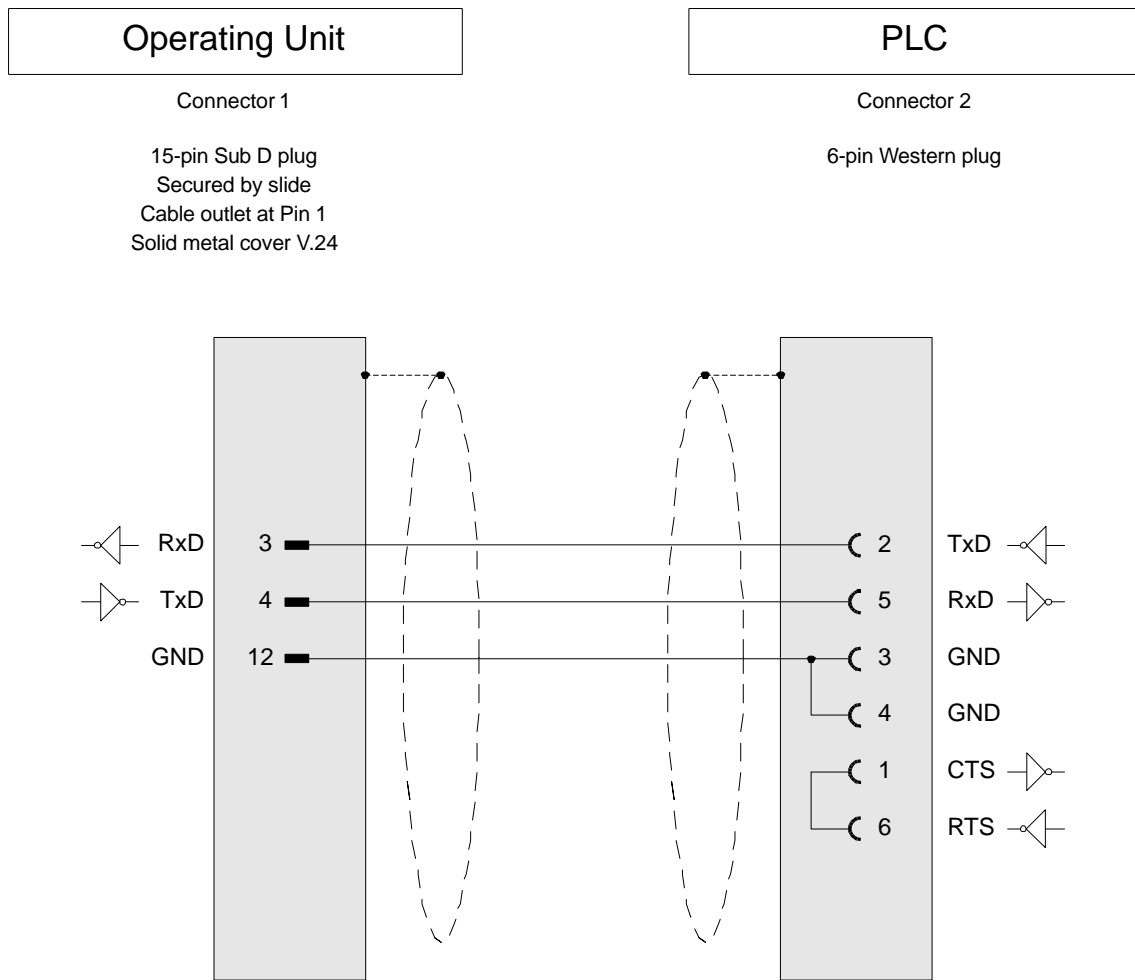
RS 232 Interface Adapter 2 via converter



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – GE Fanuc PLC

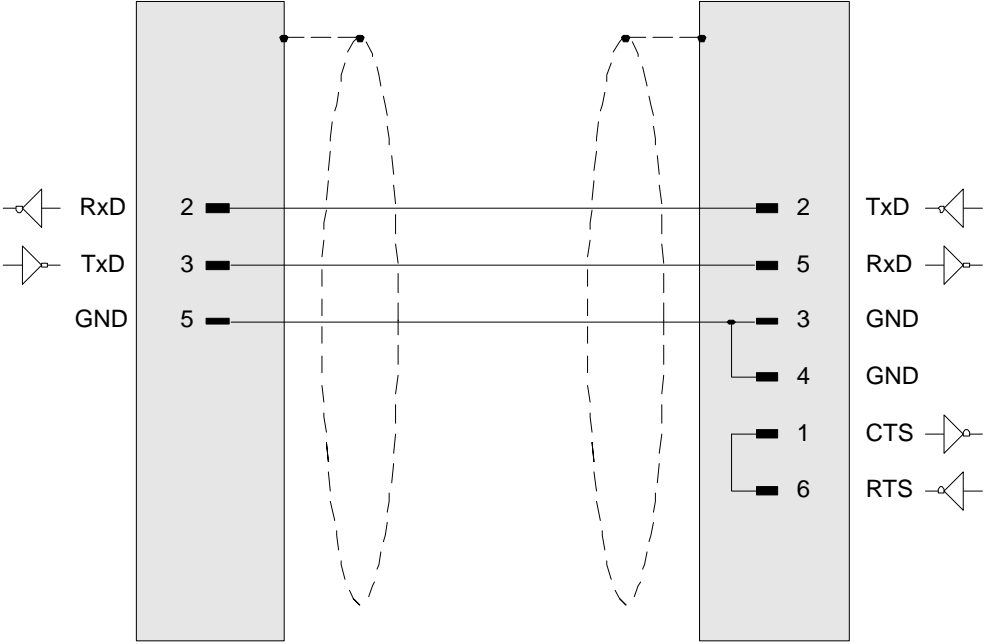
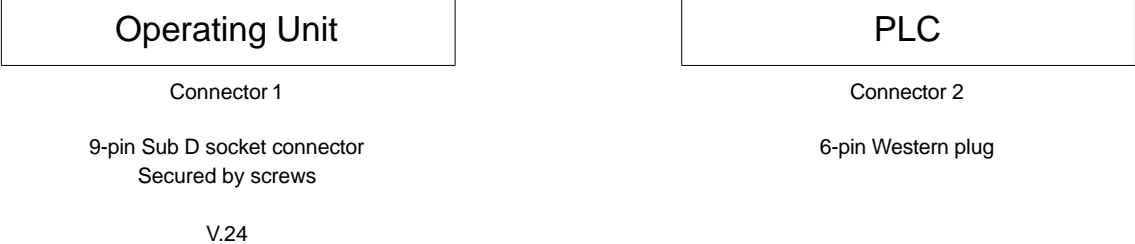
RS 232 Interface Western plug 1



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area
- Pin 1 is at the bottom when viewing the PLC (Western plug)

Plug-in Connecting Cable Operating Unit – GE Fanuc PLC

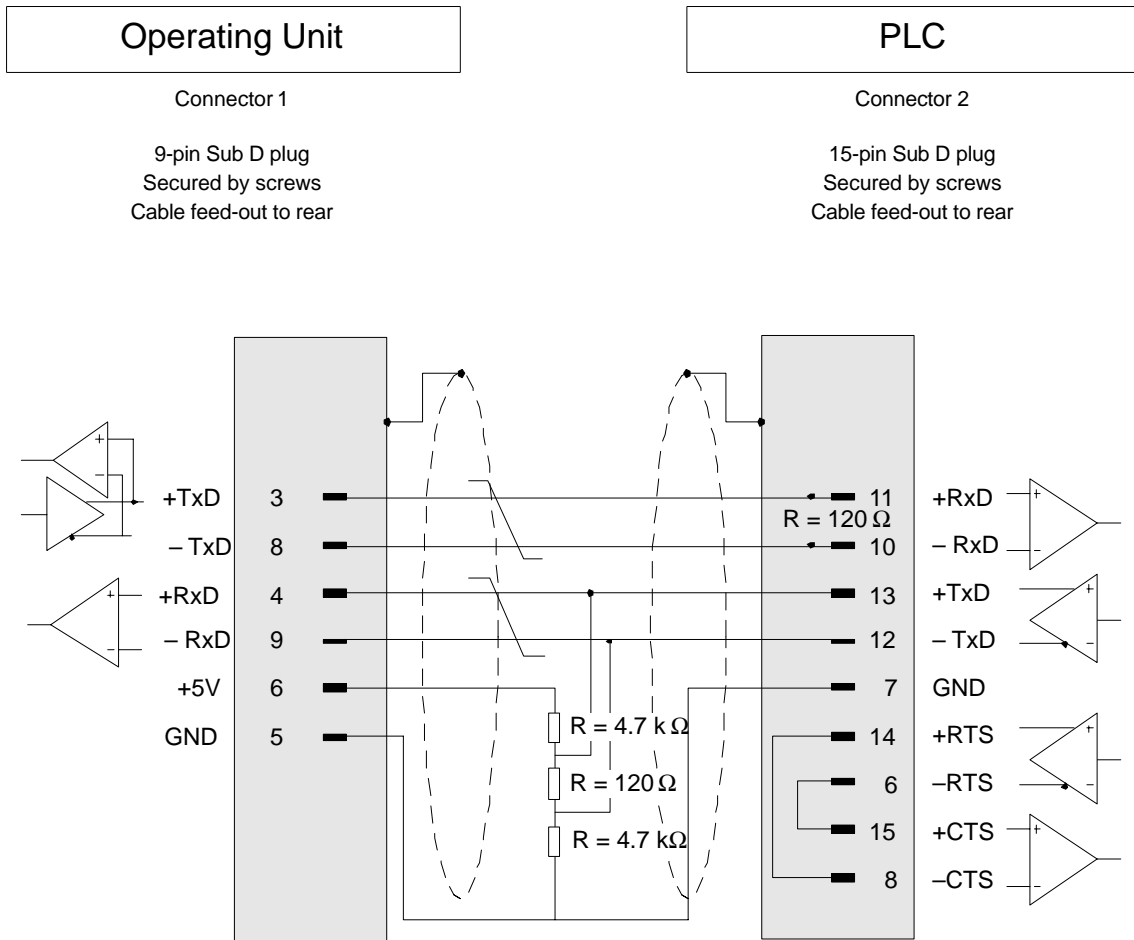
RS 232 Interface Western plug 2



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area
- Pin 1 is at the bottom when viewing the PLC (Western plug)

Plug-in Connecting Cable Operating Unit – GE Fanuc PLC

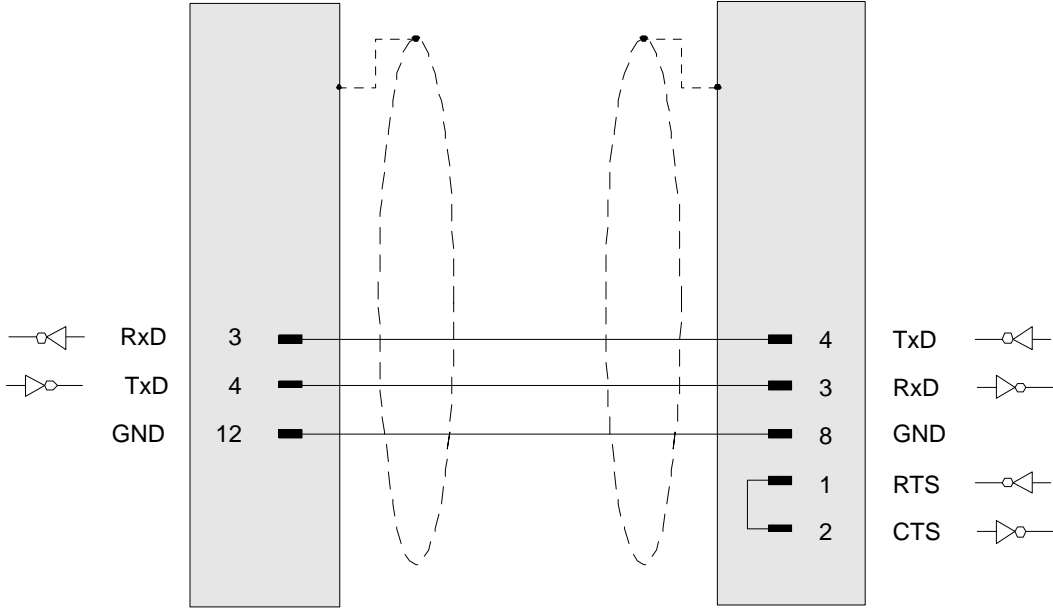
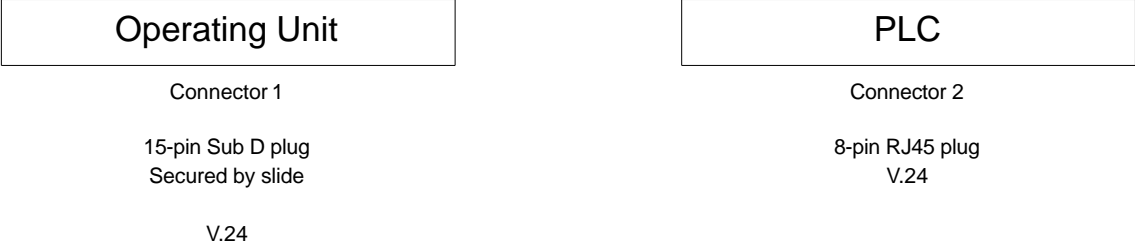
RS 422 Interface Multi-point cable 1



- Cable: 3 x 2 x 0.14 mm², shielded; max. length: 1200 m
- Shielding connected at both ends to casing with large contact area, screen contacts connected
- R is terminal resistance
- Insert terminal resistance of 120 Ohm (e.g. construction 0207)

Plug-in Connecting Cable Operating Unit – GE Fanuc PLC

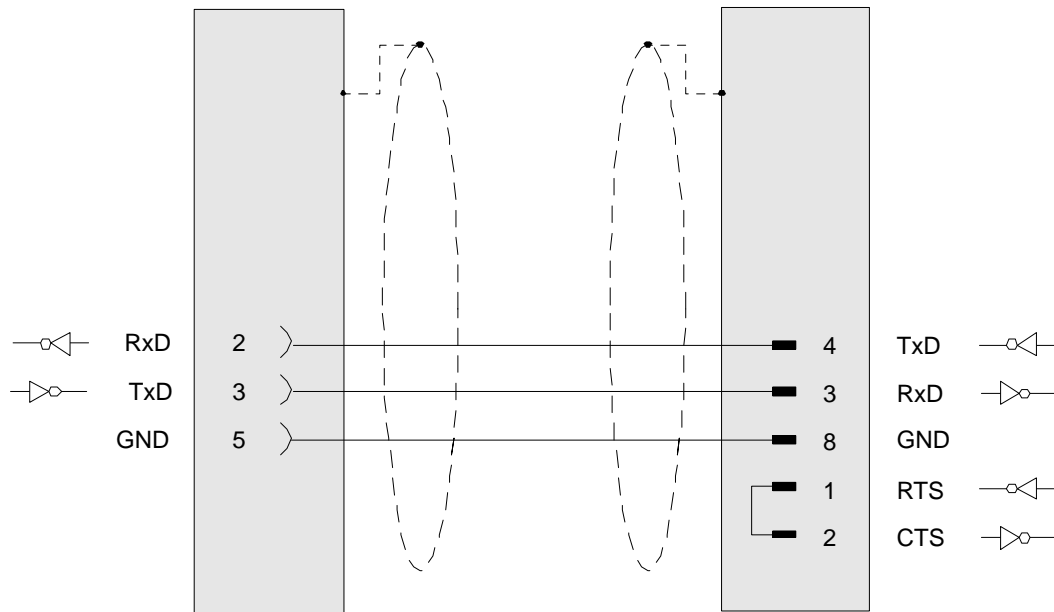
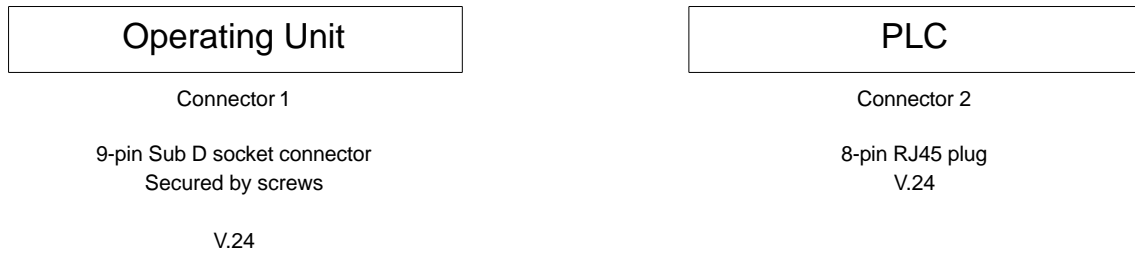
RS 232 Interface Cable with RJ45 plug



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area
- Pin 1 is at the bottom when viewing the PLC (RJ45)

Plug-in Connecting Cable Operating Unit – GE Fanuc PLC

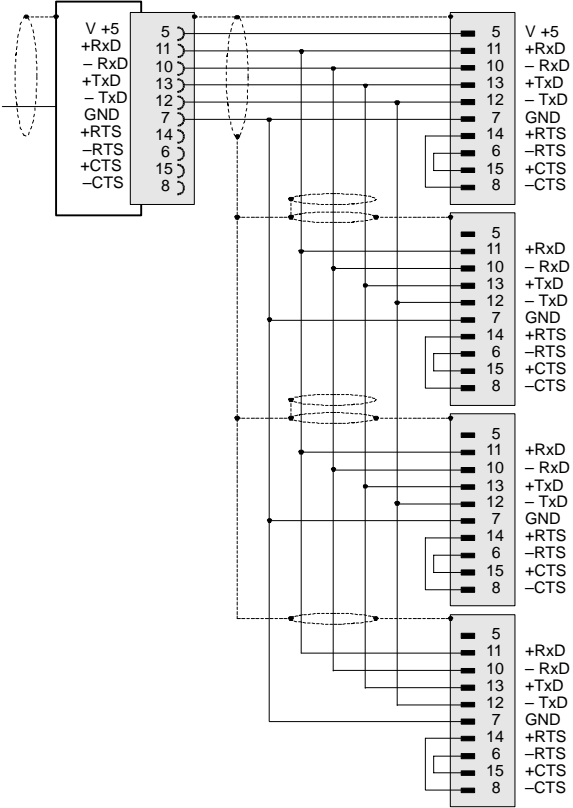
RS 232 Interface Cable with RJ45 plug



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area
- Pin 1 is at the bottom when viewing the PLC (RJ45)

Plug-in Connecting Cable Operating Unit – GE Fanuc PLC

RS 422 Interface
Multi-point cable 2 with RS 232-RS 422 adapter



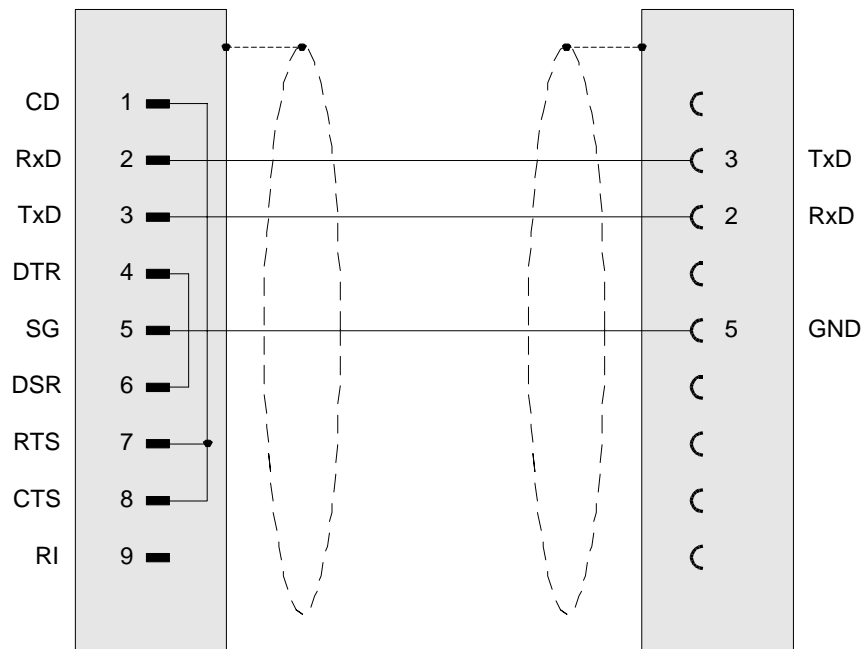
- Cable: 5 x 0.14 mm², shielded; max length: 300 m
- Shielding connected at both ends to casing with large contact area



Caution
The power supply for the adapter may only be connected to a PLC, otherwise the PLCs will be damaged.

Plug-in Connecting Cable Operating Unit – LG Industrial Systems/IMO

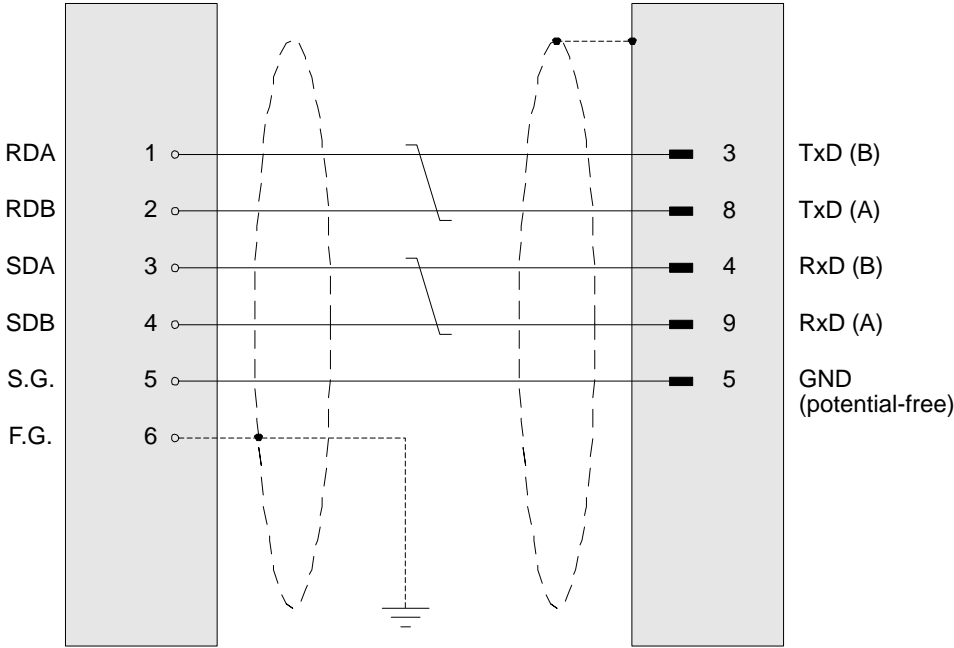
RS 232 Interface
Point-to-point cable 1



- Cable: 3 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

**Plug-in Connecting Cable
Operating Unit – LG Industrial Systems/IMO**

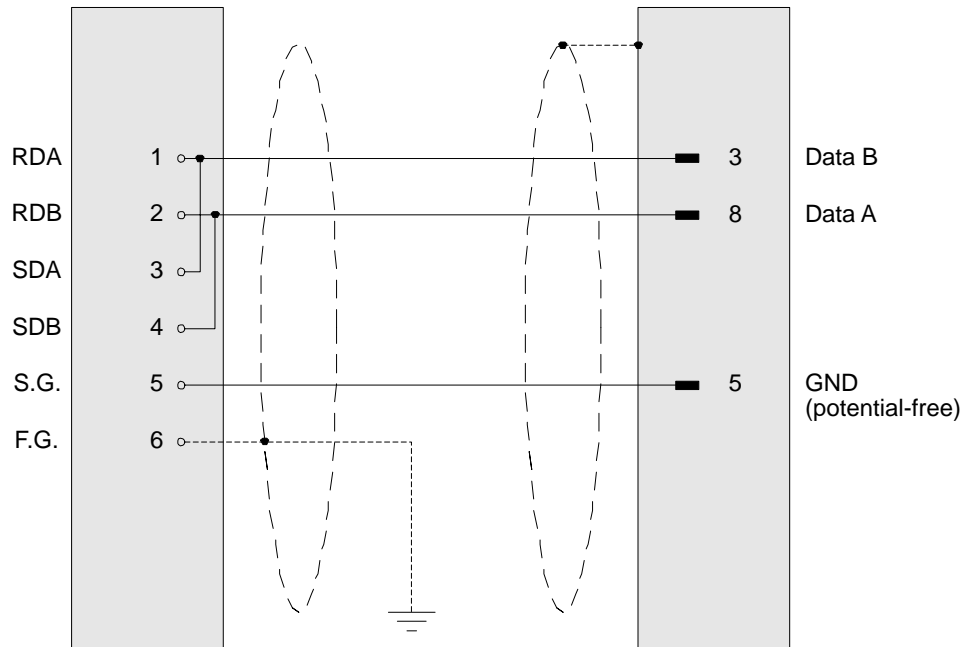
RS 422 Interface
Point-to-point cable 2



- Cable: 3 x 2 x 0.14 mm², shielded; max. length: 500 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – LG Industrial Systems/IMO

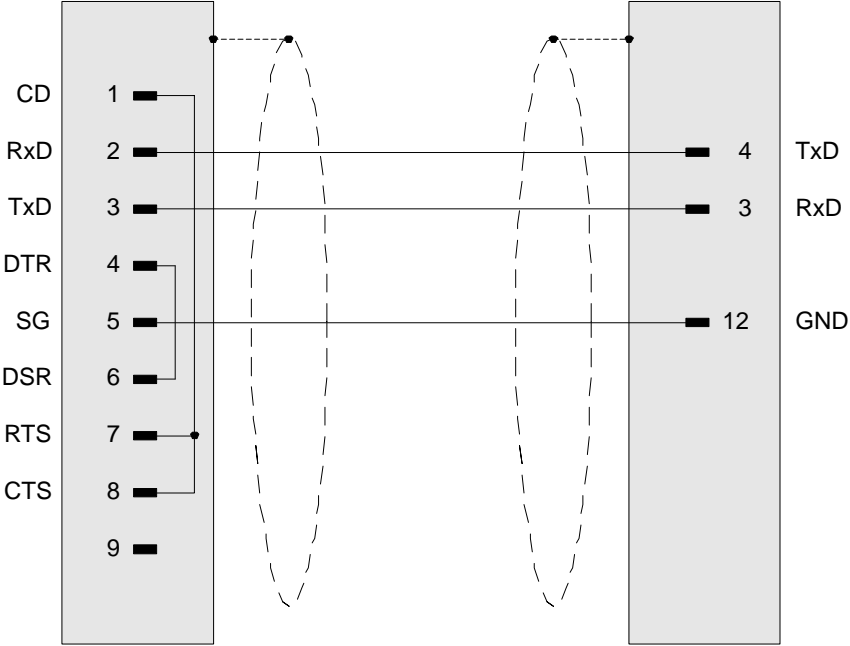
RS 485 Interface
Point-to-point cable 3



- Cable: 2 x 2 x 0.14 mm², shielded; max. length: 500 m
- Shielding connected at both ends to casing with large contact area

**Plug-in Connecting Cable
Operating Unit – LG Industrial Systems/IMO**

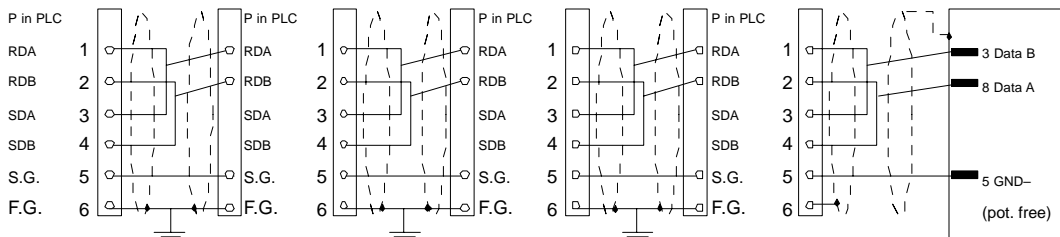
RS 232 Interface
Point-to-point cable 4



- Cable: 3 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – LG Industrial Systems/IMO

RS 485 Interface
Multi-point cable 1



- Cable: 2 x 2 x 0.14 mm², shielded; max. length: 500 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – LG Industrial Systems/IMO

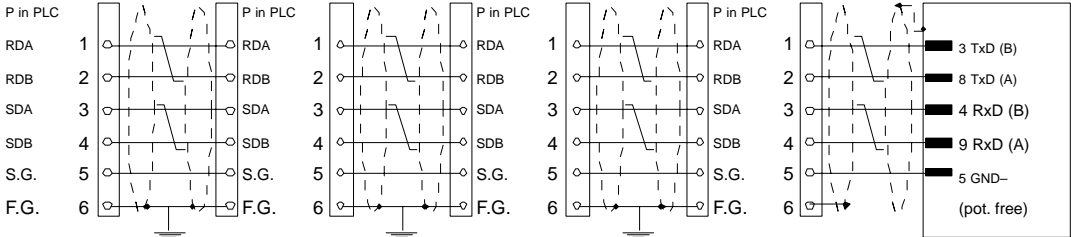
RS 422 Interface Multi-point cable 2

PLC

Operating Unit

Connector 1
Terminal strip

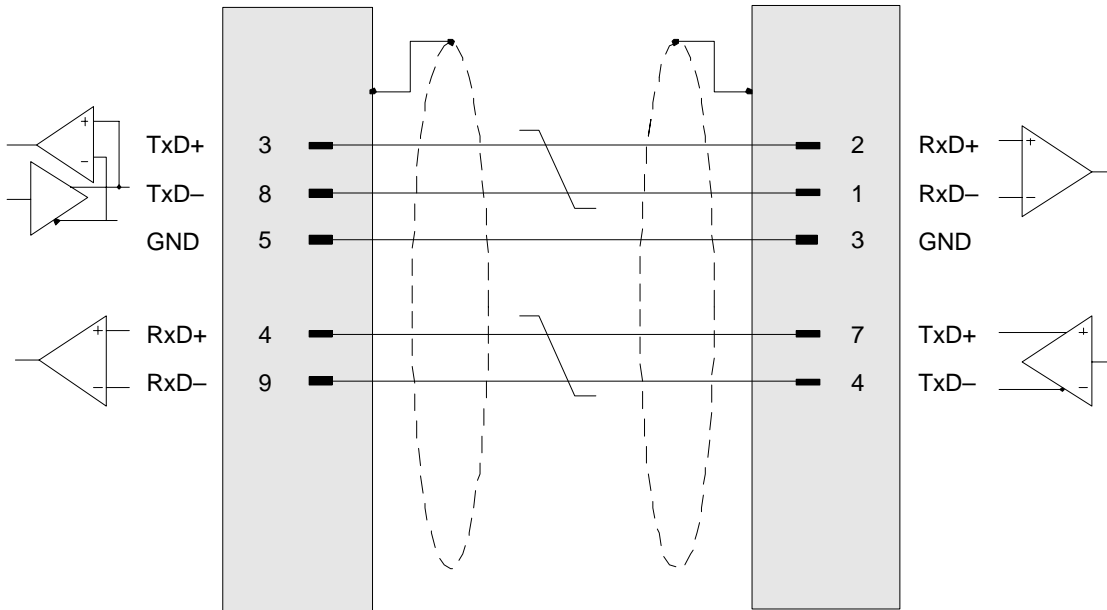
Connector 2
9-pin Sub D plug
Secured by screws



- Cable: 3 x 2 x 0.14 mm², shielded; max. length: 500 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Mitsubishi-Electric PLC

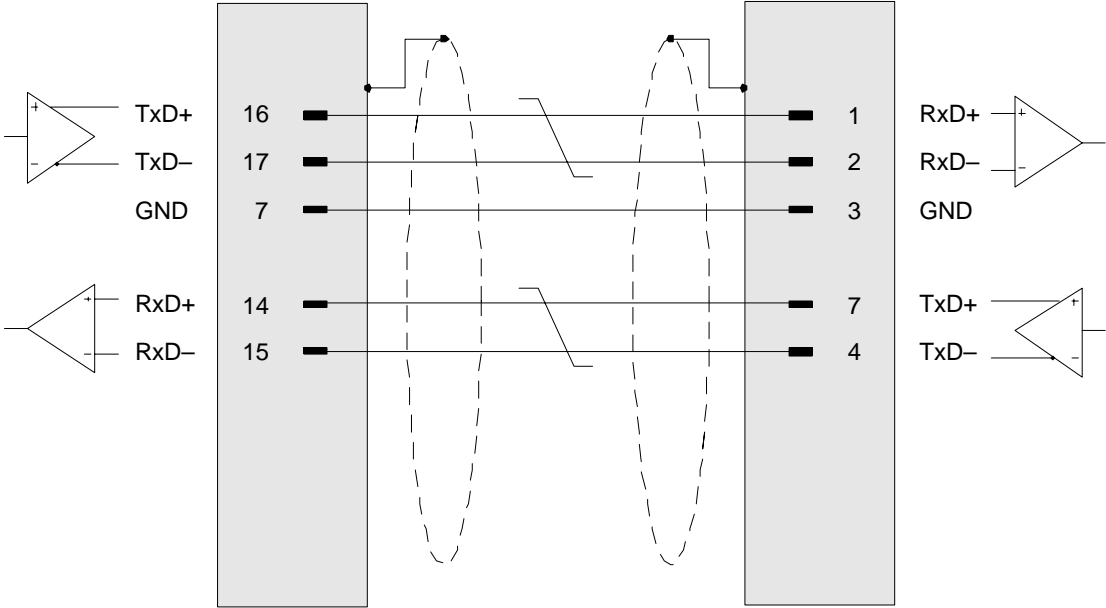
RS 422 Interface
6XV1440-2P _ _ _ _



- Cable: 3 x 2 x 0.14 mm², shielded; max. length: 500 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Mitsubishi-Electric PLC

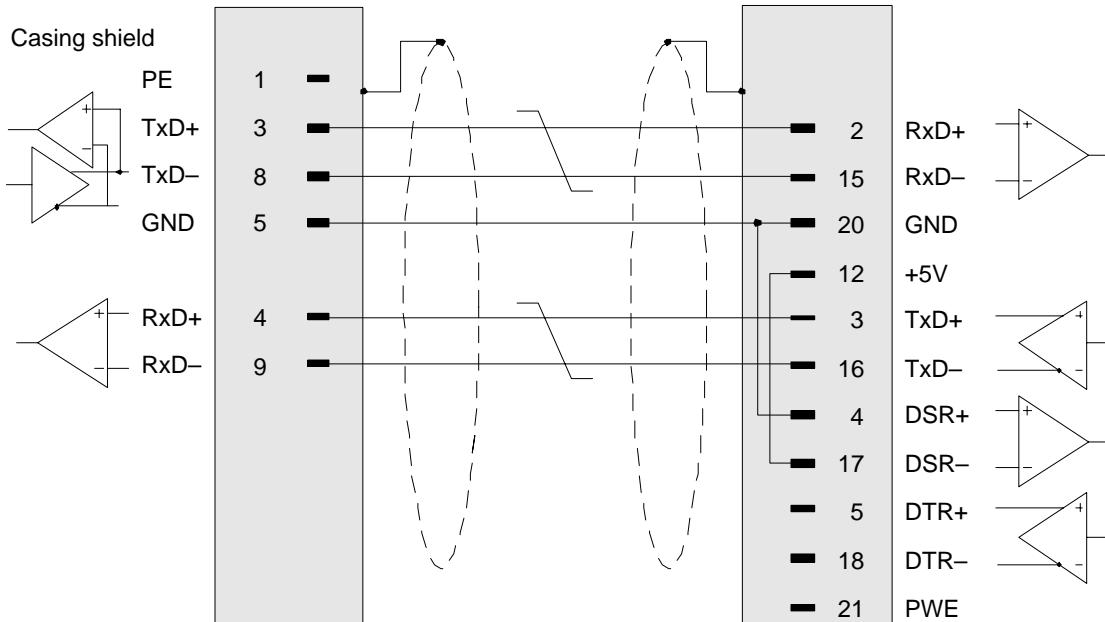
RS 422 Interface
6XV1440-2Q _ _ _ _



- Cable: 3 x 2 x 0.14 mm², shielded; max. length: 500 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Mitsubishi-Electric PLC

RS 422 Interface
6XV1440-2R _ _ _



- Cable: 3 x 2 x 0.14 mm², shielded; max. length: 500 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Mitsubishi-Electric PLC

RS 232 Interface
6XV1440-2UE32

Operating Unit

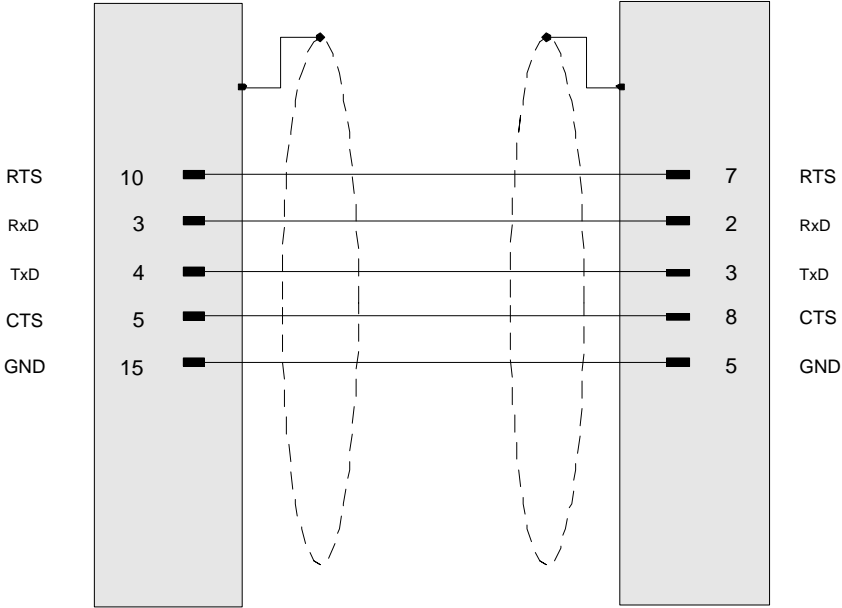
Standard PC

Connector 1

Connector 2

15-pin Sub D socket plug
Secured by slide
Cable outlet at Pin 1

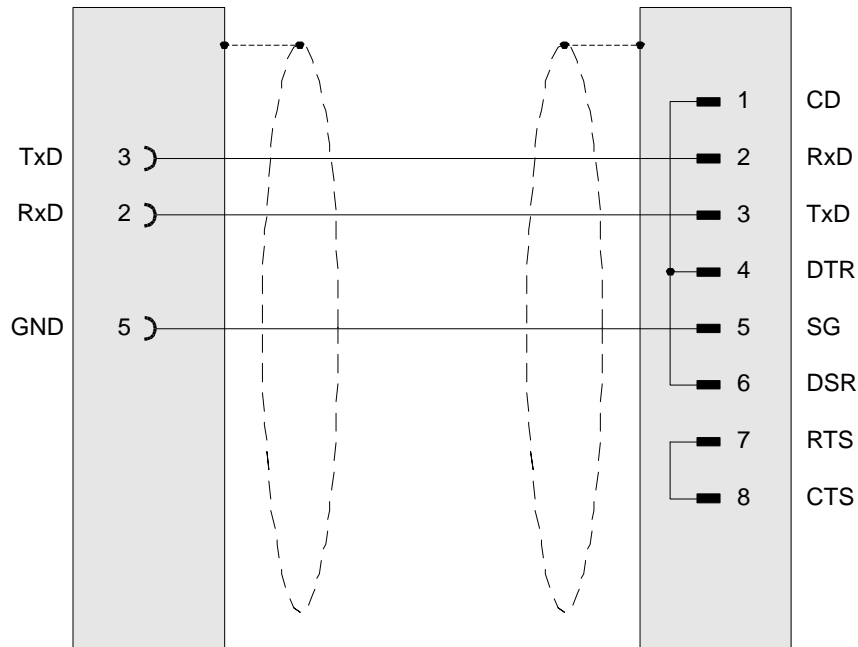
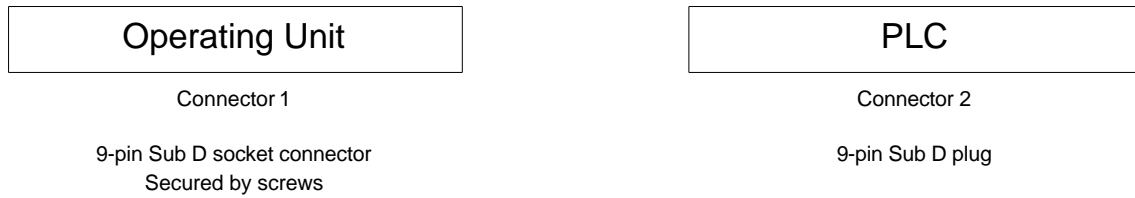
9-pin Sub D plug
Secured by screws
Cable feed-out to rear



- Cable: 5 x 0.14 mm², shielded; max length: max. 32 cm
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Mitsubishi-Melsec PLC

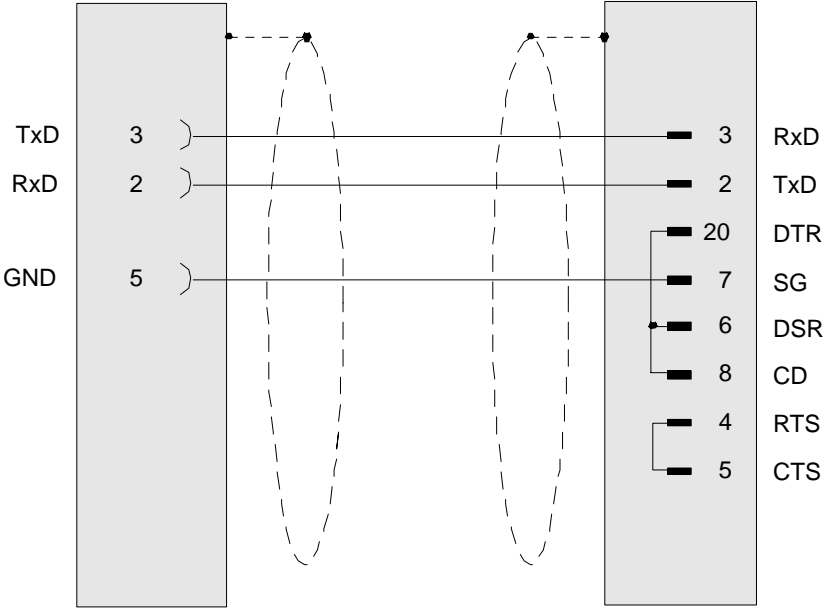
Point-to-point cable 1



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Mitsubishi-Melsec PLC

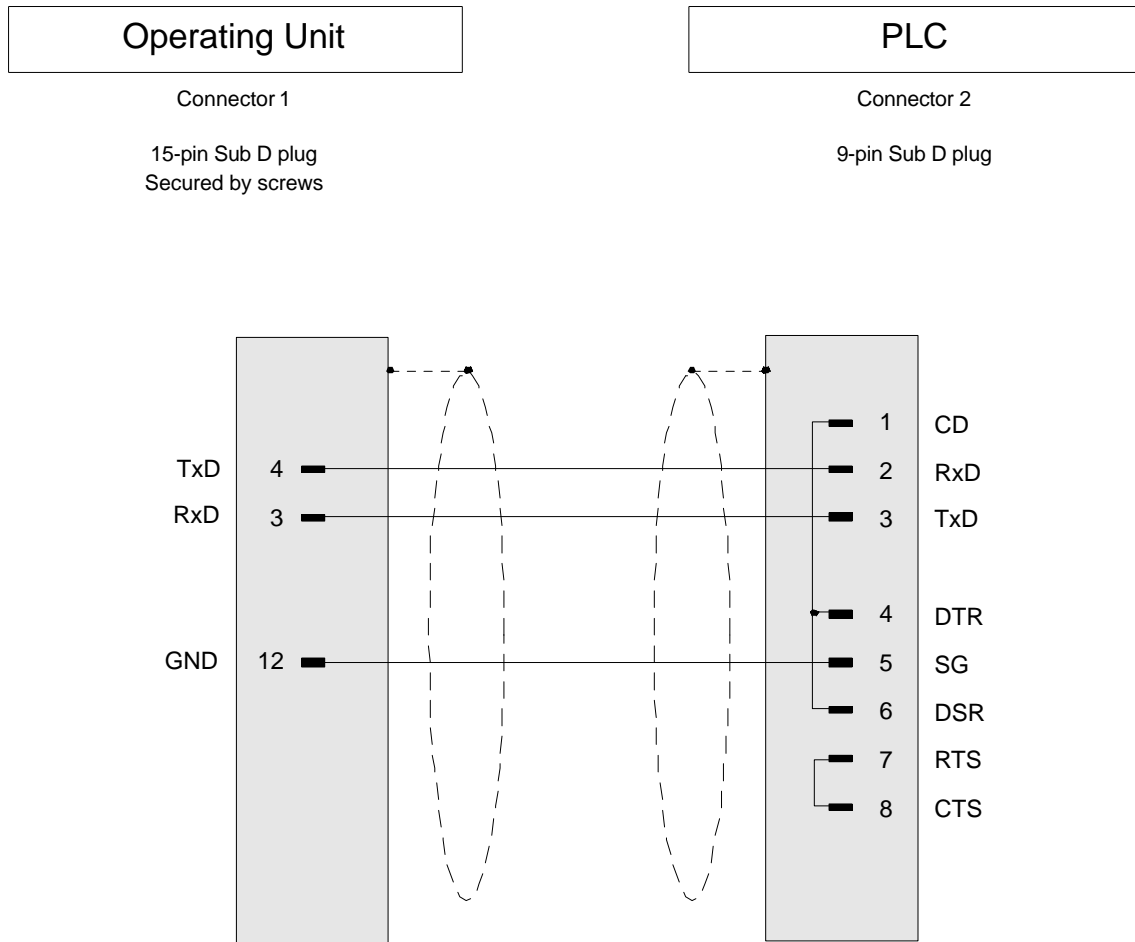
Point-to-point cable 2



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Mitsubishi-Melsec PLC

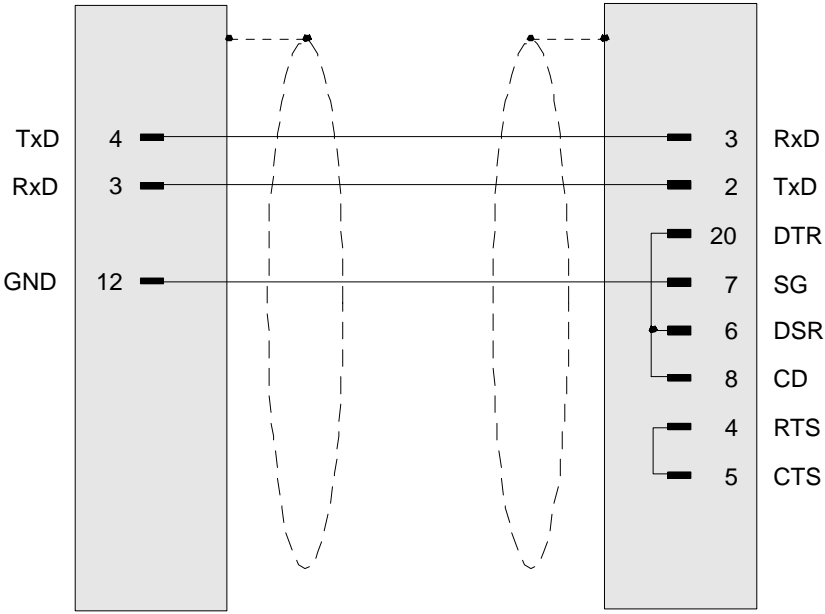
Point-to-point cable 3



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Mitsubishi-Melsec PLC

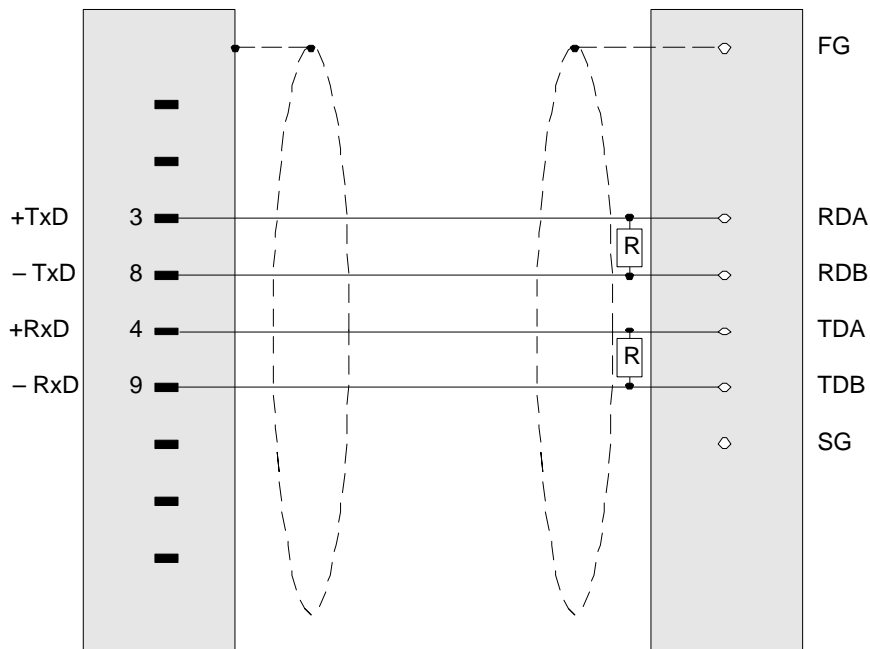
Point-to-point cable 4



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Mitsubishi-Melsec PLC

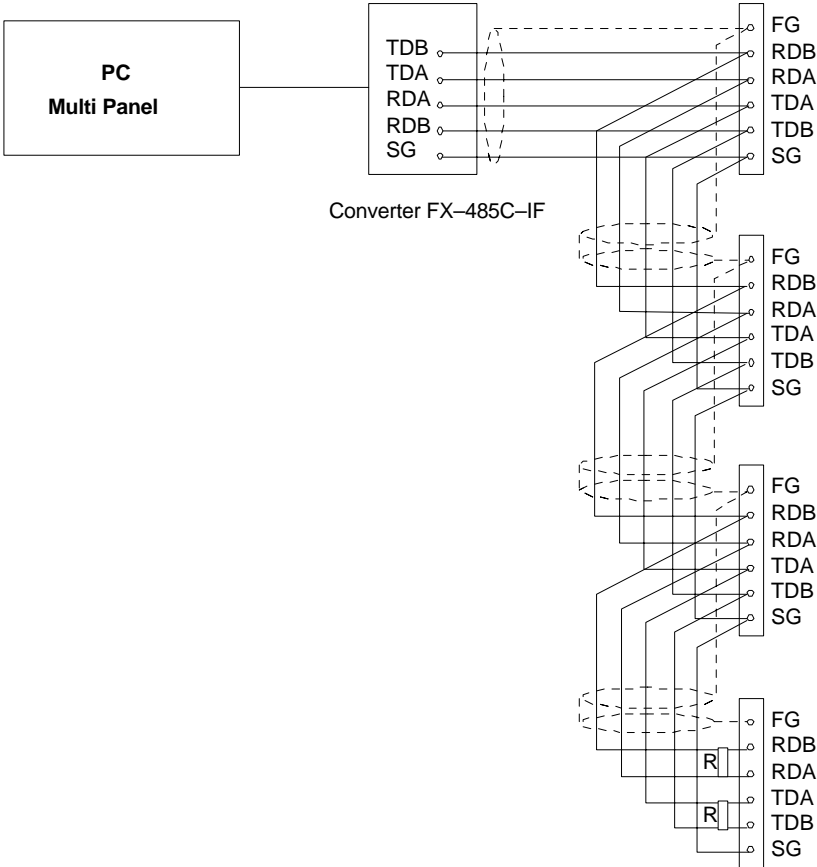
Point-to-point cable 5



- Cable: 5 x 0.14 mm², shielded; max length: 500 m
- Shielding connected at both ends to casing with large contact area
- 330 Ohm is valid for R

Plug-in Connecting Cable Operating Unit – Mitsubishi-Melsec PLC

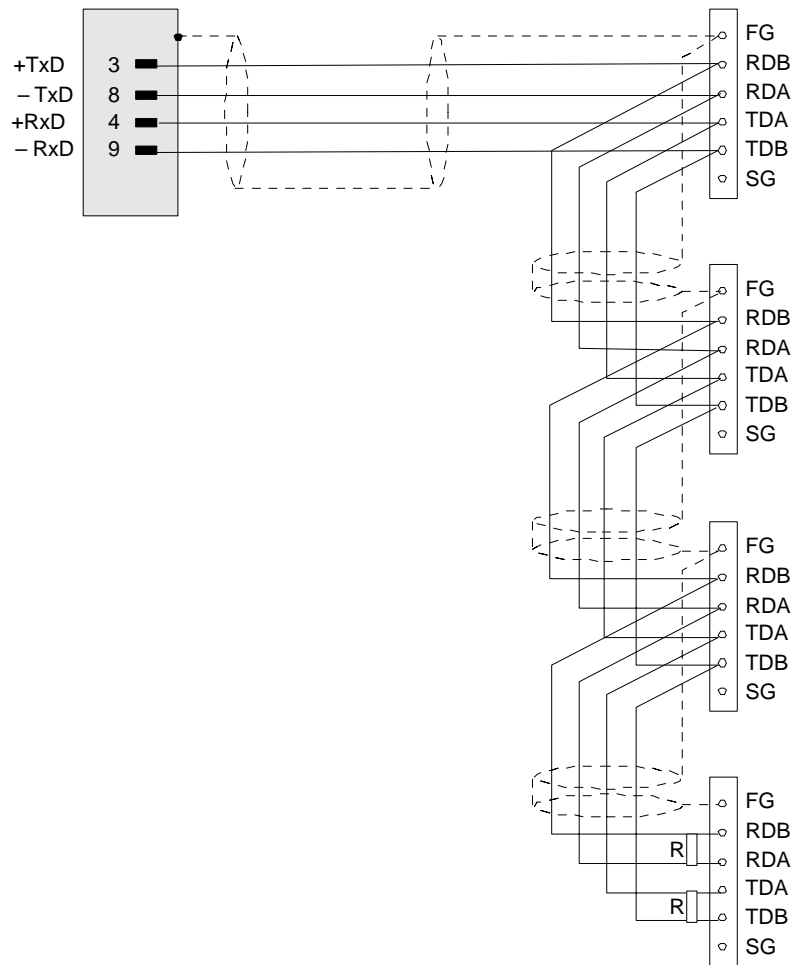
Multi-point cable 1



- Cable: 5 x 0.14 mm², shielded; max length: 500 m
- Shielding connected at both ends to casing with large contact area
- For the connection PC – Converter, use the point-to-point cable 2 and for the connection Multi Panel – Converter use the point-to-point cable 4.
- 330 Ohm is valid for R

Plug-in Connecting Cable Operating Unit – Mitsubishi-Melsec PLC

Multi-point cable 2



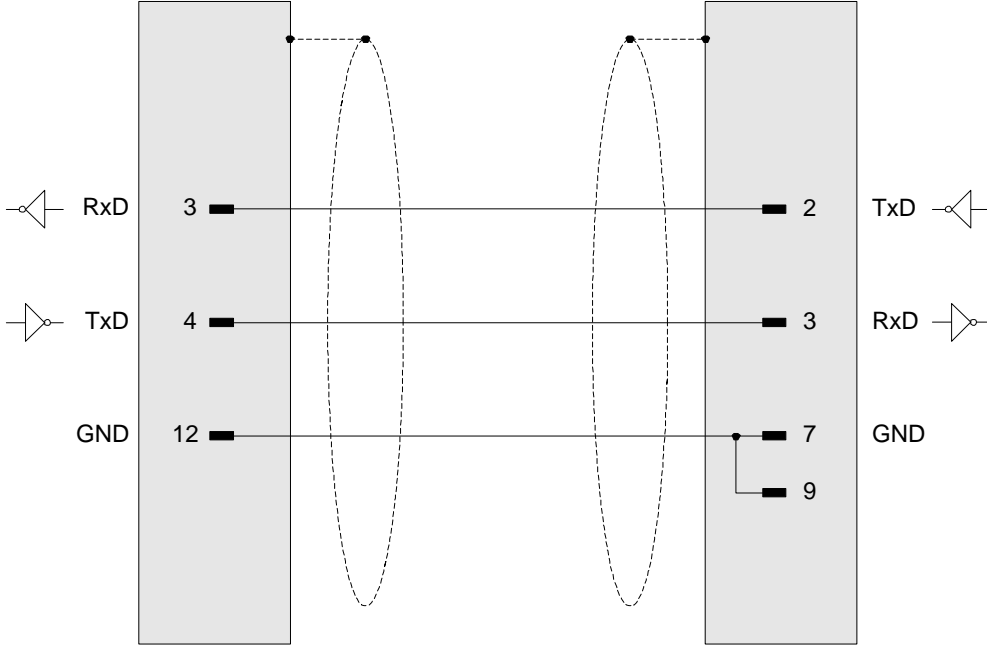
- Cable: 5 x 0.14 mm², shielded; max length: 500 m
- Shielding connected at both ends to casing with large contact area
- 330 Ohm is valid for R

Plug-in Connecting Cable Operating Unit – OMRON

RS 232 Interface
6XV1440-2X _ _ _



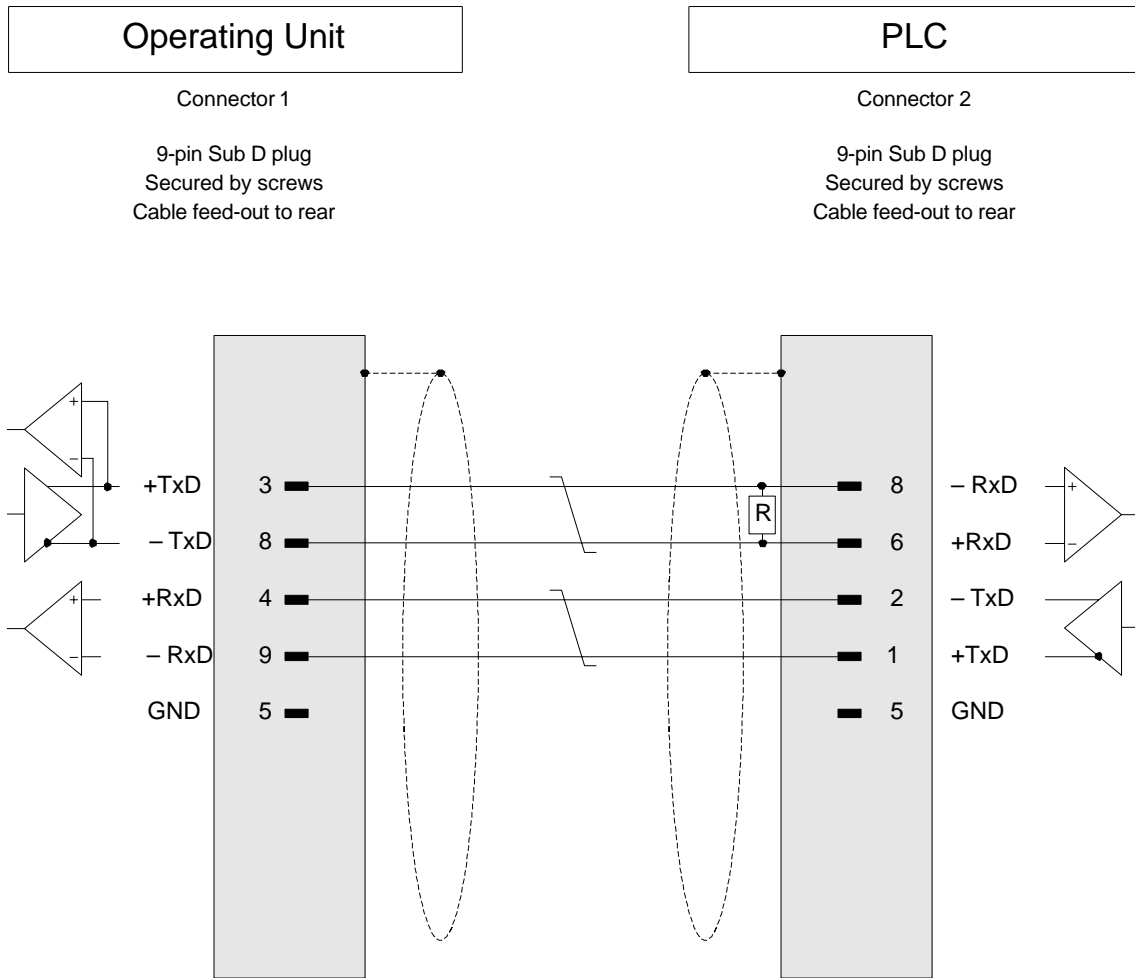
Connector 1	Connector 2
15-pin Sub D plug Secured by slide Cable outlet at Pin 1 Solid metal cover V.24	9-pin Sub D plug Secured by screws Cable feed-out, straight Solid metal cover V.24



- Cable: 5 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – OMRON

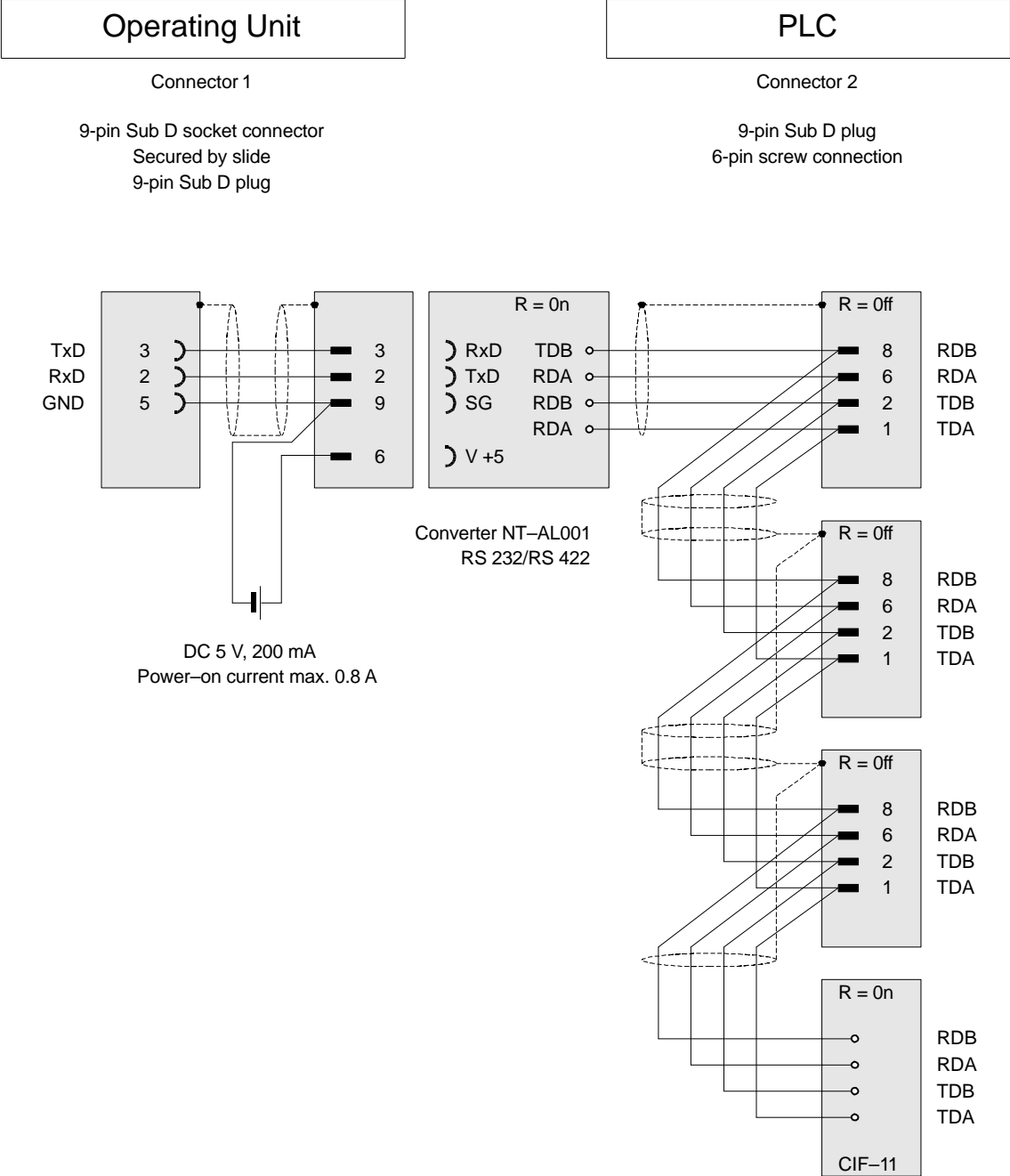
RS 422 Interface
Cable cannot be ordered



- Cable: 3 x 2 x 0.14 mm², shielded; max. length: 500 m
- Shielding connected at both ends to casing with large contact area, screen contacts connected
- Insert resistance R = 220 Ohm/> 150mW (e.g. construction 0207)

Plug-in Connecting Cable Operating Unit – OMRON

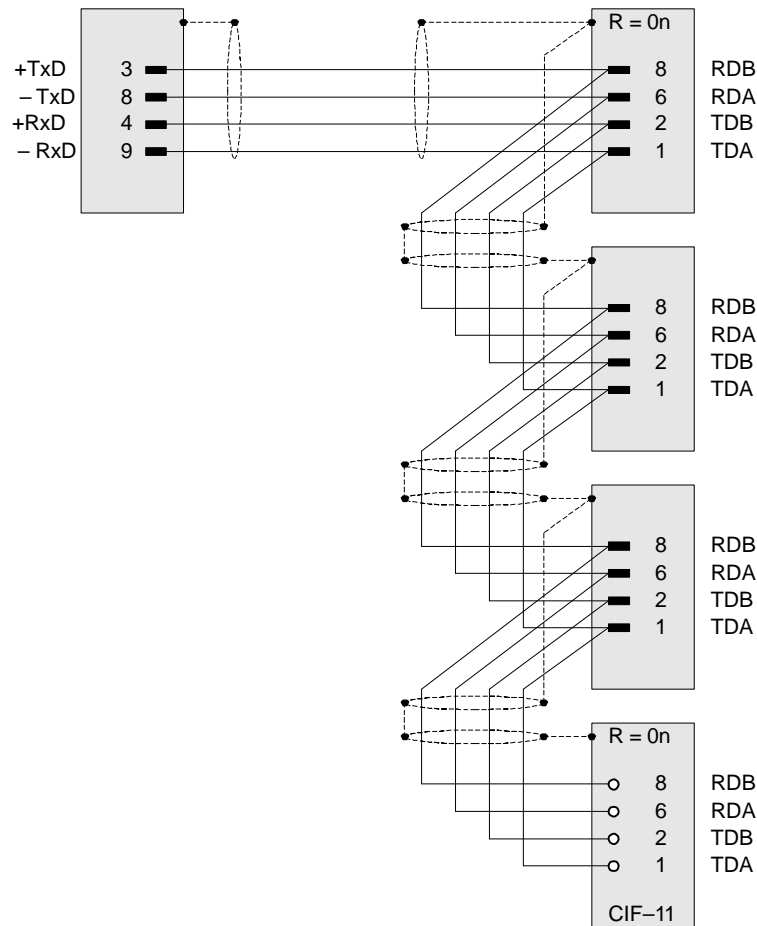
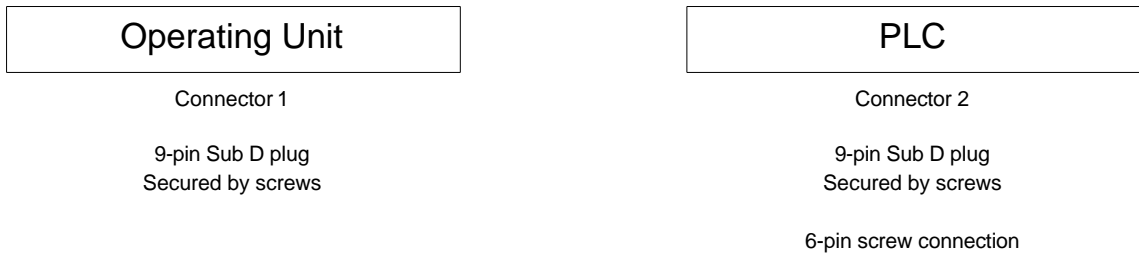
RS 232-RS 422 Converter Multi-point cable 1



- Cable: 5 x 0.14 mm², shielded; max length: 500 m

Plug-in Connecting Cable Operating Unit – OMRON

Multi-point cable 2



- Cable: 5 x 0.14 mm², shielded; max length: 500 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Modicon PLC

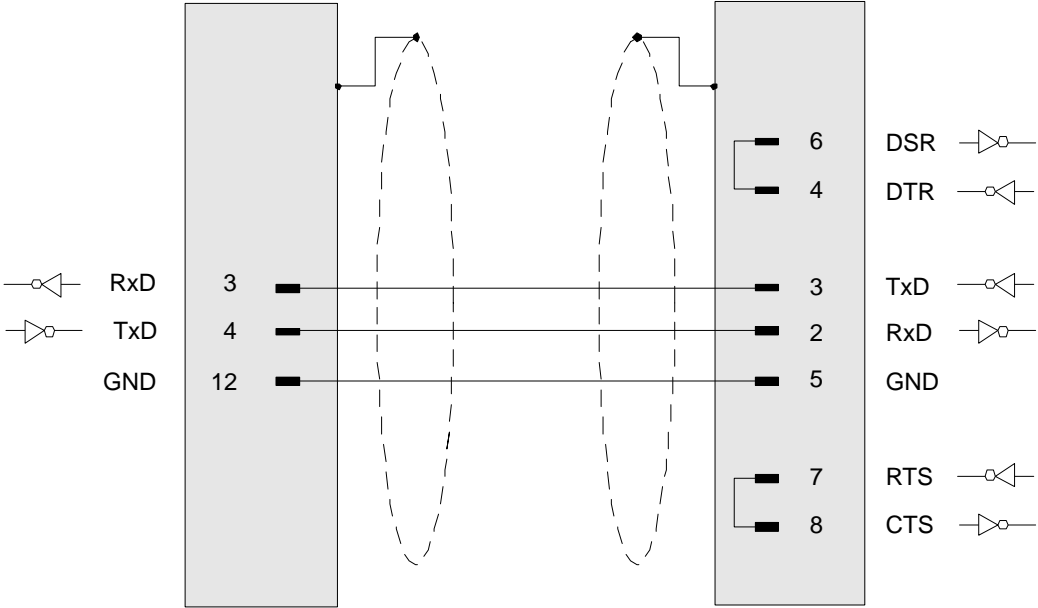
RS 232 Interface
6XV1440-1K _ _ _

Operating Unit

Modicon 984

Connector 1
15-pin Sub D plug
Secured by slide
Cable outlet at Pin 1
Solid metal cover V.24

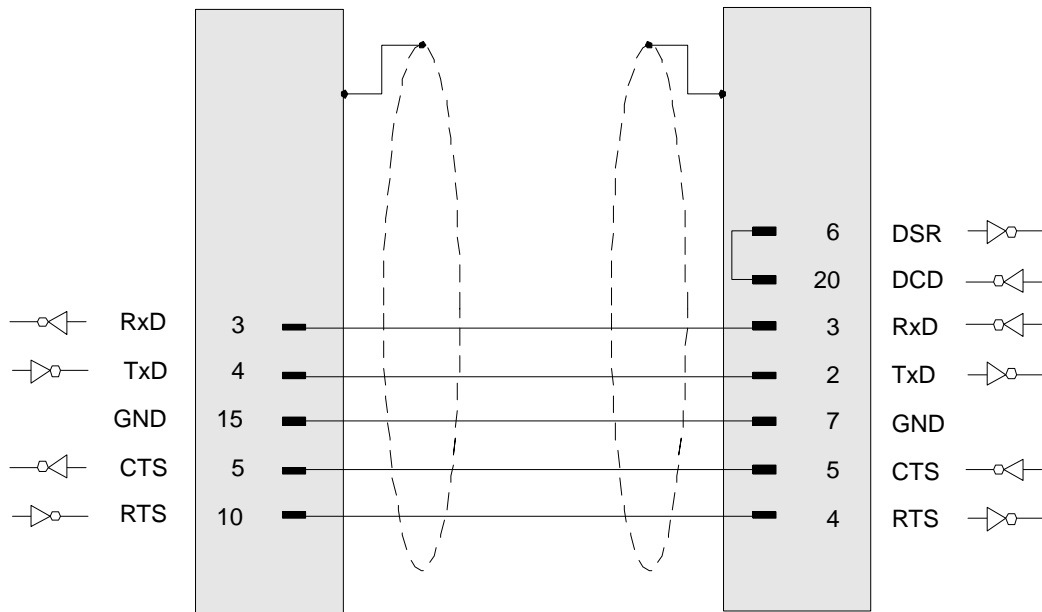
Connector 2
9-pin Sub D plug
Secured by screws
Cable outlet at Pin 1
Solid metal cover V.24



- Cable: 2 x 0.14 mm², shielded; max length: max. 3.7 m
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Modicon PLC

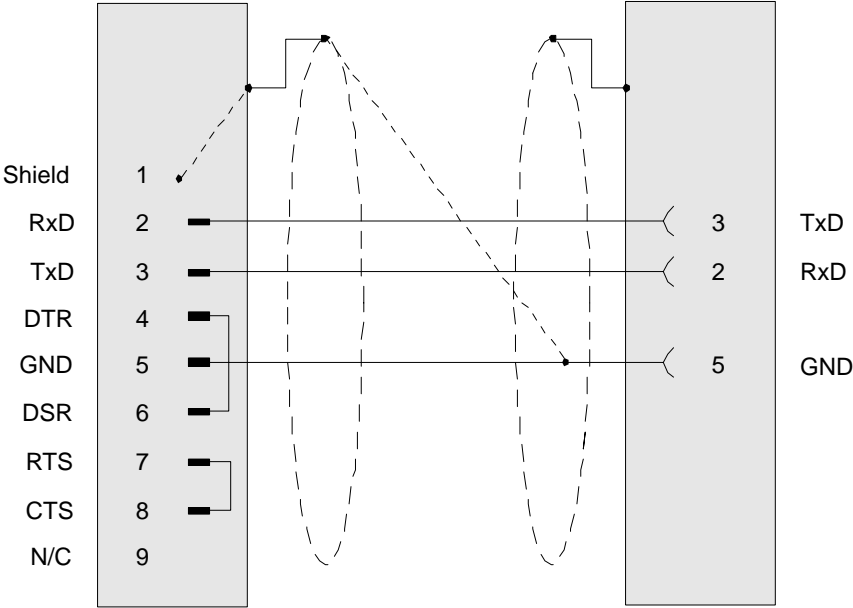
RS 232 Interface
6XV1440-1L _ _ _



- Cable: 5 x 0.14 mm², shielded; max length:
max. 3.7 m for Modicon, max. 15 m for non-Modicon applications
- Shielding connected at both ends to casing with large contact area

Plug-in Connecting Cable Operating Unit – Modicon PLC

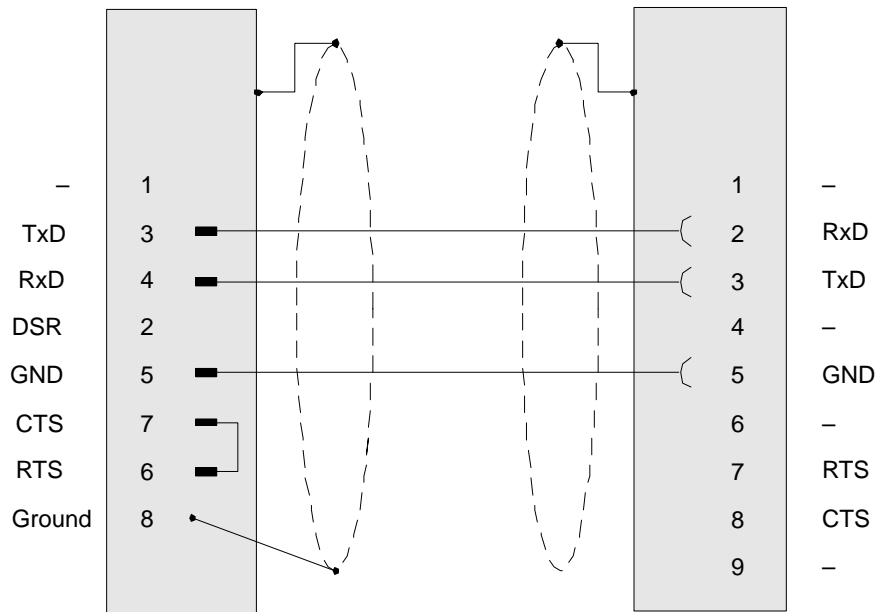
RS 232 Interface
Point-to-point cable 1



- Cable: 3 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area
- N/C = No Connection

Plug-in Connecting Cable Operating Unit – Modicon PLC

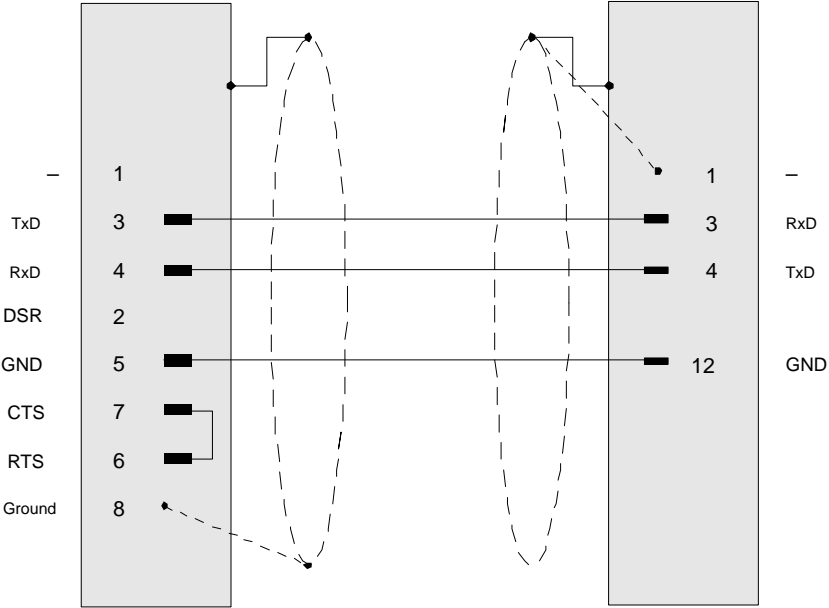
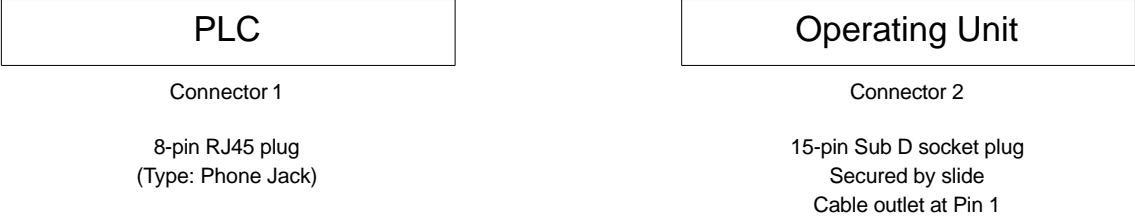
RS 232 Interface Point-to-point cable 2



- Cable: 3 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area
- Pin 1 is at the top when viewing the PLC (RJ45)

Plug-in Connecting Cable Operating Unit – Modicon PLC

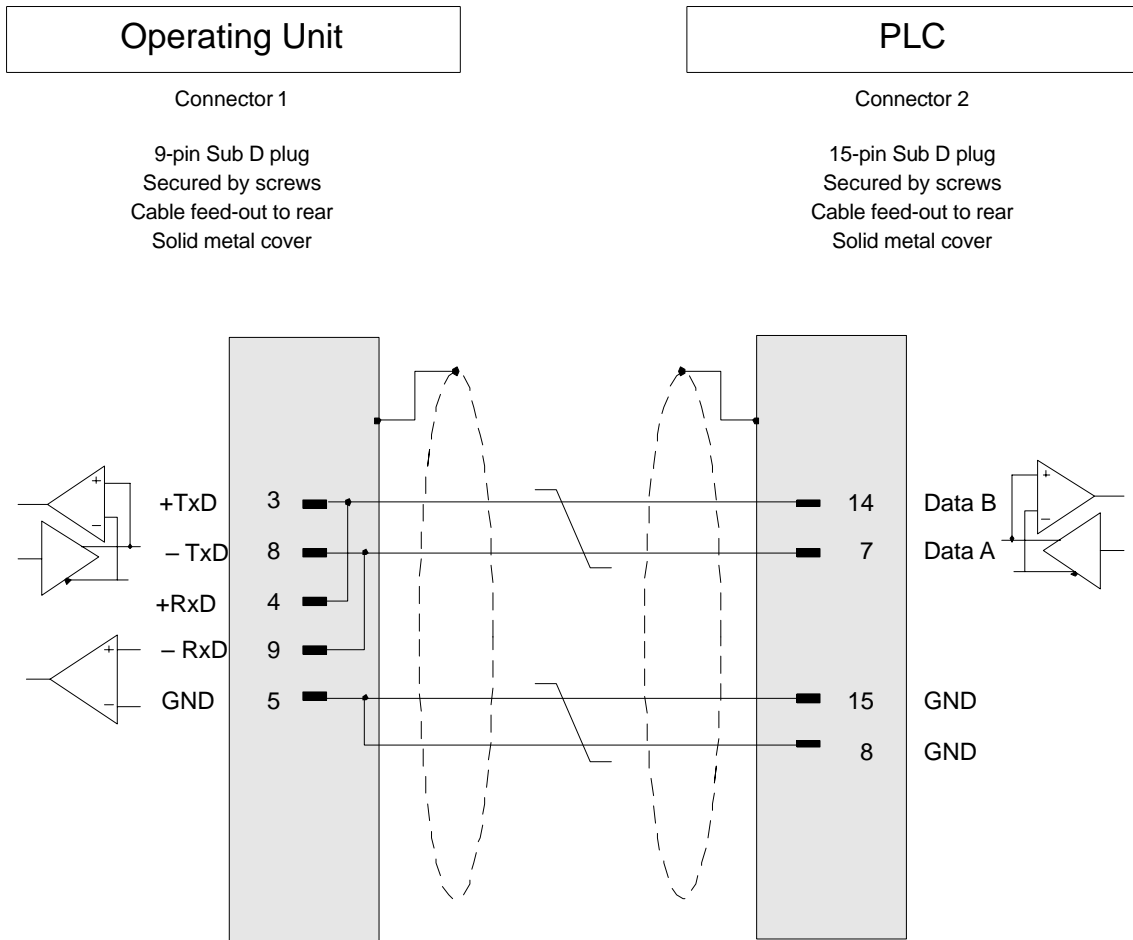
RS 232 Interface Point-to-point cable 3



- Cable: 3 x 0.14 mm², shielded; max length: 15 m
- Shielding connected at both ends to casing with large contact area
- Pin 1 is at the top when viewing the PLC (RJ45)

Plug-in Connecting Cable Operating Unit – Telemecanique

RS 485 Interface
6XV1440-1E _ _ _ _



- Cable: 3 x 2 x 0.14 mm², shielded; max. length: max. 15 m to branch socket
- Shielding connected at both ends to casing with large contact area

**Plug-in Connecting Cable
Operating Unit – Telemecanique**

RS 485 Interface
RS 485 interface cable

Operating Unit

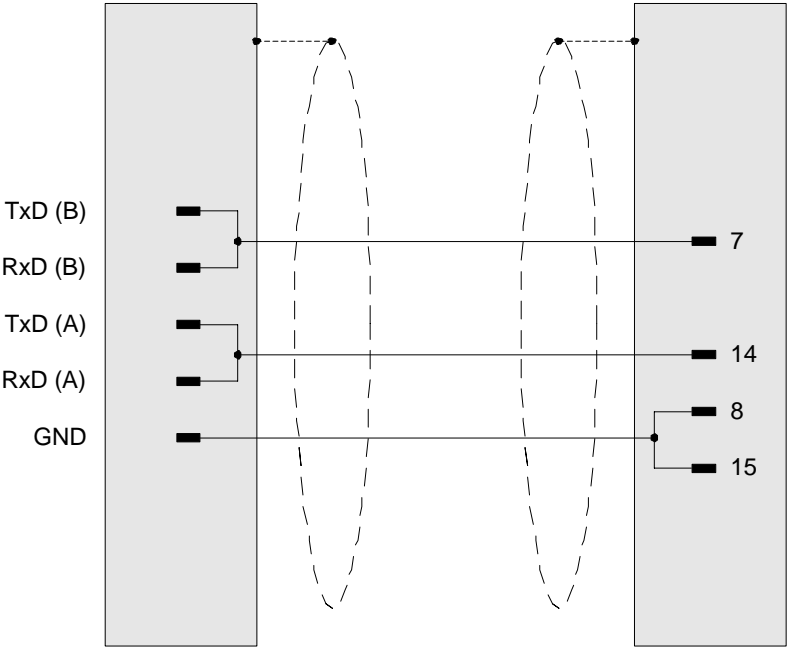
PLC

Connector 1

Connector 2

Assignment according to interface card

9-pin Sub D plug
Secured by screws



- Cable: 4 x 0.14 mm², shielded
- Shielding connected at both ends to casing with large contact area

SIMATIC HMI Documentation

D

Target groups

This section of the Appendix contains 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 <ul style="list-style-type: none"> • a screen with various objects • a screen change and • a message. This documentation is available for: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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	<p>Provides information on connecting text-based and graphics displays to the following PLCs:</p> <ul style="list-style-type: none"> • SIMATIC S5 • SIMATIC S7 • SIMATIC 500/505 • drivers for other PLCs <p>This documentation describes the</p> <ul style="list-style-type: none"> • 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	<p>Provides information on connecting Windows-based systems to the following PLCs:</p> <ul style="list-style-type: none"> • SIMATIC S5 • SIMATIC S7 • SIMATIC WinAC • SIMATIC 505 • Integration in SIMATIC iMap • SIMOTION • drivers for other PLCs <p>This documentation describes the</p> <ul style="list-style-type: none"> • 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	<p>Provides information on connecting the operating units to the OPC and PLCs from:</p> <ul style="list-style-type: none"> • Allen Bradley • GE Fanuc • Lucky Goldstar GM • Mitsubishi • Modicon • Omron • Telemecanique <p>When the drives are installed, the relevant Online Help is installed at the same time.</p>
ProAgent for OP User's Guide ProAgent/PC and ProAgent/MP User's Guide	Configurers	<p>Provides the following information about the ProAgent optional package (process diagnosis):</p> <ul style="list-style-type: none"> • 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
FB	Function Block
FM	Funktionsmodul
FW	Firmware
HMI	Human Machine Interface
HSA	Highest Station Address
IF	Interface
I/O	Input/Output
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
RTU	Remote Terminal Unit
RAM	Alarm messages
PLC	Programmable Logic Control
SRAM	Static Read Only Memory (buffered)
STW	Status word
TD	Text Display
TP	Touch Panel
WinAC	Windows Automation Center

Index

A

Abbreviations, Abbrev-1

Acknowledgement

Allen-Bradley, 6-5, 6-7

GE Fanuc, 8-5, 8-7

LG Industrial Systems/IMO, 10-5, 10-7

Mitsubishi, 13-5, 13-7

Modicon, 17-5, 17-7

OMRON, 15-5, 15-7

Telemecanique, 19-5, 19-7

Acknowledgement - OP, Allen-Bradley, 6-3

Acknowledgement area, Allen-Bradley, 6-9

Acknowledgement area OP

GE Fanuc, 8-6

Mitsubishi, 13-6

Modicon, 17-6

OMRON, 15-6

Telemecanique, 19-6

Acknowledgement area PLC

GE Fanuc, 8-6

Mitsubishi, 13-6

Modicon, 17-6

OMRON, 15-6

Telemecanique, 19-6

Acknowledgement areas

GE Fanuc, 8-9

LG Industrial Systems/IMO, 10-9

Mitsubishi, 13-9

Modicon, 17-9

OMRON, 15-9

Telemecanique, 19-9

Acquisition cycle

Allen-Bradley via DF1, 4-8

Allen-Bradley via DH485, 5-7

GE Fanuc, 7-6

LG Industrial Systems/IMO, 9-6

Mitsubishi via FX, 11-6

Mitsubishi via Protocol 4, 12-7

Modicon, 16-6

OMRON, 14-6

Telemecanique, 18-7

Alarm message area

Allen-Bradley, 6-6

GE Fanuc, 8-6

LG Industrial Systems/IMO, 10-6

Mitsubishi, 13-6

Modicon, 17-6

OMRON, 15-6

Telemecanique, 19-6

Alarm Messages

GE Fanuc, 8-5

Mitsubishi, 13-5

Modicon, 17-5

OMRON, 15-5

Telemecanique, 19-5

Alarm messages

Allen-Bradley, 6-3, 6-5

GE Fanuc, 8-3

LG Industrial Systems/IMO, 10-3, 10-5

Mitsubishi, 13-3

Modicon, 17-3

OMRON, 15-3

Telemecanique, 19-3

Allen-Bradley via DF1, communication management, 4-1

Allen-Bradley via DH485, communication management, 5-1

B

Baud rate

Allen-Bradley via DF1, 4-6

Allen-Bradley via DH485, 5-5

GE Fanuc, 7-4

LG Industrial Systems/IMO, 9-4

Mitsubishi via FX, 11-4

Mitsubishi via Protocol 4, 12-5

Modicon, 16-5

OMRON, 14-4

Telemecanique, 18-5

Bus address, GE Fanuc, 7-4

Bus module / CPU type, Telemecanique, 18-5

C

- Changing PLC, conversion, 1-6
- Checksum, Mitsubishi via Protocol 4, 12-5
- Clear alarm buffer, B-3
- Clear event buffer, B-3
- Communication driver, 1-2
- Communication management
 - Allen-Bradley via DF1, 4-1
 - Allen-Bradley via DH485, 5-1
 - GE Fanuc, 7-1
 - LG Industrial Systems/IMO, 9-1
 - Mitsubishi via FX, 11-1
 - Mitsubishi via Protocol 4, 12-1
 - Modicon, 16-1
 - OMRON, 14-1
 - Telemecanique, 18-1
- Communication structure
 - Allen-Bradley via DF1, 4-4
 - Allen-Bradley via DH485, 5-3
 - GE Fanuc, 7-3
 - LG Industrial Systems/IMO, 9-3
 - Mitsubishi via FX, 11-3
 - Mitsubishi via Protocol 4, 12-3
 - Modicon, 16-3
 - OMRON, 14-3
 - Telemecanique, 18-4
- Communication via tags
 - Allen-Bradley via DF1, 4-5
 - Allen-Bradley via DH485, 5-4
 - GE Fanuc, 7-3
 - LG Industrial Systems/IMO, 9-3
 - Mitsubishi via FX, 11-3
 - Mitsubishi via Protocol 4, 12-3
 - Modicon, 16-4
 - OMRON, 14-3
 - Telemecanique, 18-4
- Connection
 - Allen-Bradley via DF1, 4-2
 - Allen-Bradley via DH485, 5-2
 - GE Fanuc, 7-2
 - LG Industrial Systems/IMO, 9-2
 - Mitsubishi via FX, 11-1
 - Mitsubishi via Protocol 4, 12-2
 - Modicon, 16-2
 - OMRON, 14-2
 - OPC, 2-5
 - Telemecanique, 18-2
- Connection types, selection criteria, 1-2
- Connections
 - overview, 1-1
 - protocols, 1-4

- Conversion, changing PLCs, 1-6
- Coordination
 - Allen-Bradley, 6-3, 6-13–6-15
 - GE Fanuc, 8-3, 8-13
 - LG Industrial Systems/IMO, 10-3, 10-13
 - Mitsubishi, 13-3, 13-13
 - Modicon, 17-13
 - Modicon , 17-3
 - OMRON, 15-3, 15-13–15-15
 - Telemecanique, 19-13
- Coordination , Telemecanique, 19-3
- CPU type
 - Allen-Bradley via DF1, 4-6
 - Allen-Bradley via DH485, 5-5
 - GE Fanuc, 7-4
- CPU- type
 - Mitsubishi via FX, 11-4
 - Mitsubishi via Protocol 4, 12-5
 - Modicon, 16-5

D

- Data bits
 - Allen-Bradley via DF1, 4-6
 - Allen-Bradley via DH485, 5-5
 - GE Fanuc, 7-4
 - LG Industrial Systems/IMO, 9-4
 - Mitsubishi via FX, 11-4
 - Mitsubishi via Protocol 4, 12-5
 - Modicon, 16-5
 - OMRON, 14-4
 - Telemecanique, 18-5
- Data exchange, 1-2
 - OPC, 2-2
- Data mailbox
 - Allen-Bradley, 6-3
 - GE Fanuc, 8-3
 - LG Industrial Systems/IMO, 10-3
 - Mitsubishi, 13-3
 - Modicon, 17-3
 - OMRON, 15-3
 - Telemecanique, 19-3
- Data Type, Mitsubishi via FX, 11-5
- Data Types, OMRON, 14-5

- Data types
 - Allen-Bradley via DF1, 4-7
 - Allen-Bradley via DH485, 5-5
 - GE Fanuc, 7-5
 - LG Industrial Systems/IMO, 9-5
 - Mitsubishi via Protocol 4, 12-6
 - Modicon, 16-5
 - Telemecanique, 18-6
- Date/Time
 - Allen-Bradley, 6-3, 6-11–6-13
 - GE Fanuc, 8-3, 8-11
 - LG Industrial Systems/IMO, 10-3
 - Mitsubishi, 13-3, 13-11
 - Modicon, 17-3, 17-11
 - OMRON, 15-3, 15-11
 - Telemecanique, 19-3, 19-11
- Date/Time , LG Industrial Systems/IMO, 10-11
- Date/Time PLC
 - Allen-Bradley, 6-3
 - GE Fanuc, 8-3, 8-12–8-14
 - LG Industrial Systems/IMO, 10-3, 10-12–10-14
 - Mitsubishi, 13-12–13-14
 - Modicon, 17-3, 17-12–17-14
 - OMRON, 15-3, 15-12–15-14
 - Telemecanique, 19-3, 19-12–19-14
- DCOM
 - configuration, 3-1
 - settings, 3-1
- Documentation, D-1
- Download date/time, B-2
- Downloading , termination, Allen-Bradley, 6-25
- Downloading data records
 - Allen-Bradley, 6-18
 - asynchronous
 - Allen-Bradley, 6-19
 - GE Fanuc, 8-19
 - LG Industrial Systems/IMO, 10-19
 - Mitsubishi, 13-19
 - Modicon, 17-19
 - OMRON, 15-19
 - Telemecanique, 19-19
 - GE Fanuc, 8-18
 - LG Industrial Systems/IMO, 10-18
 - Mitsubishi, 13-18
 - Modicon, 17-18
 - OMRON, 15-18
 - synchronous
 - Allen-Bradley, 6-20
 - GE Fanuc, 8-20
 - LG Industrial Systems/IMO, 10-20
 - Mitsubishi, 13-20
 - Modicon, 17-20
 - OMRON, 15-20
 - Telemecanique, 19-20
 - Telemecanique, 19-18
- E**
 - Event message area
 - Allen-Bradley, 6-6, 6-17
 - GE Fanuc, 8-6, 8-17
 - LG Industrial Systems/IMO, 10-6, 10-17
 - Mitsubishi, 13-6, 13-17
 - Modicon, 17-6, 17-17
 - OMRON, 15-6, 15-17
 - Telemecanique, 19-6, 19-17
 - Event messages
 - Allen-Bradley, 6-3, 6-5
 - GE Fanuc, 8-3, 8-5
 - LG Industrial Systems/IMO, 10-3, 10-5
 - Mitsubishi, 13-3, 13-5
 - Modicon, 17-3, 17-5
 - OMRON, 15-3, 15-5
 - Telemecanique, 19-3, 19-5
- F**
 - Framing, Modicon, 16-5
 - Free parameters, Modicon, 16-5

Function, operating unit, 1-1

Function range

Allen-Bradley, 6-2–6-26

GE Fanuc, 8-2–8-26

LG Industrial Systems/IMO, 10-2–10-26

Mitsubishi, 13-2–13-26

Modicon, 17-2–17-26

OMRON, 15-2–15-26

Telemecanique, 19-2–19-26

G

Gate, Telemecanique, 18-5

GE Fanuc, Kommunikationsmanagement, 7-1

Get event message area, B-2

Get LED area, B-2

I

Interface

Allen-Bradley via DF1, 4-6

Allen-Bradley via DH485, 5-5

GE Fanuc, 7-4

LG Industrial Systems/IMO, 9-4

Mitsubishi via FX, 11-4

Mitsubishi via Protocol 4, 12-5

Modicon, 16-5

OMRON, 14-4

Telemecanique, 18-5

Interface Area Assignment, C-1

Interface type

Allen-Bradley via DF1, 4-6

Allen-Bradley via DH485, 5-5

GE Fanuc, 7-4

LG Industrial Systems/IMO, 9-4

Mitsubishi via FX, 11-4

Modicon, 16-5

OMRON, 14-4

Telemecanique, 18-5

Interfaces type, Mitsubishi via Protocol 4, 12-5

J

Job Mailbox, Telemecanique, 19-4–19-6

Job mailbox

Allen-Bradley, 6-3, 6-4–6-6

GE Fanuc, 8-3, 8-4–8-6

LG Industrial Systems/IMO, 10-3,
10-4–10-6

Mitsubishi, 13-3, 13-4–13-6

Modicon, 17-3, 17-4–17-6

OMRON, 15-3, 15-4–15-6

Telemecanique, 19-3

L

Language, System messages, A-1

LED assignment

Allen-Bradley, 6-3, 6-16–6-18

GE Fanuc, 8-3, 8-16, 8-17

LG Industrial Systems/IMO, 10-3,
10-16–10-18

Mitsubishi, 13-3, 13-16–13-18

Modicon, 17-3, 17-16, 17-17

OMRON, 15-3, 15-16, 15-17

Telemecanique, 19-3, 19-16–19-18

LG Industrial Systems/IMO, communication
management, 9-1

Life bit

Allen-Bradley, 6-14

GE Fanuc, 8-14

LG Industrial Systems/IMO, 10-14

Mitsubishi, 13-14

Modicon, 17-14

OMRON, 15-14

Telemecanique, 19-14

Literature, D-1

LongBreak, GE Fanuc, 7-4

M

Max. bus address, Allen-Bradley via DH485,
5-5

- Message areas
 - Allen-Bradley, 6-6
 - GE Fanuc, 8-6
 - LG Industrial Systems/IMO, 10-6
 - Mitsubishi, 13-6
 - Modicon, 17-6
 - OMRON, 15-6
 - Telemecanique, 19-6
 - Message bit
 - Allen-Bradley, 6-7
 - GE Fanuc, 8-7
 - LG Industrial Systems/IMO, 10-7
 - Mitsubishi, 13-7
 - Modicon, 17-7
 - OMRON, 15-7
 - Telemecanique, 19-7
 - Message number
 - Allen-Bradley, 6-7
 - GE Fanuc, 8-7
 - LG Industrial Systems/IMO, 10-7
 - Mitsubishi, 13-7
 - Modicon, 17-7
 - OMRON, 15-7
 - Telemecanique, 19-7
 - Messages, System messages, A-1
 - Mitsubishi via FX, communication management, 11-1
 - Mitsubishi via Protocol 4, communication management, 12-1
 - Modicon, communication management, 16-1
- O**
- OMRON, communication management, 14-1
 - OP acknowledgement area
 - Allen-Bradley, 6-6
 - LG Industrial Systems/IMO, 10-6
 - OP acknowledgement-
 - LG Industrial Systems/IMO, 10-3
 - Mitsubishi, 13-3
 - Modicon, 17-3
 - OMRON, 15-3
 - Telemecanique, 19-3
 - OP address, Allen-Bradley via DH485, 5-5
 - OPC
 - conditions, 2-2
 - configuration
 - as OPC-client, 2-3
 - as OPC-server, 2-4
 - configurations, 2-2
 - connection, 2-5
 - data exchange, 2-2
 - Networking, 2-1
 - OPC parameters - client, 2-6
 - OPC-server parameters, tags, 2-9
 - PLC protocol, 2-5
 - settings for DCOM, 3-1
 - starting up, 2-5
 - tag parameters - client, tags, 2-7
 - tags, 2-5
 - OPC parameters - client, OPC, 2-6
 - OPC-client tag parameters, tags, 2-7
 - OPC-server parameters, OPC, 2-9
 - Operating mode
 - Allen-Bradley, 6-14
 - GE Fanuc, 8-14
 - LG Industrial Systems/IMO, 10-14
 - Mitsubishi, 13-13
 - Modicon, 17-13
 - OMRON, 15-14
 - Telemecanique, 19-13
 - Operating mode switch, LG Industrial Systems/IMO, 9-2
 - Operating unit
 - function, 1-1
 - Mitsubishi via Protocol 4, 12-1
 - possible protocols, 1-4
 - selection criteria, 1-4
 - Operating unit acknowledgement, GE Fanuc, 8-3
 - Operating unit- Un-iTelwa-y station, Telemecanique, 18-5

Operating units

- Allen-Bradley via DF1, 4-1
- Allen-Bradley via DH485, 5-1
- GE Fanuc, 7-1
- LG Industrial Systems/IMO, 9-1
- Mitsubishi via FX, 11-1
- Modicon, 16-1
- OMRON, 14-1
- Telemecanique, 18-1

Optimization

- Allen-Bradley via DF1, 4-8
- Allen-Bradley via DH485, 5-7
- GE Fanuc, 7-6
- LG Industrial Systems/IMO, 9-6
- Mitsubishi via FX, 11-6
- Mitsubishi via Protocol 4, 12-7
- Modicon, 16-6
- OMRON, 14-6
- Telemecanique, 18-7

Optimizing PLC jobs

- Allen-Bradley via DF1, 4-9
- Allen-Bradley via DH485, 5-8
- LG Industrial Systems/IMO, 9-7

Optimizing screens

- Allen-Bradley via DF1, 4-9
- Allen-Bradley via DH485, 5-7
- Mitsubishi via FX, 11-6
- Mitsubishi via Protocol 4, 12-8

Optimizing trends

- Allen-Bradley via DF1, 4-9
- Allen-Bradley via DH485, 5-8
- Mitsubishi via FX, 11-7
- Mitsubishi via Protocol 4, 12-8

Overview

- connections, 1-1
- protocols, 1-1

P**Parameters, system message, A-1****Parity**

- Allen-Bradley via DF1, 4-6
- Allen-Bradley via DH485, 5-5
- GE Fanuc, 7-4
- LG Industrial Systems/IMO, 9-4
- Mitsubishi via FX, 11-4
- Mitsubishi via Protocol 4, 12-5
- Modicon, 16-5
- OMRON, 14-4
- Telemecanique, 18-5

Password logout, B-2**Performance**

- Allen-Bradley via DF1, 4-8
- Allen-Bradley via DH485, 5-7
- GE Fanuc, 7-6
- LG Industrial Systems/IMO, 9-6
- Mitsubishi via FX, 11-6
- Mitsubishi via Protocol 4, 12-7
- Modicon, 16-6
- OMRON, 14-6
- Telemecanique, 18-7

PLC, changing the PLC, 1-6**PLC acknowledgement**

- Allen-Bradley, 6-3–6-27
- GE Fanuc, 8-3

PLC acknowledgement area

- Allen-Bradley, 6-6
- LG Industrial Systems/IMO, 10-6

PLC acknowledgement-

- LG Industrial Systems/IMO, 10-3
- Mitsubishi, 13-3
- Modicon, 17-3
- OMRON, 15-3
- Telemecanique, 19-3

PLC date/time

- Allen-Bradley, 6-12–6-14
- Mitsubishi, 13-3

PLC job

- Clear alarm buffer, B-3
- Clear event buffer, B-3
- Get event message area, B-2
- Get LED area, B-2
- Password logout, B-2
- Read data record from PLC, B-3
- Retrieve alarm message area and acknowledgement area, B-3
- Select screen, B-3
- Set Date, B-2
- Set password level, B-2
- Set Time, B-2
- Transfer date/time, B-2
- Write data record in PLC, B-3

PLC job optimization

- GE Fanuc, 7-7
- Mitsubishi via FX, 11-7
- Mitsubishi via Protocol 4, 12-8
- Modicon, 16-7
- OMRON, 14-7
- Telemecanique, 18-8

PLC jobs, B-1

- Download date/time, B-2

Protocol, possible for use, 1-4

Protocols

- available, 1-2
- overview, 1-1

R**Recipes**

- Allen-Bradley, 6-18–6-20
- causes of errors
 - Allen-Bradley, 6-24
 - GE Fanuc, 8-24
 - LG Industrial Systems/IMO, 10-24
 - Modicon, 17-24
- GE Fanuc, 8-18–8-20
- LG Industrial Systems/IMO, 10-18–10-20
- Mitsubishi, 13-18–13-20
- Modicon, 17-18–17-20
- OMRON, 15-18–15-20
- PLC jobs
 - Allen-Bradley, 6-25
 - GE Fanuc, 8-25
 - LG Industrial Systems/IMO, 10-25
 - Mitsubishi, 13-25
 - Modicon, 17-25
 - OMRON, 15-25
 - Telemecanique, 19-25
- possible causes of errors
 - Mitsubishi, 13-24
 - OMRON, 15-24
 - Telemecanique, 19-24
- Telemecanique, 19-18–19-20
- termination
 - GE Fanuc, 8-25
 - LG Industrial Systems/IMO, 10-25
 - Mitsubishi, 13-25
 - Modicon, 17-25
 - OMRON, 15-25
 - Telemecanique, 19-25
- Retrieve alarm message area and acknowledgement area, B-3

S**Screen number**

- Allen-Bradley, 6-3, 6-10–6-12
 - GE Fanuc, 8-3, 8-10
 - LG Industrial Systems/IMO, 10-3, 10-10
 - Mitsubishi, 13-3, 13-10
 - Modicon, 17-3, 17-10
 - OMRON, 15-3, 15-10
 - Telemecanique, 19-3, 19-10
- Screen optimization**
- GE Fanuc, 7-7
 - LG Industrial Systems/IMO, 9-7
 - Modicon, 16-7
 - OMRON, 14-7
 - Telemecanique, 18-8
- Select, connection, 1-2**
- Select screen, B-3
 - Set Date, B-2
 - Set password level, B-2
 - Set Time, B-2
- SIMATIC HMI documentation, D-1**
- Slave address, Modicon, 16-5
- Startup bit**
- Allen-Bradley, 6-13
 - GE Fanuc, 8-13
 - LG Industrial Systems/IMO, 10-13
 - Mitsubishi, 13-13
 - Modicon, 17-13
 - OMRON, 15-13
 - Telemecanique, 19-13
- Station, LG Industrial Systems/IMO, 9-4**

Stop bits

- Allen-Bradley via DF1, 4-6
- Allen-Bradley via DH485, 5-5
- GE Fanuc, 7-4
- LG Industrial Systems/IMO, 9-4
- Mitsubishi via FX, 11-4
- Mitsubishi via Protocol 4, 12-5
- Modicon, 16-5
- OMRON, 14-4
- Telemecanique, 18-5

Structure of the documentation, D-1

Switch buffer

- Allen-Bradley, 6-15
- GE Fanuc, 8-15
- LG Industrial Systems/IMO, 10-15
- Mitsubishi, 13-15
- Modicon, 17-15
- OMRON, 15-15
- Telemecanique, 19-15

Synchronization

data mailbox

- Allen-Bradley, 6-20
- GE Fanuc, 8-20
- LG Industrial Systems/IMO, 10-20
- Mitsubishi, 13-20
- Modicon, 17-20
- OMRON, 15-20
- Telemecanique, 19-20

process

- Allen-Bradley, 6-21
- GE Fanuc, 8-21
- LG Industrial Systems/IMO, 10-21
- Mitsubishi, 13-21
- Modicon, 17-21
- OMRON, 15-21
- Telemecanique, 19-21

System messages, A-1

- Language, A-1

T

Tags

- Allen-Bradley via DF1, 4-5
- Allen-Bradley via DH485, 5-4
- GE Fanuc, 7-3
- LG Industrial Systems/IMO, 9-3
- Mitsubishi via FX, 11-3
- Mitsubishi via Protocol 4, 12-3
- Modicon, 16-4
- OMRON, 14-3
- OPC, 2-5
- Telemecanique, 18-4

Target address

- Allen-Bradley via DF1, 4-6
- Allen-Bradley via DH485, 5-5

Target groups, D-1

- Telemecanique, communication management, 18-1

- Telway 7, Telemecanique, 18-5

- Transfer date/time, B-2

Trend optimization

- GE Fanuc, 7-7
- LG Industrial Systems/IMO, 9-7
- Modicon, 16-7
- OMRON, 14-7
- Telemecanique, 18-8

- Trend Request, LG Industrial Systems/IMO, 10-3

Trend request

- Allen-Bradley, 6-3, 6-14–6-16
- GE Fanuc, 8-3, 8-14
- LG Industrial Systems/IMO, 10-14
- Mitsubishi, 13-3, 13-14
- Modicon, 17-3, 17-14–17-16
- OMRON, 15-3, 15-14–15-16
- Telemecanique, 19-3, 19-14

Trend transfer

- Allen-Bradley, 6-3, 6-14–6-16
- GE Fanuc, 8-3, 8-14
- LG Industrial Systems/IMO, 10-3, 10-14
- Mitsubishi, 13-3, 13-14
- Modicon, 17-3, 17-14–17-16
- OMRON, 15-3, 15-14–15-16
- Telemecanique, 19-3, 19-14

Trends

- Allen-Bradley, 6-14
- GE Fanuc, 8-14
- LG Industrial Systems/IMO, 10-14
- Mitsubishi, 13-14
- Modicon, 17-14
- OMRON, 15-14
- Telemecanique, 19-14

Triggering messages

- Allen-Bradley, 6-6
- GE Fanuc, 8-6
- LG Industrial Systems/IMO, 10-6
- Mitsubishi, 13-6
- Modicon, 17-6
- OMRON, 15-6
- Telemecanique, 19-6

U**Update time**

- Allen-Bradley via DF1, 4-8
- Allen-Bradley via DH485, 5-7
- GE Fanuc, 7-6
- LG Industrial Systems/IMO, 9-6
- Mitsubishi via FX, 11-6
- Mitsubishi via Protocol 4, 12-7
- Modicon, 16-6
- OMRON, 14-6
- Telemecanique, 18-7

User data area, partitioning

- Allen-Bradley, 6-15
- GE Fanuc, 8-15
- LG Industrial Systems/IMO, 10-15
- Mitsubishi, 13-15
- Modicon, 17-15
- OMRON, 15-15

User data areas

- Allen-Bradley, 6-1
- GE Fanuc, 8-1
- LG Industrial Systems/IMO, 10-1
- Mitsubishi, 13-1
- Modicon, 17-1
- OMRON, 15-1
- partitioning, Telemecanique, 19-15
- Telemecanique, 19-1

User version

- Allen-Bradley, 6-3, 6-4–6-6
- GE Fanuc, 8-3, 8-4–8-6
- LG Industrial Systems/IMO, 10-3,
10-4–10-6
- Mitsubishi, 13-3, 13-4–13-6
- Modicon, 17-3, 17-4–17-6
- OMRON, 15-3, 15-4–15-6
- Telemecanique, 19-3
- Telemecanique-, 19-4–19-6

